



When Oases dry up

*The Oasis Project:
Historical evolution of adaptability in a oasis region to water resource changes
Research Institute for Humanity and Nature in Kyoto, Japan*



Gobi Dessert. The annual rain-fall is only 10-20 mm.

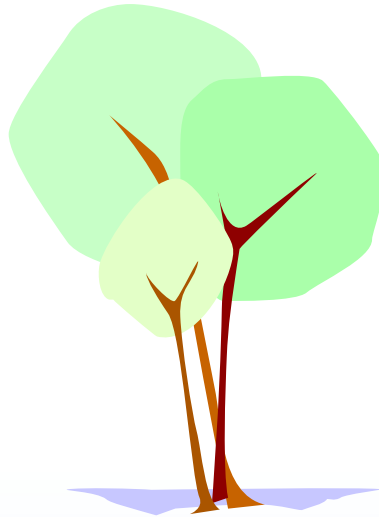


The great wall, the place where the nomadic and agricultural peoples faced up.

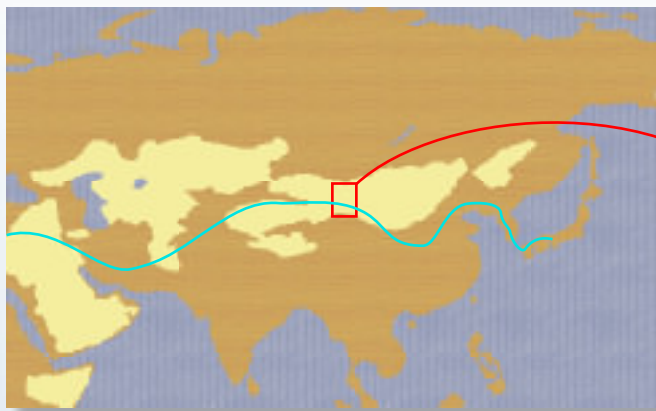


Ancient Chinese cavalry in a wall painting.

A Long History of Oases in Central Eurasia



A vast arid desert extends throughout the central area of the Eurasian continent. Although the land of this region seems barren, it has been occupied by various groups of people for more than 3000 years. This region has been an important trade route between the East and the West, and also a major route for traffic between northern nomadic and southern agricultural cultures. In this arid region, water is available in places called oases that provide subsistence for the local people at present as well as in ancient times.



Extent of the arid deserts in central Eurasia continent, and the ancient Silk Road trade route,.

For the Future Capability of Oasis Regions

The Oasis Project: :A Joint Research Project of Japan and China

The Oasis Project is a research project aiming at reconstructing the history of the interaction between people and nature for the last 2000 years in an arid region of China. The project adopts a trans-disciplinary approach, integrating various studies including history, archeology, ethnology, economics, hydrology, meteorology, glaciology, biology, and agriculture. In this way, we may learn something important that can increase the capabilities of oasis regions over the long term.



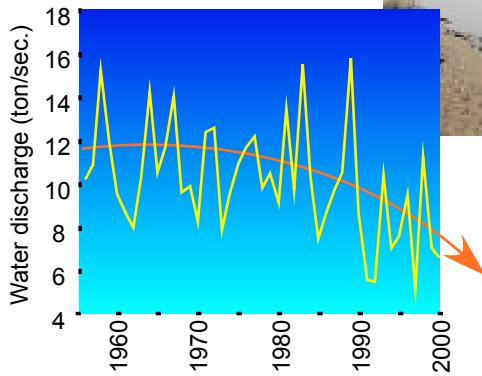
The study site of the Oasis Project is the Heihe River Basin in Qinghai, Gansu Provinces, and Inner Mongolia, China:

The Tung Dynasty
1200 years B.P.

The Qing Dynasty
300 years B.P.



A lake that was full in the past completely dried up in the late 1990s.



Discharge from a river originating in the high mountains has been decreasing recently. (Heihe River)



Future of this Oasis Region: How to Keep its Water Resources

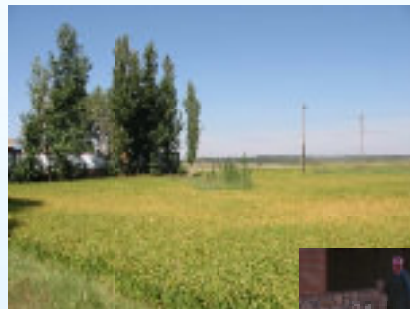
Water shortages have recently become a big issue in this region. Shortages force the local people to move and change their traditional life-style. Impacts force from human activities including overuse of agricultural water, over grazing, and climate change (e.g. global warming) could have caused the water shortage, but exact reason is still unknown. It is important to elucidate the causes and to maintain adequate water resources in the region. For future capability, however, it is more important to consider the basic questions; who possesses the water, and why water is to be used by people.

Causes for the water decline

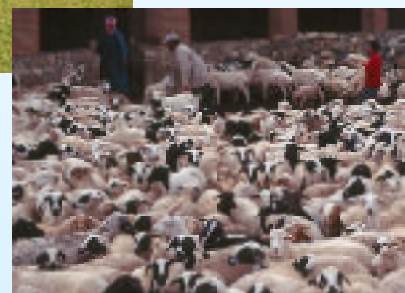
Climate change (Global warming)?



Overuse of agricultural water?



Decrease of vegetation by overgrazing?



RECONSTRUCTION OF THE HISTORY IN THE OASIS REGION

The history of the interaction between people and nature will be reconstructed for the last 2000 years by examining historical documents, ice cores from glaciers, lake sediments, and tree-ring samples.

STUDIES OF THE WATER CIRCULATION SYSTEM: WATER RESOURCES AND DEMANDS

Interviews with local people and field observations will help determine how much water is required for agriculture and the nomadic lifestyle and the transport of water from rainfall, to glaciers, rivers, ground water, and evapo-transpiration.



Glacier



Clouds



River



Evapotranspiration



Ground water (well)

Water Sources for Oases

Oases, with a small amount of rainfall, are supplied with water from rivers and ground water. These originate from precipitation in mountains including melt-water from glaciers. Some water is used for agriculture and the sustenance of local people, and the rest flows out and evaporate due to the intense solar radiation in desert. To understand how water shortages occur in this region, the local water circulation process should be quantified, and how the local water cycle connects with the global water circulation system should be determined. The global connection is important because the water originally comes from the Atlantic and Indian Oceans.



The water circulation process in the oasis region is in association with global water system. Rain water in the region originate from the Atlantic and Indian Oceans. Desertification of the region causes frequent sand-storms that spread toward eastern China, and blow Kosa (yellow sand) to Japan.



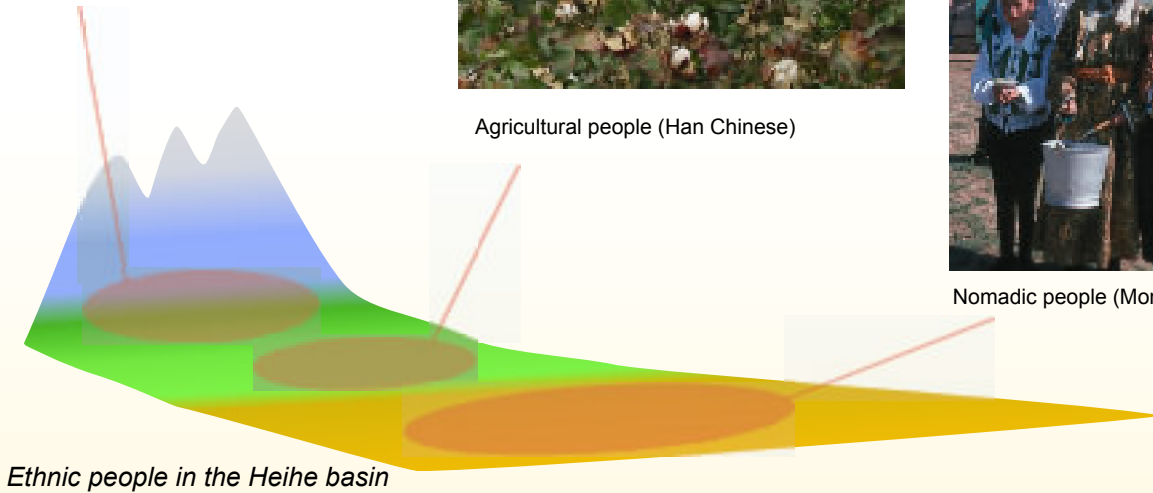
Stock farmers in mountain region (Yugur)



Agricultural people (Han Chinese)

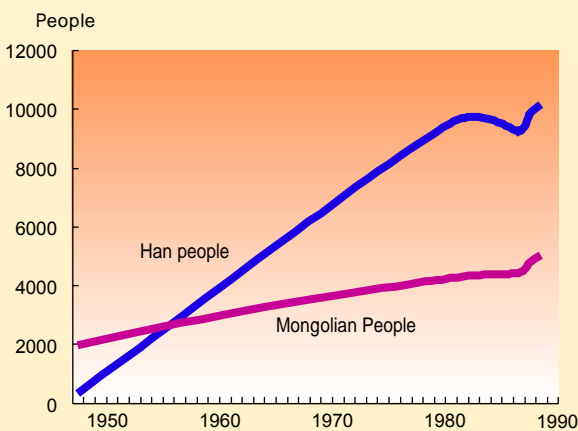


Nomadic people (Mongolian)

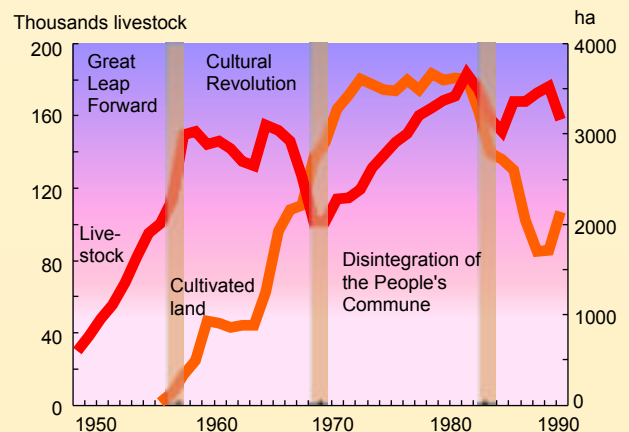


Various People around Water in the Oasis Region

The oasis region has been inhabited by various ethnic groups who have different religions, cultures, and lifestyles. In the present Heihe river basin, stock farmers (Yugu people) live in the mountains, agricultural people (Han people) live in the oasis area, and nomadic people (Mongolian people) live in the Gobi-desert. The lifestyles of these people have drastically changed with changes in natural environment and government policy. In particular, the recent water shortage greatly impacts the local people and destroys their traditional lifestyles.



Population change of Han and Mongolian people in Ejina city, Inner-mongolia: the city used to be a settlement of nomadic people (Mongolian), but agricultural people (Han) have significantly increased recently.



Change of cultivated land area and the number of livestock in Ejina City: they have changed with Chinese government policies.



The Han Dynasty
206 BC~220 AD



The Han Dynasty was ambitious in western China. In particular, they fought against the nomadic Xiongnu Dynasty, which had a sphere of influence in the western area. The Han Dynasty reclaimed land to expand its farmland.

The Yuan Dynasty
1206~1367 AD



The Yuan Dynasty, which was ruled by nomads, also developed irrigated farmland. This could be one of the eras when nomadic and farming people were in harmony.



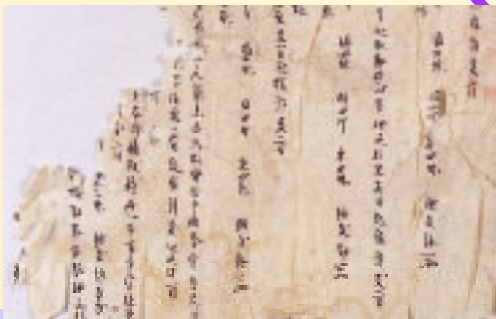
Stone rubbings (Shanxi Lishi Huaxiangshi E01-05, Zuobiaomu Qima Chuxing Huaxiang) in the holdings of the Institute for Research in Humanities, Kyoto University

People and Water Throughout History

There are many ruins in the desert that indicate the history for the last two thousand or more years. Many documents have been excavated in these ruins that will be read by historians, social scientists, hydrologists, meteorologists to be better understand the water environment of the region in the past. We might discover a previous era in which people lived in harmony with the water resources.



Irrigation systems in the Yuan Dynasty still remain in the desert. (agricultural people in a wall painting and an irrigation channel, Lucheng)



The Qing Dynasty
1644~1912 AD

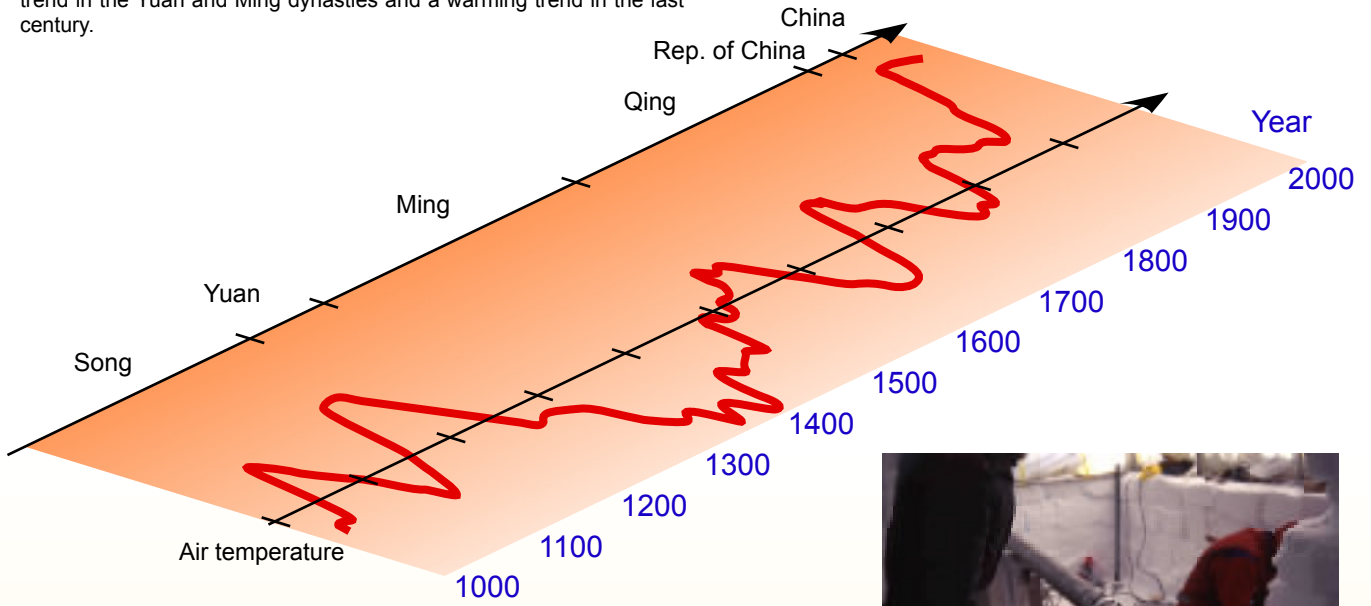
Many documents have been discovered in the ruins of the Xixia and Yuan Dynasties. These documents tell us about the life of the people at that time. (A ruin, the Heicheng, and a document discovered there.)



The vast collection of official documents of the Qing Dynasty includes detailed meteorological and agricultural information of the region.



Air temperature variations over the last thousand years. These were reconstructed using an ice core retrieved from a glacier in the Qilian Mountains located upstream of the Heihe Basin. It shows a cooling trend in the Yuan and Ming dynasties and a warming trend in the last century.



Ice core drilling on a mountain glacier.

Reconstruction of Past Water Environments

Natural changes in the environment could have caused some historical events. The past environmental conditions, such as air temperature and precipitation, have been recorded in glaciers, trees, and the bottom of lakes. Physical and chemical analyses of these natural proxies can allow us to reconstruct the past environment. The natural history would help to understand the interactions between people and nature.



Records in tree rings indicate past environmental conditions.



Sampling of lake sediments. Pollen and remains of plankton that accumulated at the bottom of a lake can tell us about past environments.



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