Science-technology Support & Suggestions for Reducing Drought Risk in North China

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Outline

- Emergency water issue
- Major challenge
- Opportunity & Challenges on cooperation
Emergency Water Issue
China is a developing country with a variety of climate & much stress from its *population & economic development*
## Climatic zoning in China

<table>
<thead>
<tr>
<th>Zones</th>
<th>Annual Precipitation (mm)</th>
<th>Annual runoff (mm)</th>
<th>Area percent of total China (%)</th>
<th>Annual water resources percent of total China (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arid</td>
<td>&lt;200</td>
<td>&lt;10</td>
<td>26.6</td>
<td>2</td>
</tr>
<tr>
<td>Semi-arid</td>
<td>200~400</td>
<td>10~50</td>
<td>20.9</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total: arid and semi-arid</strong></td>
<td></td>
<td></td>
<td><strong>47.5</strong></td>
<td><strong>7</strong></td>
</tr>
<tr>
<td>Semi-humid</td>
<td>400~800</td>
<td>50~200</td>
<td>18.6</td>
<td>12</td>
</tr>
<tr>
<td>Humid</td>
<td>800~1600</td>
<td>200~800</td>
<td>26.5</td>
<td>58</td>
</tr>
<tr>
<td>Utterly humid</td>
<td>&gt;1600</td>
<td>&gt;800</td>
<td>7.81</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total: semi-humid, humid and utterly humid</strong></td>
<td></td>
<td></td>
<td><strong>52.5</strong></td>
<td><strong>93</strong></td>
</tr>
</tbody>
</table>
Water problem is well known in the world. Droughts and floods are major environmental issues.
e.g., 2006’s major drought in Chongqing, Sichuan. More than 20 million population suffer from this disaster, and direct economic loss over 5 billion RMB etc.

• 2006年8月10日，重庆渝北区茨竹镇点灯村，往日的鱼塘如今已干裂见底。

• 四川内江干裂的庄稼地。
Water Shortage & Environmental Issues in North China

Population in 2000: 0.437 billion, 35% of total in China.

GDP: 386 billion US$, 32% of total in China.

Irrigation area: 42% of total in China (0.346 B Mu)

Agricultural Product: 40% of total in China.
For the Hai River Basin, it is only 305 m³, that is only 1/7 of the national average and 1/24 of the world average.
Water Crises

Water conflict in North China

Over exploitation of ground water: 100 billion m$^3$

Water shortage in 2000: 8 billion m$^3$
Increase of ground water depth in the Beijing, China
Drying-up of Rivers

40% of the total rivers was changed to be seasonal rivers

Wetland degradation

the rate reaches 90%

Ecosystem degradation due to water shortage

Over-extraction of the Groundwater

The area in the aquifer comes to 44,000km²

Decrease of Inflow to Sea

the rate approaches 90%
Major Challenges
1. Climate change impact

Climate change impact to water resource is a big issue in China.
It is shown that temperature change in China is significantly in recent 50 years.

Tendency coefficient of annual mean surface air temperature over China from 1951 to 2004 (Ren, 2007)
Annual precipitation change—difference of precipitation between 1980-2000 and 1956-1979

Trend coefficient of annual mean precipitation over China from 1956 to 2002
A2 Scenario analysis shown that the risk of droughts in North (Yellow River/Hai river etc.) will be increased due to climate change (2061-2090)

A2 scenario: population continually increase as present trend
Point II: Human activity impact

Chang trend of the total water use in China (Unit: 0.1BCM)
## Cause Analysis

**Conflict between the economic-social development & the carrying capacity of water resources**

*Case Analysis of the Haihe River Basin*

<table>
<thead>
<tr>
<th>Indexes</th>
<th>Beginning of 1950s</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>55 Million</td>
<td>126 Million</td>
</tr>
<tr>
<td>Urbanization</td>
<td>16%</td>
<td>30%</td>
</tr>
<tr>
<td>GDP</td>
<td>30 Billion</td>
<td>100 Billion</td>
</tr>
<tr>
<td>Water resources per capita</td>
<td>750 m³</td>
<td>305 m³</td>
</tr>
</tbody>
</table>
Big challenges: How to wisely manage water by multiple ways to reduce drought risk?

Climate change

1. GDP
2. GDP
3. GDP
4. GDP

Land use/cover Change

1. 1
2. 1
3. 1
4. 1

Water Cycle Process

Water

Land

Vegetation

Eco-environmental system

How to wisely manage water by multiple ways to reduce drought risk?
Opportunity & Challenges
Problem of water security in North China is the priority issue in sustainable development of China.

New National Comprehensive Planning of Water Resources in China (2001-2010)

- Eco-restoration Plan in Haihe River Basin
- South-to-North Water Diversion Project
Chinese Academy of Science is the national scientific research body

Water Cycle & Water Security in China is the priority issue in resources & environmental fields

- Key Lab. of Water Cycle & Related Land Surface Process, CAS
- Water Resources Research Center, CAS
- Others
e.g., the key Project, namely

*Water Cycle and Water Resources Security to Environmental Change in North China*

*funding by CAS (US$ 1.6 million)*

*(Leading by Xia Jun, 2001-2005)*
New Research Project in 2007-2010

- **Cross-basin Water Diversion Projects and their Impacts on the Hydrological Process and Water Security**, supported by the Chinese Academy of Sciences, Lead by Xia Jun)
Major directions on water research

- **Policy:**

  Basic research

  Application research

  Encouraging scientific problem’s research of key national remands for water issue
Multiple Approaches are encouraged on water research

Spatial Observation

Field observation & experiments

Modeling
Water observation & experiments network, Key Lab. of Water Cycle & Related Land Surface Processes CAS

China CERN Network

Distribution of field experimental catchment

RS (MODIS etc.) & its cover areas

Ground water monitory network

SPAC system observation

China CERN Network

Distribution of field experimental catchment

RS (MODIS etc.) & its cover areas

Ground water monitory network

SPAC system observation
1. Applying the result of drought monitoring and early warning and forecasting in practical production
China drought regionalization with 217 sub-regions
2. 干旱产生与维持机理的研究
(Research on the mechanism of drought establishing and maintaining)

- 大尺度陆地水系统的水循环相互作用
与水文极端事件综合模拟研究
(Study on mechanism and comprehensive simulation of the interactive function of land-water system on large scale)
3. Research Projects on Screening for Climate Change Adaptation: Managing the potential impacts of climate change to water sector in China
Proposal for Cooperation Research on Water Security in North China
Five priority research topics are identified by China-Australia Center on Water Resources Research.

- Linking Climate and catchment models
- Integrated river basin management
- Groundwater management
- Irrigation Water Efficiency
- Water policy
Proposal for ANU Water Initiative Project

Developing the project on *Comparison study to reduce droughts risk to changing environment between case study of North China and Marry Darling Basin.*

Major area could focus on

- **Agricultural Water**
- **Urban Water**
- **Eco-water**
- **Drinking Water**
Understanding both individual and hybrid impacts of climate change and human activity on water cycle and droughts

Quantifying water security linked with hydrology and social-economic & environment issues

Providing adaptations strategies & policy for sustainable water management in water shortage areas.
Research & Cooperation between China & Australia will be very benefited each other!

Thank you!

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