

National Geographic Documentary

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1. Describe the water situation in China. What is the root of the problem there? How does this compare to the rest of the world?

- 20% of world population; only 7% of world's freshwater
- 1/3 of world average in per capita freshwater availability
- Very unevenly distributed runoffs: Yellow River - 2%, Yangtze River – 52%
- 67% of freshwater used in agriculture (of which 90% for rice), much inefficiency (< 50%)
- North China plains 65% of China's agricultural land, relying on irrigation and underground aquifers
- Groundwater provides potable water for 70% population and irrigation for 40% of agriculture (60% up North)
- 70% rivers and lakes polluted to various degrees; 90% groundwater in cities non-potable
- Irrigated agriculture unsustainable
- Industrialization 22% of water demand
- Impending water crisis - increasing demand, inefficiencies, pollution, and climate change.

2. What sources of surface water are available to China?

- 6th in world in total runoffs, replenished by glaciers and precipitation

- Yangtze 52% of total runoffs; Yellow: 2%
- Yangtze, Yellow, Heilong, Pearl, Liao, Hai and Huai rivers flow east and empty into the Pacific Ocean.
- Yellow, Huai, and Hai rivers supply the North China Plain, home to largest urban and industrial concentrations and most intensive irrigated agriculture including Beijing and Tianjin

3. How is China's groundwater supply?

- Groundwater provides potable water for 70% of population and irrigation for 40% of agricultural land (60% in North)
- Pumping deeper > 300 meters and counting
- Potential slow arsenic poisoning

4. How is climate change having an impact on China's water supply?

- Yellow River source lake retreated by 5.28% 1990-2005; drops in precipitation in northern rivers decreased by 10-40%
- Glaciers covering China's Qinghai-Tibet plateau are shrinking by 7 % a year
- Extreme weather conditions exacerbate flooding and drought

5. What are the human effects of China's water shortage?

- 25 million people exposed to dangerously high levels of aquifer arsenic contamination
- Part reason for 70 m still trapped in poverty (<US\$1.03@day)

6. How is China tackling their water problems?

- "*Water Ten Plan*" (Directives) issued by the State Council on 16 April, 2015, to achieve significant water improvement across the board by 2030

- To stay within the 2020 cap of 670 billion m³ of water use.
- Pollution control, water efficiency, improvement in agriculture, municipal water use, coastal water management and overall ecological protection.
- 7 key rivers: Yangtze, Yellow, Pearl, Songhua, Huai, Hai & Liao River; 9 key coastal bays; 3 key regions: Beijing-Tianjin-Hebei, Yangtze River Delta & Pearl River Delta; and 36 key cities including Beijing, Tianjin, Shanghai, Chongqing, 27 provincial capitals & 5 cities including Dalian, Ningbo, Qingdao, Shenzhen & Xiamen.
- RMB1.9 trillion of new investment in environmental-protection related industries (of which RMB1.4 trillion will go to purchasing products & services) and create 3.9 million new non-agriculture jobs

7. Describe the path of the Salween – Mekong. What countries depend on this basin?

- Salween (Nujiang) , one of the longest free-flowing rivers in the world
- 2,815 km long flowing from the Tibetan Plateau into the Adaman Sea, watershed of 324,000 sq km covering China (Yuanan) , Burma, and Thailand
- A wide southward arc between the Tibetan and Yunnan-Guizhou Plateaus, dropping into "China's Grand Canyon", a 4,000-metre - deep gorge that takes it past the Chinese border into northeastern Burma through Shan State and Kayah State
- Biodiversity comparable to Mekong, and home to 7 m people

8. Describe China's dam projects along the upper Mekong and Irrawaddy. How do China's dam projects compare to other countries?

- Mekong region is Asia's rice bowl: in 2014 lower Mekong countries (Myanmar, Laos, Cambodia, Thailand and Vietnam) produced more than 100m tonnes of rice, around 15% of the world's total.

- Fertile soil depends on nutrient-rich sediment that the Mekong carries downriver, mainly during the rainy season from June to October; more than half the sediment in central Cambodia comes from China. The river and the nutrients it brings support the world's biggest inland fishery, accounting for a quarter of the global freshwater catch.
- Massive biodiversity and ethnic diversity
- China building 14 dams including the Manwan, and the Wunonglong. China boasts of having half of the world's dams
- Downriver countries intend to build another 11 large dams on the Mekong, with dozens more planned for its tributaries. In 20 years the Mekong could well be dammed from Tibet to Phnom Penh, where the delta begins.
- Dam-builders tend to assess the impact of each dam individually; NGOs pay more attention to the cumulative effect of multiple dams.

9. How do these dams affect the ecological systems downstream?

- The Mekong, e.g. is a gigantic economic ecosystem. During the monsoon season, 50x more water. Ebb and flow drive the fisheries economies of some 60 m people in the lower basin.
- Asia's biggest freshwater lake, Tonle Sap, is a massive fisheries nursery in heart of Cambodia. During the monsoon, it flows the other way, bringing water and fertilizing silt from the Mekong to the lake. Billions of fish fry swept here to feed on floating vegetation of a flooded forest. The fattened fish are trapped and harvested as the water recedes after the monsoon season.
- The fisheries yield 2.6 million tonnes a year, worth some \$2 billion in sales.

- The fish also attract a cornucopia of wildlife.
- Dams disrupt > half of the river's flow.

10. What is the Tibetan plateau and why is it important?

- The Plateau glaciers supply water to almost 1.35 billion people in Asia, a fifth of the world's population.
- Qinghai-Tibetan Plateau is the source of rivers that reach India, Bangladesh, Burma, Bhutan, Nepal, Cambodia, Pakistan, Laos, Thailand, and Vietnam. The Plateau is thus the fountain head of Asia's mighty rivers of life and livelihood affecting billions of people.
- India has negotiated water-sharing agreements with Pakistan and more recently with Bangladesh. It has also reached deals with Nepal on barrage building, hydropower dams, and flood control. India also provides Pakistan with flood forecast data. In the 2000s, China and India reached data sharing agreements (PDF) on seasonal flood patterns for the Brahmaputra Basin.

11. How is China exploiting its access to freshwater resources in Tibet?

- In October 2015, China operationalized the world's highest-altitude power station, the \$1.5 billion Zangmu hydropower facility in Tibet on the Brahmaputra.
- At the border between China and India, the "Great Bend" of the Brahmaputra drops 2,800 meters into Arunachal Pradesh in India. It is the site of China's proposed giant Tehri dam project capable of producing 300 billion kilowatts of electricity a year, about three times the size of the Three Gorges Dam.

12. What is the South to North Water Diversion project? Is there anything comparable in scale elsewhere in the world?

- SNWD, which is not expected to be completed until at least 2050, will eventually divert 44.8 billion m³, or 8% of China's total water, of water annually to the drier north. The complete project is expected to cost \$62 billion, more than twice as much as the Three Gorges Dam.
- There are three routes of the SNWD project: the eastern, which will supply the Shandong Province and the Huang-Huai-Hai Plain, the central, which will supply the Henan and Hebei Provinces, and the northern, which will bring water to northwest China.
- The SNWD project is the biggest of its kind in the world. Capacity to deliver 25 billion cubic meters of fresh water per year from the Yangtze River in China's south to the drier north by two routes — each of which covers a distance of more than 1,000 km. The project connects four major river basins, three megacities, six provinces and hundreds of millions of water users and polluters.

13. What water resources will be affected by the SNWD?

SOUTH-TO-NORTH WATER TRANSFER

Mainland China has the capacity to pump 25 billion cubic metres of fresh water per year over a distance of more than 1,000 kilometres — from the Yangtze River in China's south to Beijing and other cities in the drier north.



1 WESTERN ROUTE
Yet to be built but would divert up to 20 billion cubic metres of water per year from tributaries of the Yangtze River to the Yellow River.

2 CENTRAL ROUTE
Provides up to 9.5 billion cubic metres of water per year, including one-third of Beijing's water.

3 DANJIANGKOU RESERVOIR
More than 300,000 people have been resettled owing to rising waters, and to lessen pollution.

4 EASTERN ROUTE
Supplies up to 14.8 billion cubic metres of water per year to the provinces of Jiangsu, Anhui, Shandong and Hebei and the city of Tianjin.

14. Describe the water sources shared by India and China. Why are relations so tense between the two?

- China and India share the waters from the Tibetan Plateau, of which India enjoys the Indus, the Sutlej, the Ganges, and the Brahmaputra, which flows from the Yarlung Tsangpo through the Tibetan Plateau.
- The conflict over upstream-downstream water rights adds to the long-standing frictions between the two countries over territorial disputes of Arunachal Pradesh, which China calls South Tibet, memories of past war, and recent geopolitical rivalry.

15. Describe the path of the Yarlung Tsangpo, the river that feeds into the Brahmaputra. How important is this river basin?

- The 2,880 km-long Brahmaputra originates in Tibet, where it is known as the Yarlung Tsangpo. It flows eastwards through southern Tibet for a distance of 1,625 kilometers and at its easternmost point it swings around to make a spectacular U-turn at the Shuomatan Point or Great Bend before it enters India's easternmost state, Arunachal Pradesh. Here it is known as the Siang River. After gathering the waters of several rivers it announces itself as the Brahmaputra in the state of Assam. The river snakes through Assam to then enter Bangladesh, where it is known as the Jamuna. In Bangladesh it is joined by the Ganges (known as the Padma in Bangladesh) and Meghna and together these rivers form the world's largest delta before emptying their waters into the Bay of Bengal.

16. Describe the Zangmu dam and other hydropower projects China is building along the Yarlung Tsangpo. What effect will these have on India and Bangladesh?

- The \$1.5 billion 510 megawatts Zangmu Dam, China's largest hydroelectric dam on the Brahmaputra, became fully operational in 2016.
- In India, 168 massive dams are planned on the upper reaches of the Yanlung Tsangpo and its tributaries in Arunchal Pradesh and Assam, both rich in ecological and cultural diversity.
- Up to 360 dams may be built all over the slopes with a gradient up to 60%.
- The Zangmu dam does not store water, but riparian states are concerned that the dam may alter water flows, disturb downstream ecology, including fishing resources, and cause the displacement of people.
- Major bilateral hydropower deals such as those reached between China and Bhutan and India and Nepal have been met with alarm from activists and experts. Some critics have expressed skepticism about the thoroughness of environmental impact assessments, equity in electricity distribution, and the risks of hydropower hubs along geological fault lines prone to earthquakes and other environmental disasters.

17. What was the plan to divert the headwaters of the Brahmaputra into the South North Water Diversion Project? Do these plans still exist?

- The original plan to divert the headwaters of the Brahmaputra into the South North Water Diversion Project is the "Western Route" (see above diagram). This is now held in abeyance owing to the controversy.
- China's dams (run-of-the-river models) don't store water.
- 70% of the waters of the Brahmaputra comes from precipitation
- Need for more sharing of data and joint scientific research into how best to manage joint water resources in terms of renewable energy production, water source sustainability, ecological and economic outcomes.

18. How does water play into the historical rivalry between India and China?

- The conflict over upstream-downstream water rights adds to the long-standing frictions between the two countries over territorial disputes over Arunachal Pradesh, which China calls South Tibet, memories of past war, and recent geopolitical rivalry.

19. How are China's relations with its Southeast Asian neighbors? Do they have good reason to be concerned about their rivers?

- The high water-mark of friendly China-ASEAN relations was when China signed a Treaty of Amity in 2003.
- Since then, the relations with Vietnam and the Philippines have become frayed owing to territorial disputes over the waters of the South China Sea.
- Nevertheless, despite China's more assertive stance, the rest of ASEAN adopt a more nuanced approach towards China geared towards avoiding confrontation and balancing between China and the United States' geopolitical rivalry.
- After all, China is at the hub of a global supply and value chain and most ASEAN countries depend on China for trade, investment, creation of jobs and economic growth.
- SE Asian countries are alive to the risks to their rivers. But they are also influenced by the need for hydroelectric power, and water demand from agriculture and industries.

20. How common is conflict over water resources in general? What are some examples of regional conflicts over water?

- Conflict over water dates back to time immemorial. In recent decades, notable examples include the Six-day War between Israel and its Arab neighbors over water rights of the River Jordan, the Jordan Valley and aquifers in the West bank.
- Such conflict continues to fuel animosity between Israelis and Palestinians.
- It is “a sword of Damocles” over other water-stressed domains including Pakistan and various parts of Africa.

21. How will climate change and population growth change current relationships?

- Climate Change will exacerbate these conflicts as will population growth, which is most prominent in developing world including India (soon to overtake China as the most populous nation), Latin America and Africa.

22. China is building a series of scientific outposts in Antarctica, and some have said they are for “resource security”. What is the purpose of these stations?

- China signed the Antarctic Treaty, which regulates affairs on the continent, in 1983.
- Antarctica is home to possibly the world’s third-largest oil reserves, as many as 203 billion barrels, as well as coal, iron ores,

manganese, and hydrocarbon, fish, and 90% of the world's fresh water.

- Chinese tourism to the region is already booming.
- Chinese leader Xi Jinping said last summer that the country should “take advantage of ocean and polar resources.
- Members of the treaty, including China, have agreed not to begin mining or exploiting the region until 2048.
- China's Antarctic aspirations are likely for status and more importantly, leverage over a distant future when the region opens up. (Much like its interest in the Arctic where it gained status as an observer member to the Arctic Council last year).

23. How concerned should we be about the global water crisis? Are there historical examples of cities or civilizations that have collapsed because of water issues?

- Two-thirds of the world's freshwater is locked up in icecaps and glaciers. A large part of the remainder is buried deep in ancient aquifers, mostly underneath huge deserts.
- Water is needed to grow fodder for animals. It is needed in growing cotton for fabrics and grains, fruit and vegetables for human consumption. It is also needed for power generation. An average westerner water footprint is about a hundred times his own weight every day.
- A great deal of water is wasted in inefficient irrigation, gardening and lack of infrastructure for rainwater conservation and water recycling.
- Treatment systems, efficient irrigation and the monitoring and enforcement of pollution levels can also improve the supply of

usable water. Lower-quality water could be used for urban landscaping and industry, and some water-intensive activities could be moved to the south.

- According to authoritative research, the Khmer civilization in Angkor Wat in Cambodia eventually perished in early fifteenth century due to environmental catastrophe brought about by chronic drought resulting from failure in water management. In Southwest of the United States, the Chaco Canyon Anasazi civilization flourished from 600 A.D until it collapsed around 1150 and 1200 A.D. due to over-population relative to the productive capacity of the land, chronic drought and deforestation. A similar fate befell the ancient Mayans ending with the worst drought in millenniums in A.D. 760.
- We should be very concerned. It's not that overall, the Earth has a water deficit. It's the availability of freshwater, and how they are distributed where and when most needed. It is about who owns such water rights. It's about how the world's water systems are disrupted by human activities and how they impact on human sustenance and the world's ecological sustainability. It's about when the rivers run dry. It's about how all these challenges are exacerbated by climate change and regional rivalries.
