Water Challenges Faced by China in Its Urbanization

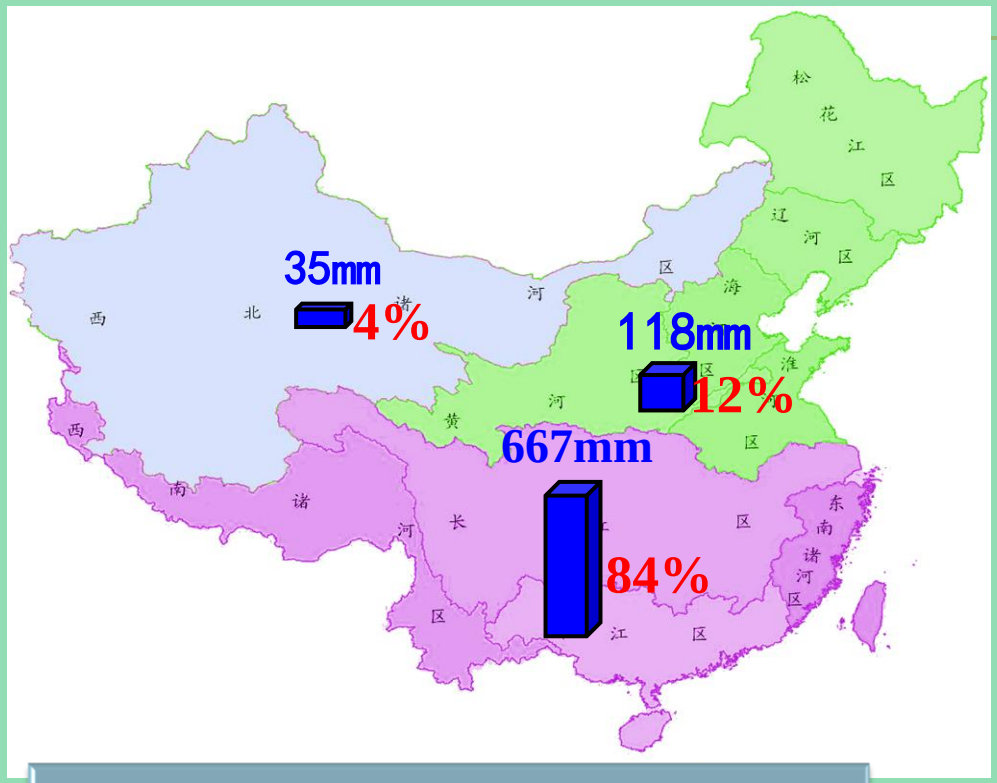
Wu Shiqiang

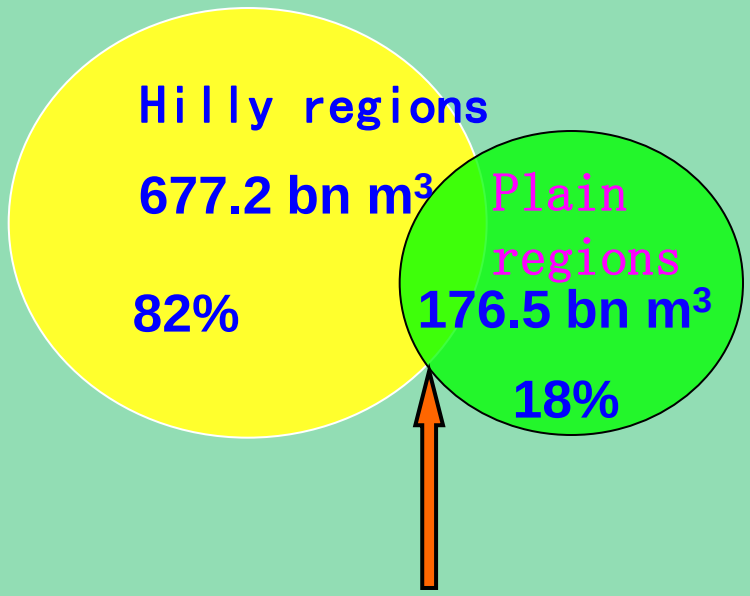
Nanjing Hydraulic Research Institute(NHRI)

Content

Content

Status Quo of China's Water Resources





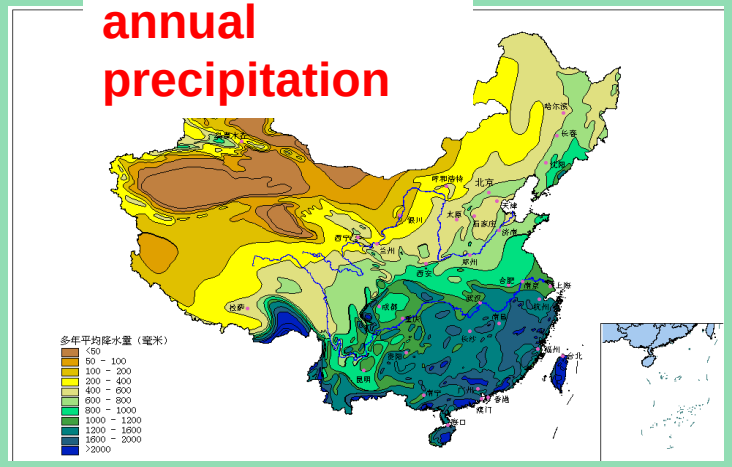
Overlapping:31.8 bn

- Average annual runoff depth: 288mm
- Volume of surface water: 2737.5 bn m³

- Volume of underground water 821.9 bn m³

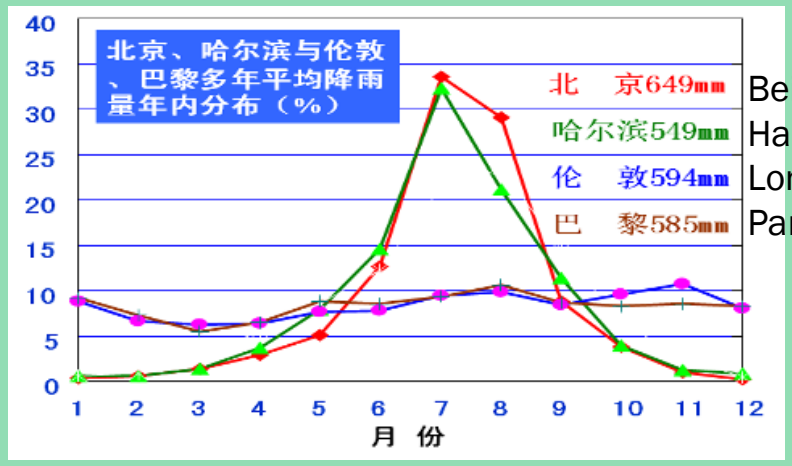
(Source: Water Resource Evaluation, 2008)

Problems of China's Water resources



Spatial distribution: more in the South but less in the North

Precipitation in a year in Beijing , Harbin, London and Paris (%)



Time distribution: 80% in flood season

- Seriously uneven in terms of Spatial and time distribution: more in the South but less in the North and concentrated in flood season
- Low volume per capita: only 1/4 of the world's average
- Serious shortage of water resources: 400 cities (in 668) are short of water of 40 bn m^3 in normal years

- Huge loss caused by draught: >1% of GDP on average per year

Features of China’s Water resources

Rank of total water resources

1. China's total water resources: 6th
2. Water resource per capita: 2200 m^3
3. Less than 30% of the world’s average

Water quality

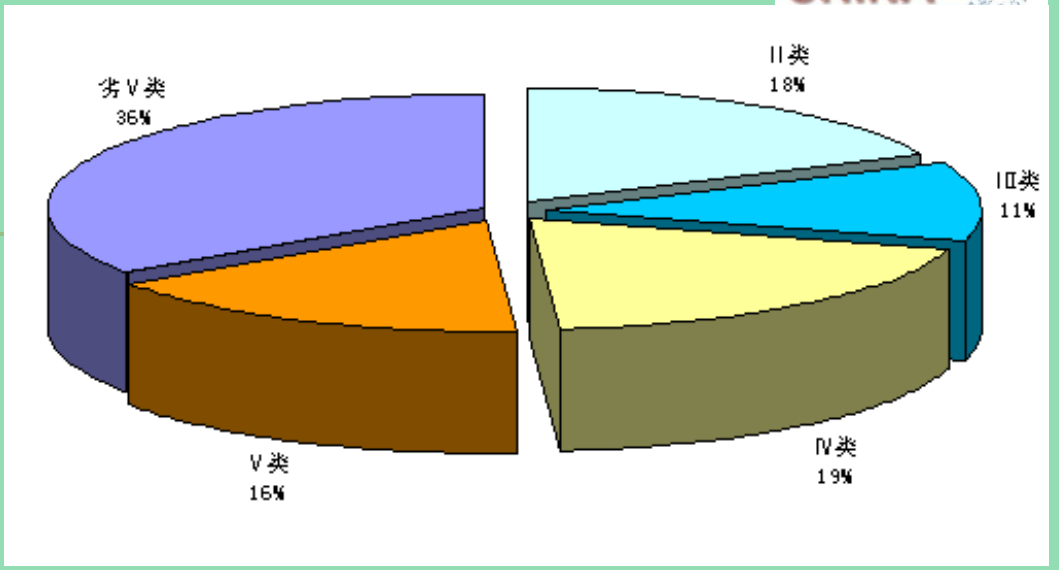


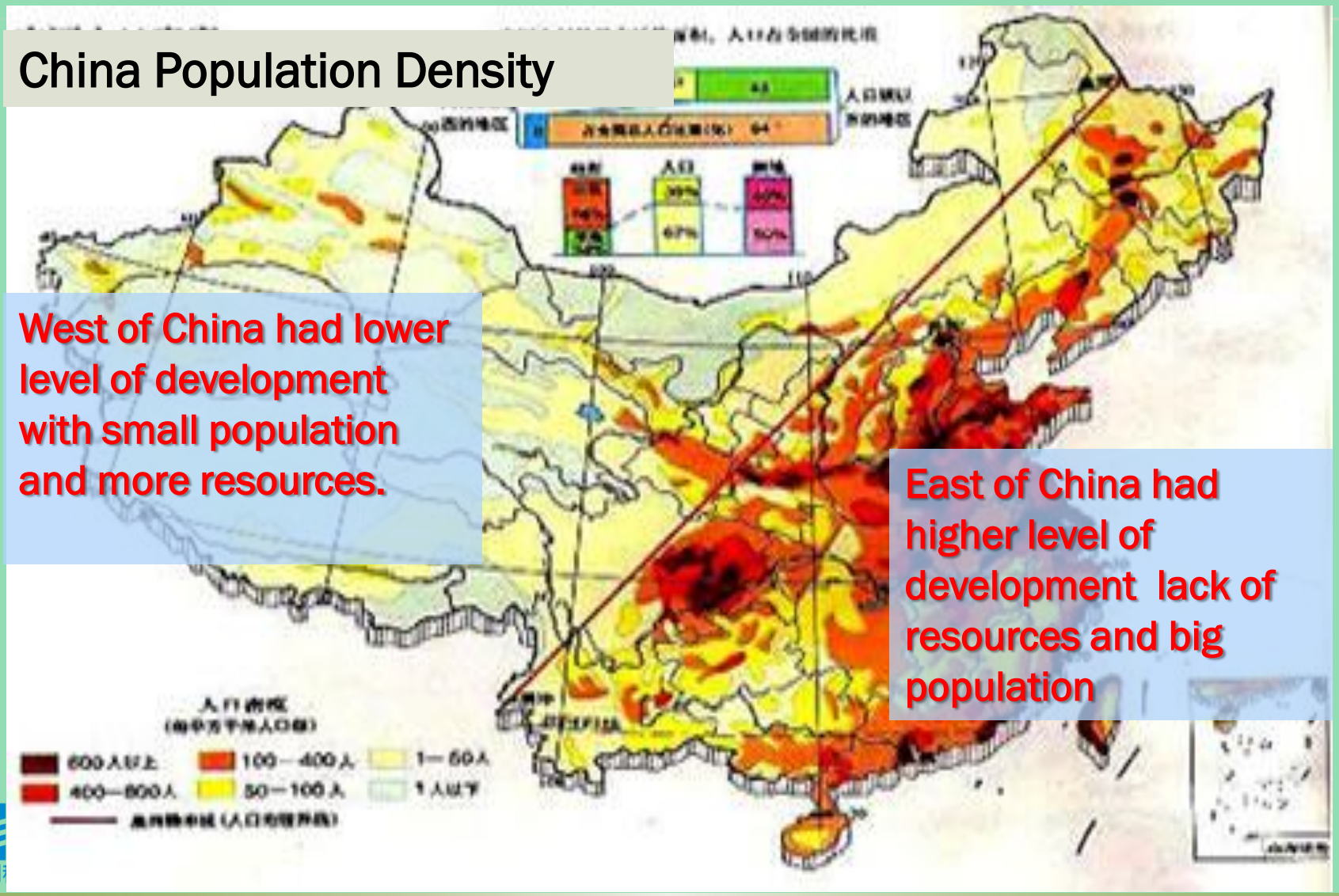
Table 2. Water Quality[10] in the Seven River Basins in 2005

Unit: %

Rivers		Class I, II	Class III	Class IV	Class V	Worse than Class V
Northern Rivers	Yellow	7	27	34	7	25
	Huai	3	14	38	13	32
	Hai	17	5	18	6	54
	Liao	14	16	22	8	40
	Songhua	5	19	45	12	19
Southern Rivers	Yangtze	56	20	11	2	11
	Zhu (Pearl)	55	21	18	0	6

Source: *China Environment Bulletin 2005 (中国环境状况公报).*
Available Online: http://www.sepa.gov.cn

Population Distribution in China

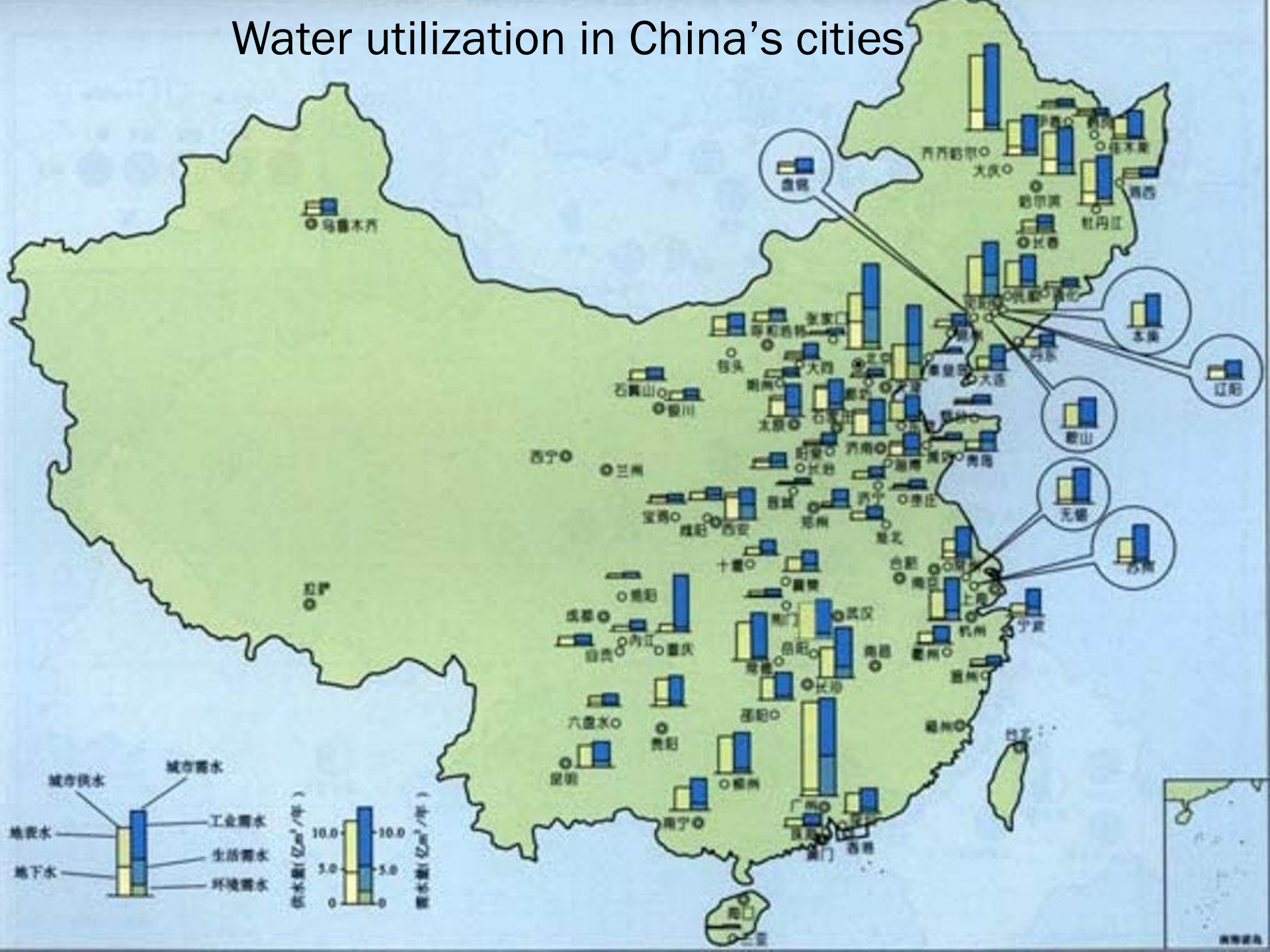


Urban Water resources

- In 660 cities, 2/3 of them are short of water to different degrees and 136 cities are in serious shortage.
- Over 400 cities have exploited underground water which contributes 30% of total water consumption, 72% in North China and 66% in Northwest China.
- Underground water in 50% of the cities are polluted to different degrees and some cities are faced with serious crisis of water.
- Main causes for water shortage in urban areas:
  - Low precipitation, lag in water source project construction, degradation of water environment, and efficiency decline of water resource management system

Source:
http://news.xinhuanet.com/photo/2005-12/01/content_3861000.htm

Water utilization in China's cities

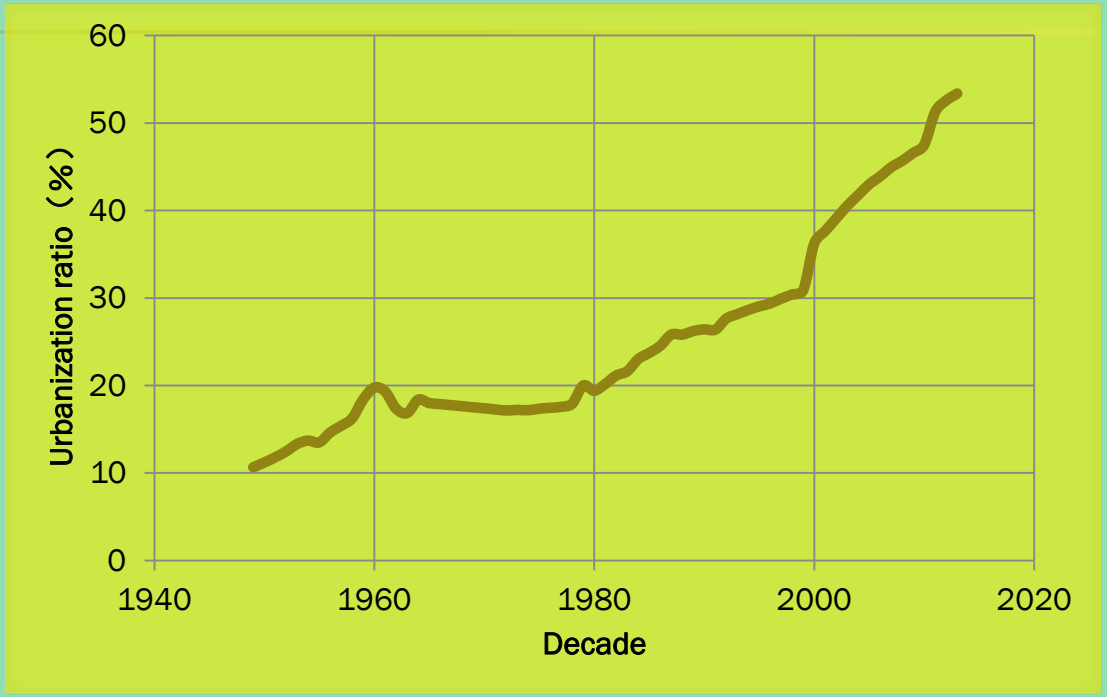


Urbanization Trend in China

◆Urbanization started in the 1980s and developed very fast after 2000. It is expected that the ratio will reach 58% in 2020. The speed will accelerated in coming 10 years.

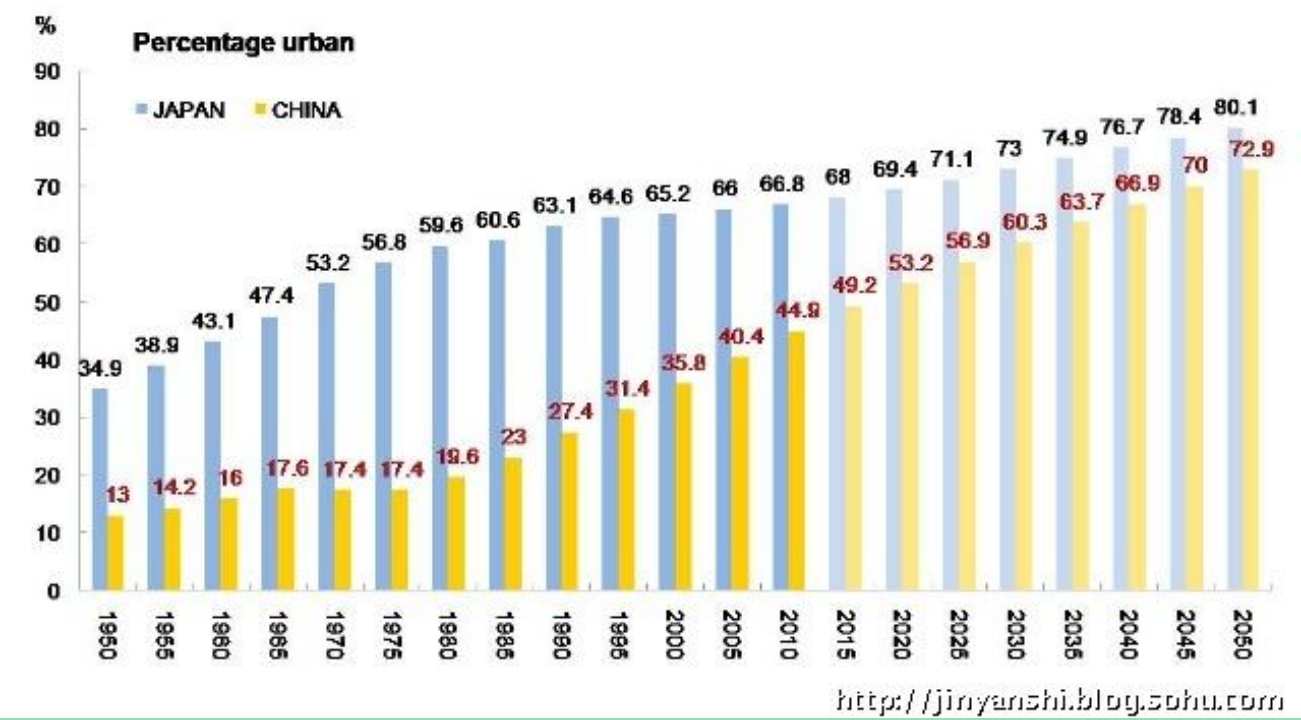
◆Rapid urbanization will change the original resource distribution and energy consumption structure.

◆Water is one of the basic resources for human and social development. Over exploitation will limit social development and may lead to disasters.



International urbanization level comparison											
Year	Global	Low-income countries	Middle-income countries	High-income countries	China	Japan	The U.S.	India	Indonesia	Brazil	the Philippines
1978	46	22	46	74	19	58	74	22	21	65	37
1998	55	30	57	79	34	65	78	27	39	80	57
2005	57	33	60	80	40	66	81	29	48	84	63

Urbanization Trend in China



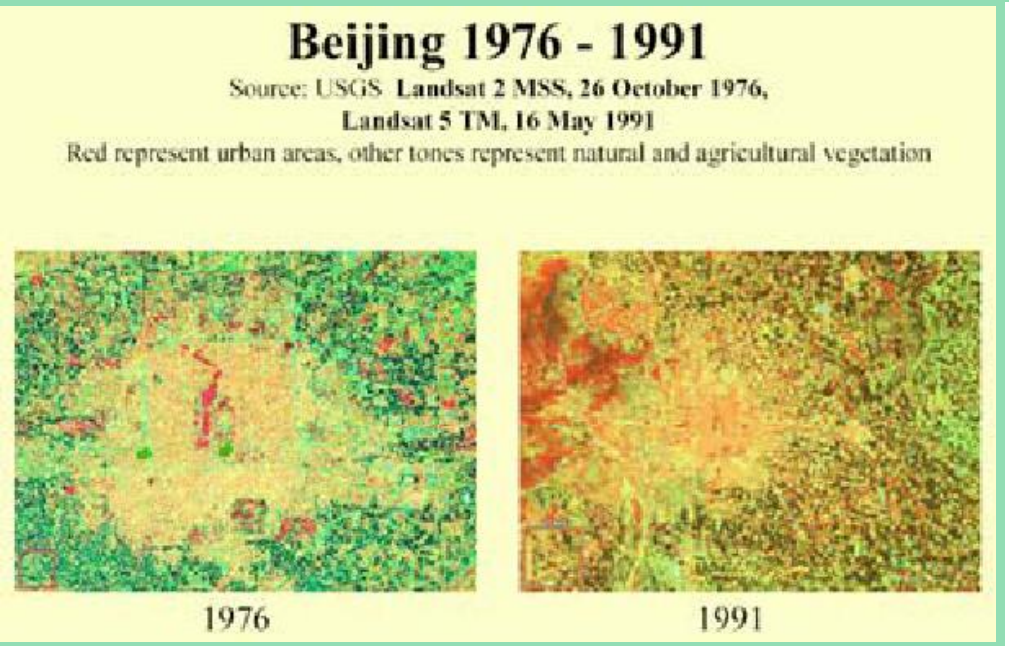
- Urbanization level lags behind other countries at the same economic levels
- Developing speed is much higher than other countries.

Comparison of urbanization process between China and Japan

International urbanization level comparison											
Year	Global	Low-income countries	Middle-income countries	High-income countries	China	Japan	The U.S.	India	Indonesia	Brazil	the Philippines
1978	46	22	46	74	19	58	74	22	21	65	37
1998	55	30	57	79	34	65	78	27	39	80	57
2005	57	33	60	80	40	66	81	29	48	84	63

Urbanization Trend in China

Uneven land and population urbanization



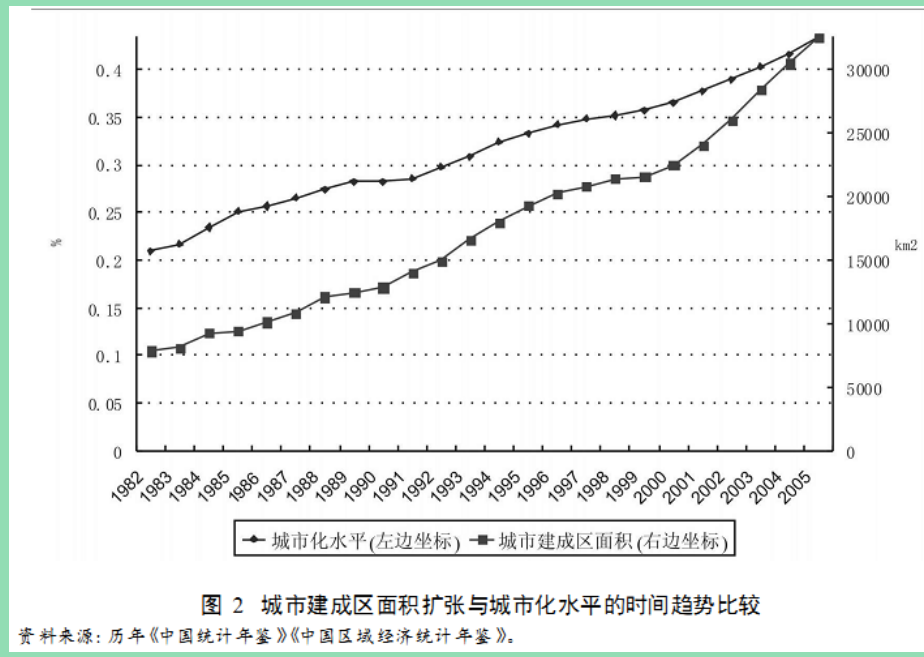


图 2 城市建成区面积扩张与城市化水平的时间趋势比较

资料来源：历年《中国统计年鉴》《中国区域经济统计年鉴》。

Urban areas expanded a lot.

Content

- Status Quo of China's Water Resources and Its Urbanization
- Water Challenges Faced by China in Its Urbanization
- China's Coping Strategies
- Cooperation Plans under CEWP
- Conclusions

1 Serious Conflict in Water Resource Supply

Major water safety problems in urbanization in different stages

Urbanization stage	Average growth rate of urbanization level %	Perception of the position of water resources	Major water safety problems	Strategies adopted
1949-1958 Starting stage	5.64	Irrigation works are the basics for agriculture.	Water supply shortage caused by insufficient infrastructure	Supply deemed by demand and enhanced source introduction
1959-1977 Spiral stage	-0.27		Source introduction and insufficient infrastructure	Source introduction as the main and water conservation
1978-1988 Rapid development	3.72	Water is the important basis and guarantee for national economic and social development in a sustainable and stable manner.	Water supply shortage caused by insufficient infrastructure and sources, the start of shortage caused by pollution	Equal stress on source introduction and water conservation
1989-1999 Stable development	1.66		Water supply shortage caused by insufficient infrastructure and sources and by pollution	Equal stress on source introduction, water conservation and pollution treatment
2000- Accelerated development with improved quality		Water is the basic natural resource and strategic economic resource.	Water supply shortage caused by insufficient infrastructure and sources and by pollution and stressed with urban water logging.	Priority in water conservation, stress on pollution treatment, and multi-channel water introduction, water conservation and emission reduction and scientific development

Xu Yingming, Exploration of Urbanization Transformation under the Concept of Water Safety, Industrial and Technical Economy, No.4, 2013:121-124

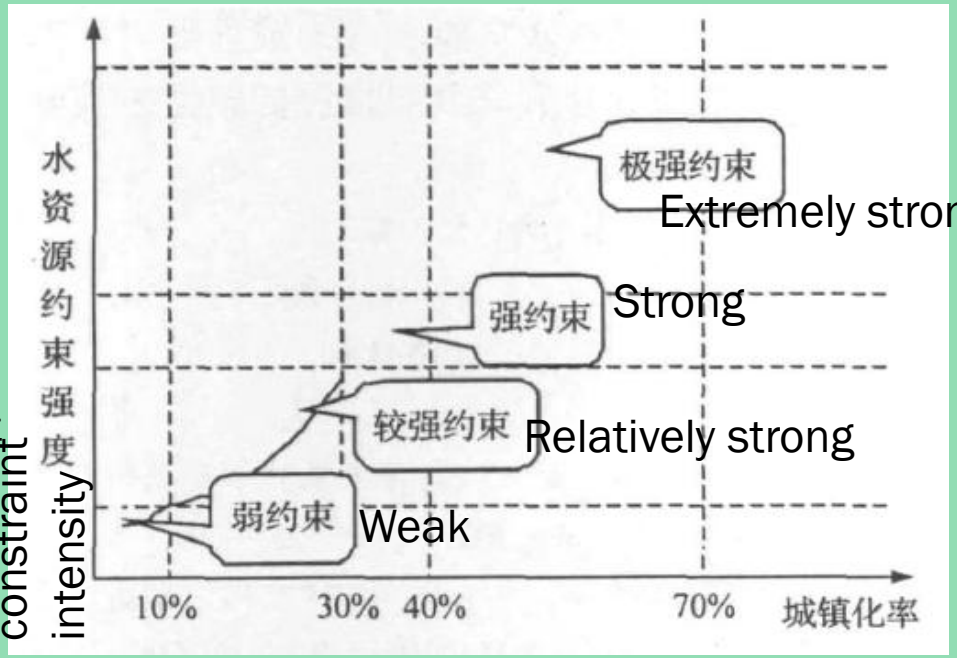
Challenges in water resources

- Increased demand on water
- Water supply safety
- Regional water resource balance
- The issue of water conservation
- Over exploitation of underground water
- Water consumption structure

水资源将约束城镇化发展进程

- The shortage of water resource volume and bad quality constrain the speed and scale of urbanization.
- High degree of water resource exploitation will impact ecological environment, thus constraining urbanization.
- Water consumption structure change will intensify the conflict between industry and agriculture, thus constraining urbanization.

China's urbanization ratio has exceeded 50%. The constraint of water resources on the mode and path of urbanization will be more obvious. The urbanization path should be adjusted and optimized according to water resource constraint and the law of urbanization.



The relationship between water resource constraint and urbanization

2 The Pressure of Urban Flood Control Increased Dramatically

Rapid urbanization has changed the hazard-formative environment s for floods and disaster-causing factors for floods.

In developed urban areas, the indurations areas take up over 70%. The city river, ponds, lakes and weirs are filled up and the river bed are strengthened with concrete. The natural structure of urban water system are seriously damaged. The capacity of a city to cope with extreme weather has been weakened , so is the urban ecological system.

Since 1996, China's urban land has increased by 3.38 times, while the urban population only by 1.08 times**. Urbanization has increased land for industrial use. The urban land increased is in positive correlation with water quality degradation.

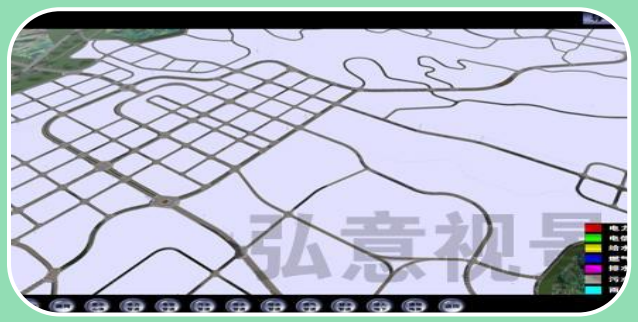
**Li Weizhuo, Problems and Coping Strategies for Sustainable Development in China's Cities Under the Context of Rapid Urbanization [J]. North Economy. 2012(01) .

Challenges for Urban Flood Control and Safety

- Challenges for urban drainage capacity, improved urban flood control standards;
- Capacities of cities to cope with extreme weather, such as heavy rain and snow;
- Water storage capacity for urban river courses and lakes and function areas for flood detention in new urban areas;
- Protection and development for urban underground water.

3 Urban Water Supply Safety

Water supply sanitation and quality maintenance



Urban water supply network and layout

Sewage recollection and discharge

Management system for urban water supply and water fee levy and disposal

4 Aggravated Degradation of Water Environment

- Sewage discharge increases as water consumption increases, but sewage collection and disposal capacities lag behind.
- The pollution of runoffs are more serious because of land induration.
- Water system adjustment has weakened the self-cleaning capacity of urban waters.
- Increased risks in water pollution have threatened the safety of drinking water sources.
- Pollution of underground water.

5 Weakened Ecological Function of Urban Water

- Drainage network adjustment, declining water surface ratio, impaired water ecological function;
- River way induration has weakened biological habitat;
- Ecological degradation has been worsened by water pollution; and
- Land urbanization has aggravated water and soil erosion.

6 Relevant Resource Demand

- Water-energy-food bond: energy demand, food demand and other accumulative effects have brought higher demand on water resource allocation.
- Adaptation and synergy of resources, such as water, food and energy
- The relationship between industry structure adjustment and water resources

Content

- Status Quo of China's Water Resources and Its Urbanization
- Water Challenges Faced by China in Its Urbanization
- China's Coping Strategies
- Cooperation Plans under CEWP
- Conclusions

China's Coping Strategies

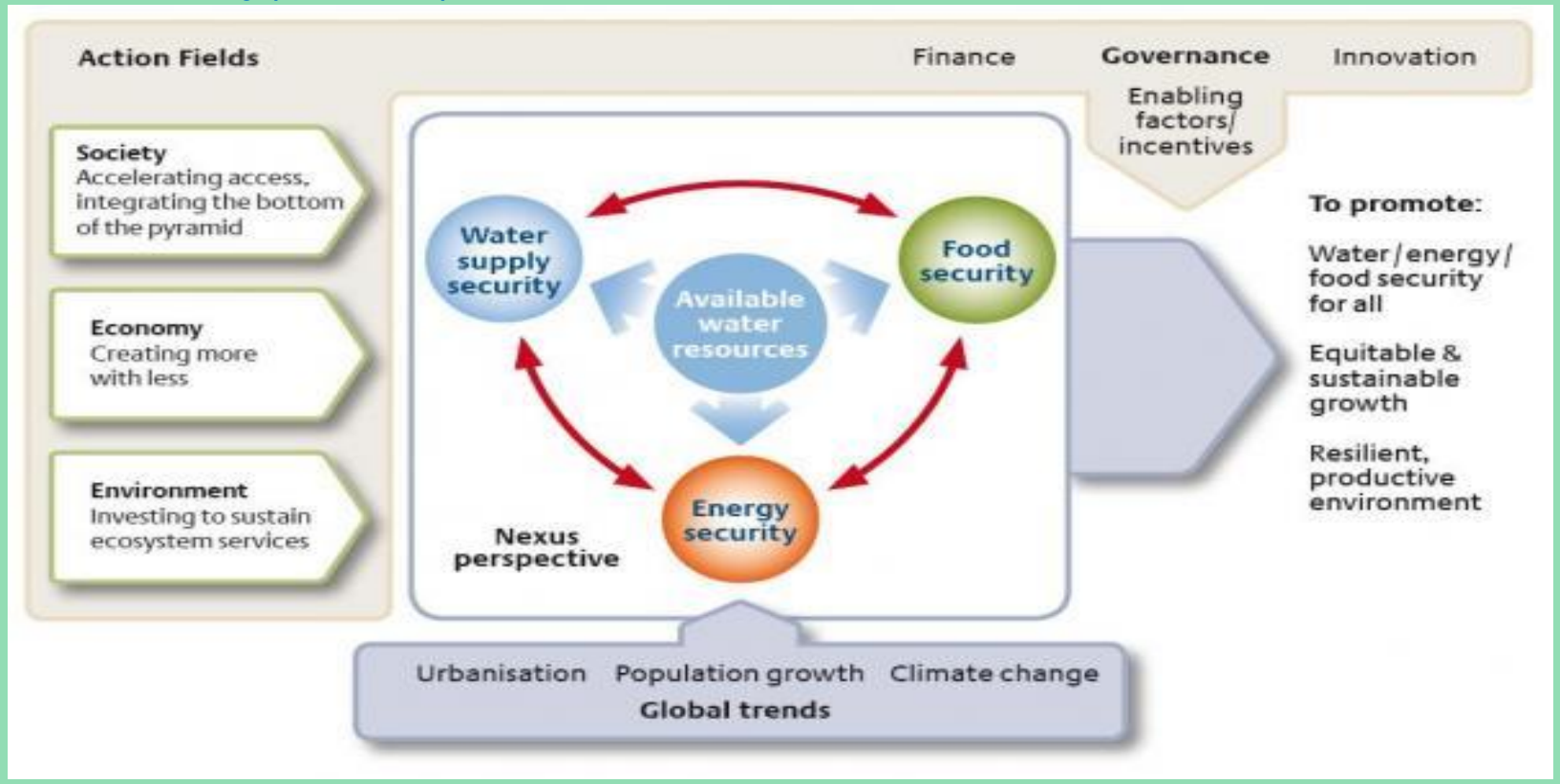
- Limiting demand and building a water-conserving society
- Promoting construction of civilized cities with water ecology
- Improving sewage disposing standards
- Promoting non-conventional water utilization (complementation of underground and surface water, rain, recycled water and sea water, etc.) to improve water utilization ratio.
- Enhancing construction of water diversion projects to improve allocation capacity of water resources.

Content

- Status Quo of China's Water Resources and Its Urbanization
- Water Challenges Faced by China in Its Urbanization
- China's Coping Strategies
-  Cooperation Plans under CEWP
- Conclusions

Cooperation Plans under CEWP

- Water-Energy-Food Nexus(China-Sweden)
- Water-Energy Efficiency(China-UK)
- Water Quality(China-?)



Content

- Status Quo of China's Water Resources and Its Urbanization
- Water Challenges Faced by China in Its Urbanization
- China's Coping Strategies
- Cooperation Plans under CEWP
- Conclusions

Conclusions

- In urbanization, both China and the Europe face the same challenges which impact sustainable development. What's different is that the Europe has entered the stage of stable development while China is in rapid development.
- Under CEWP framework, the cooperation in urban flood management, drinking water safety, capacity building in infrastructure adaptation, resource management and policy formulation can be enhanced.

CHINA EUROPE Water Platform
www.cewp.org

Thank you

sqwu@nhri.cn

NHRI Since 1935
南京水利科学研究院