



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

***Natural and Cultural Heritage Site:
A Special Documentor of Global Changes***

Wang Xinyuan

**International Center on Space Technologies for Natural and Cultural Heritage
Under the Auspices of UNESCO (HIST)
Institute of Remote Sensing and Digital Earth (RADI), CAS**

wangxy@radi.ac.cn

Sep.13 , 2016 Huangshan, China



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

**HIST , a Category II center under the auspices of UNESCO,
is hosted by the Institute of Remote Sensing and Digital Earth of
the Chinese Academy of Sciences (RADI,CAS).**

**It's aimed to provide technical services to UNESCO and its
member states on using space technologies for UNESCO
designated areas.**



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Outline

- 1. World Heritage and Functions**
- 2. Impact of global change on the world heritage site**
- 3. WH could be of a documentor of global change**
- 4. Countermeasures for preserving WH against global changes**



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

1. World Heritage and Functions



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

World Heritage

from UNESCO

Heritage is our legacy from the **past**, what we live with **today**, and what we pass on to **future generations**. Our cultural and natural heritage are both **irreplaceable** sources of life and inspiration.

The UNESCO has sought to encourage the **identification, protection and preservation** of cultural and natural heritage around the world considered to be of outstanding value to humanity.

That is embodied in an international treaty called the Convention concerning the Protection of the World Cultural and Natural Heritage, adopted by UNESCO in 1972.



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

What is the Function of WH

World Heritage are recognized as cultural relics, historic sites, and natural landscapes of outstanding significance and universal value. They are unique, irreplaceable assets to humankind:

- ◆ the **keys** to understanding the evolutionary history of the earth we live on, the evolution of the human being, and the cultural diversities of different nationalities.
- ◆ the World Heritage Sites play roles in education, civilization inheritance and inspiration.
- ◆ and can make unique contributions to world peace and security.
- ◆ is precious resources for the development of tourism and economy.
- ◆ heritage sites can be of particular importance for mitigating further impacts of climate change.



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

2. Impact of global change on the world heritage site



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Global change

Global change refers to **planetary-scale** changes in the **Earth system**.

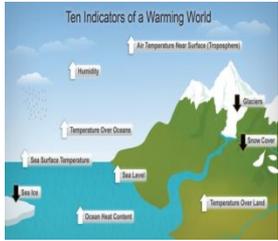
“global change” encompasses: climate, the economy, population, communication, land use and land cover, urbanization, globalization, transport, resource use, energy development, atmospheric circulation, ocean circulation, the carbon cycle, the water cycle and other cycles, sea ice loss, sea-level rise, food webs, biological diversity, pollution, health, over fishing, and more



United Nations
Educational, Scientific and
Cultural Organization

International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

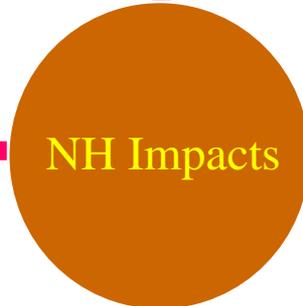
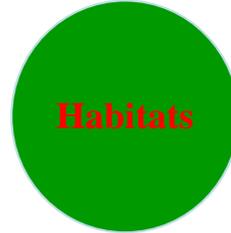
Impacts—NH



Galapagos Island



Himalayan



Wolong



Bwindi





United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Impacts—CH



**Temple-Nepal
(Earthquake)**



Old City of Jerusalem



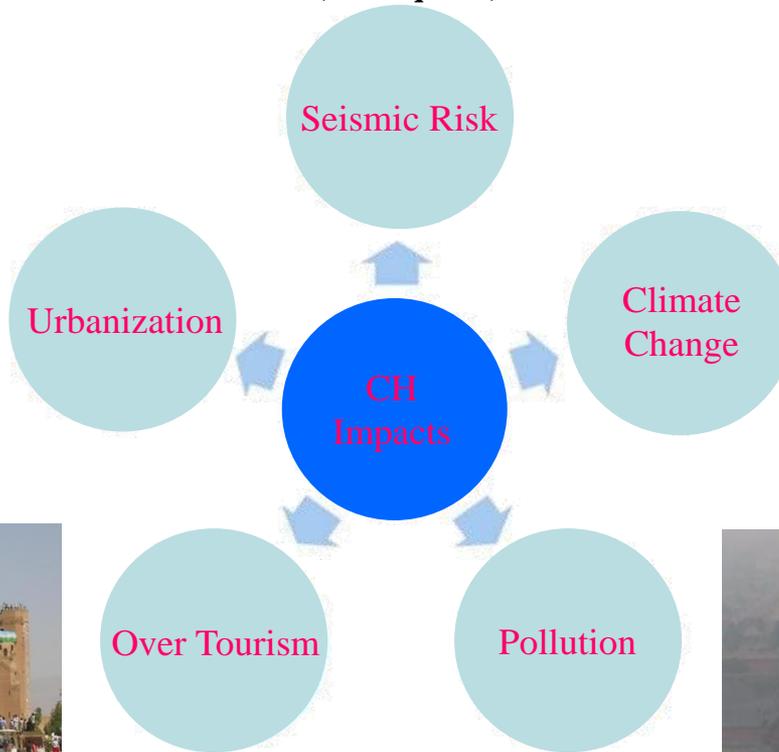
**Venice
(sea level rise)**



Shakhrisyabz



**Imperial Palace
(air pollution)**



Urbanization

**Climate
Change**

Over Tourism

Pollution



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

3. WH is of a documentor of global change



United Nations
Educational, Scientific and
Cultural Organization



In cooperation with UNESCO's
World Heritage Centre

The Great Wall

China

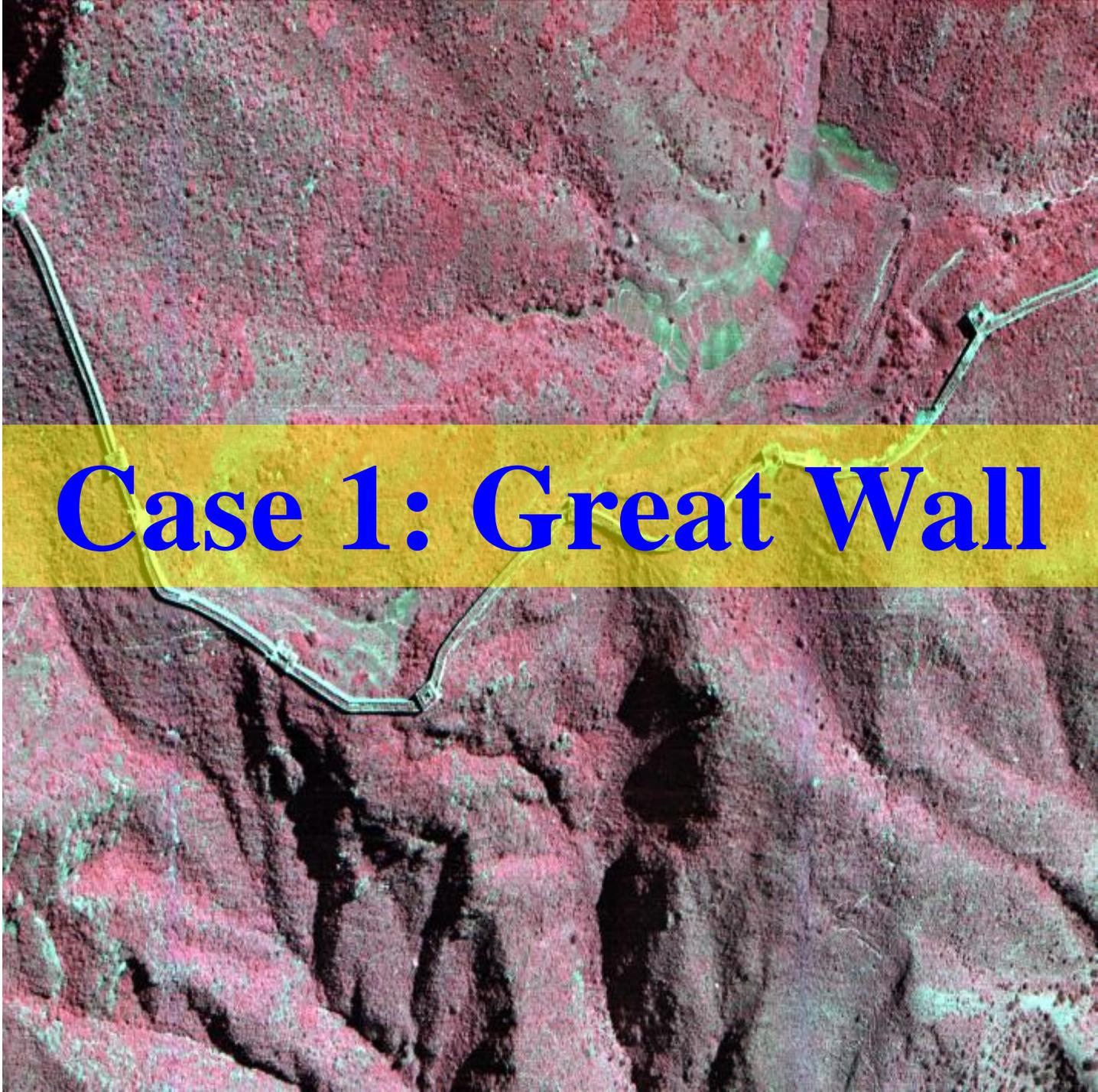


©UNESCO

In c. 220 B.C., under Qin Shi Huang, sections of earlier fortifications were joined together to form a united defence system against invasions from the north. Construction continued up to the Ming dynasty (1368–1644), when the Great Wall became the world's largest military structure. Its historic and strategic importance is matched only by its architectural significance.

[More details](#)

Ref.	438
Year inscribed	1987
Criteria	(i)(ii)(iii)(iv)(vi)
Core zone	2151.5500 Ha
Buffer zone	4800.8000 Ha
Multiple locations	Display in Google Earth



Case 1: Great Wall



United Nations



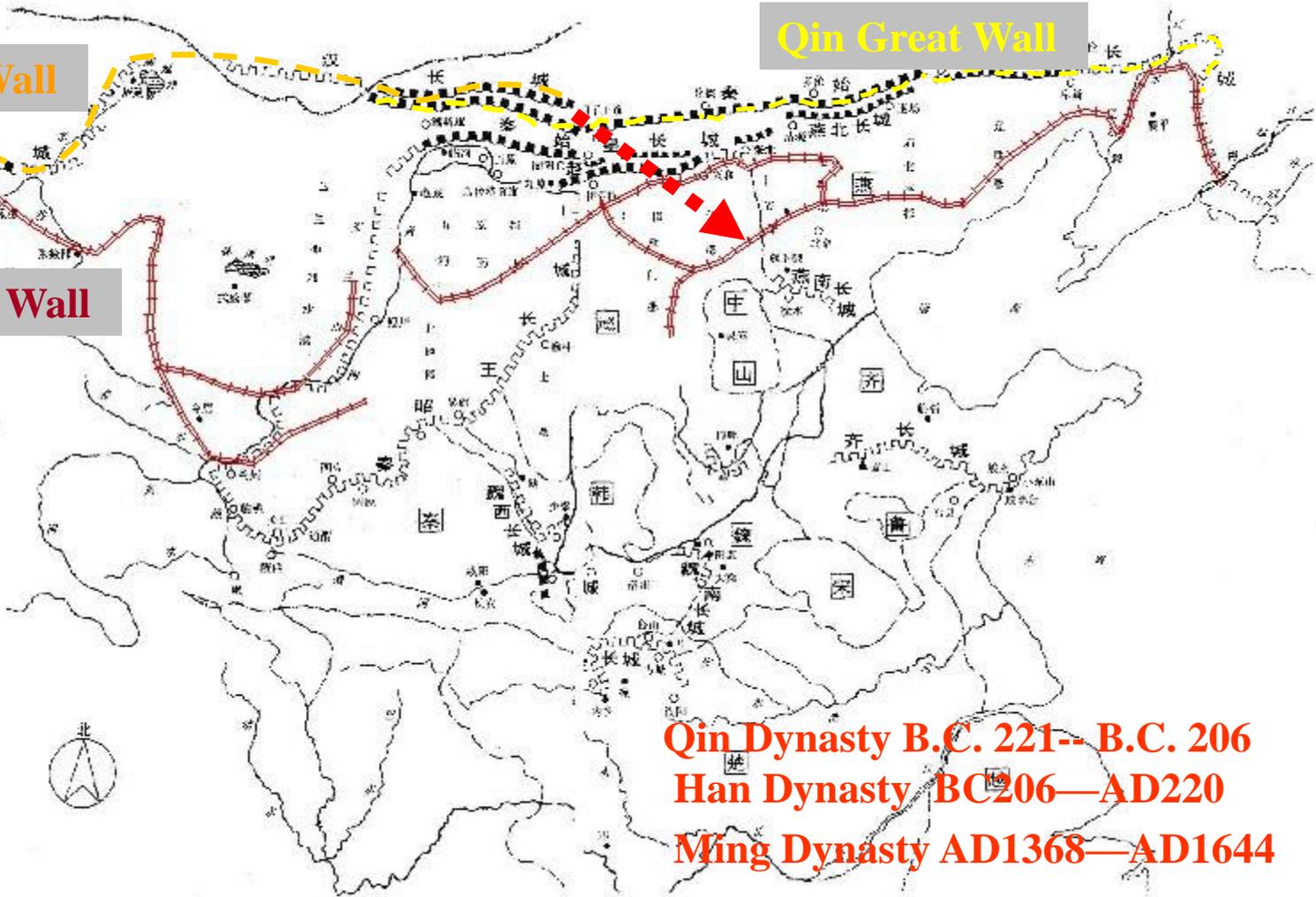
International Centre on Space Technologies for

The boundary wall position is **not at the same location in different era,**
Why? The location of the Great Wall has a relationship with climate
in the building era...

Han Great Wall

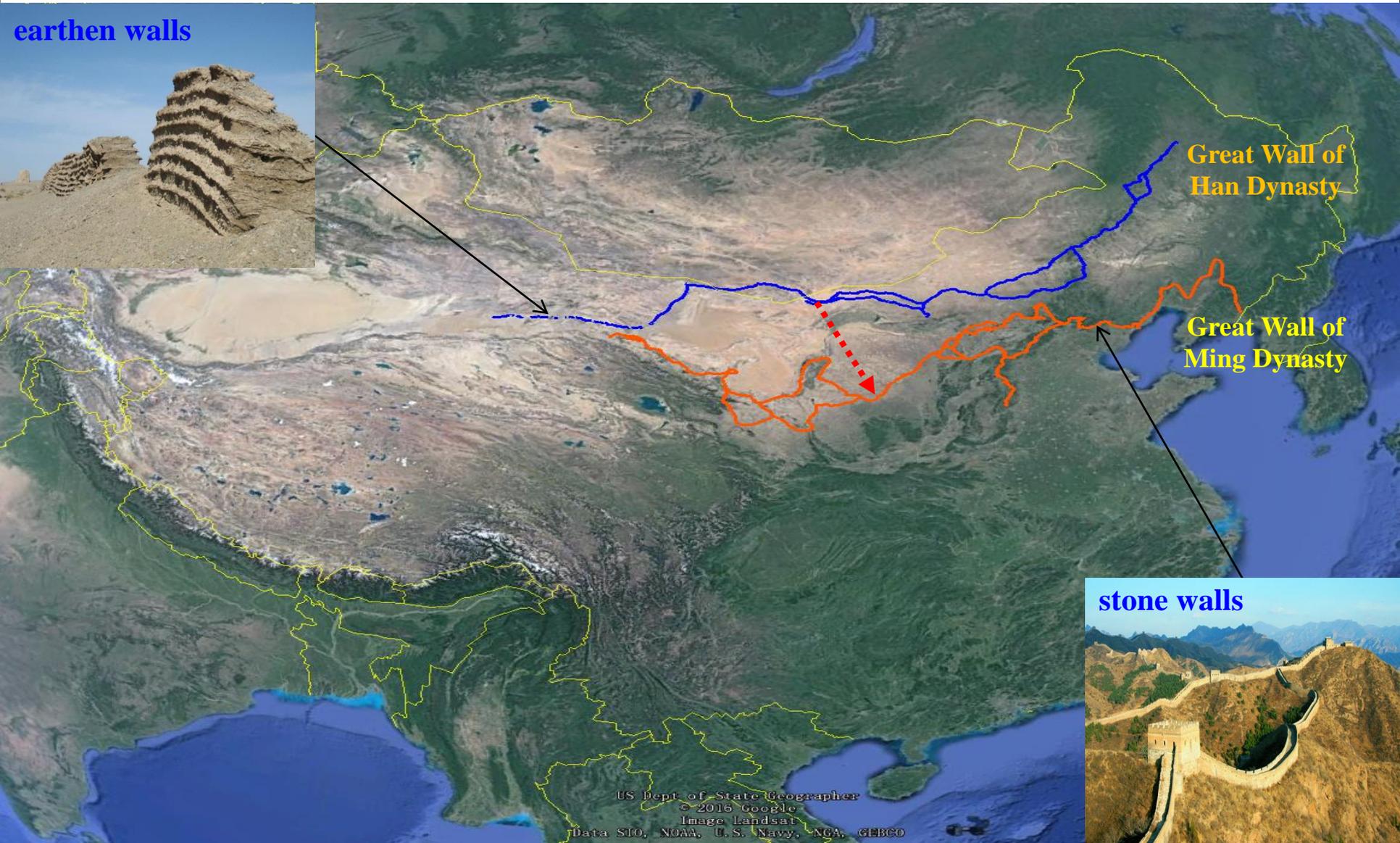
Qin Great Wall

Ming Great Wall



Qin Dynasty B.C. 221-- B.C. 206
Han Dynasty BC206—AD220
Ming Dynasty AD1368—AD1644

The Great Wall forms the boundary between the agriculturalist and pastoralist. The sites reflects the changes of boundaries between agriculture and animal husbandary in NorthernChina in Chinese history





United Nations
Educational, Scientific and
Cultural Organization

International
N und

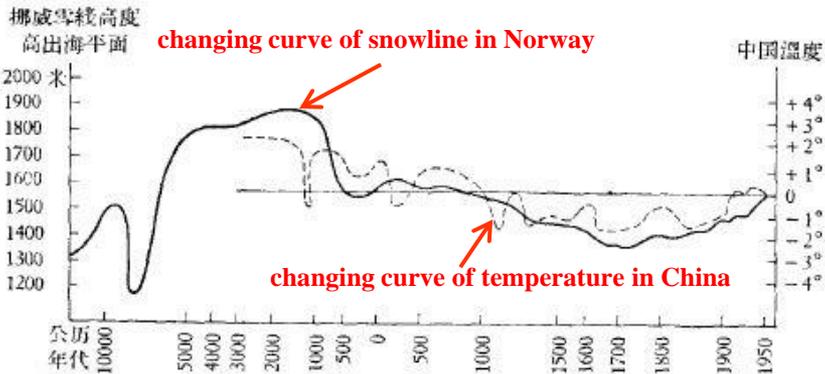
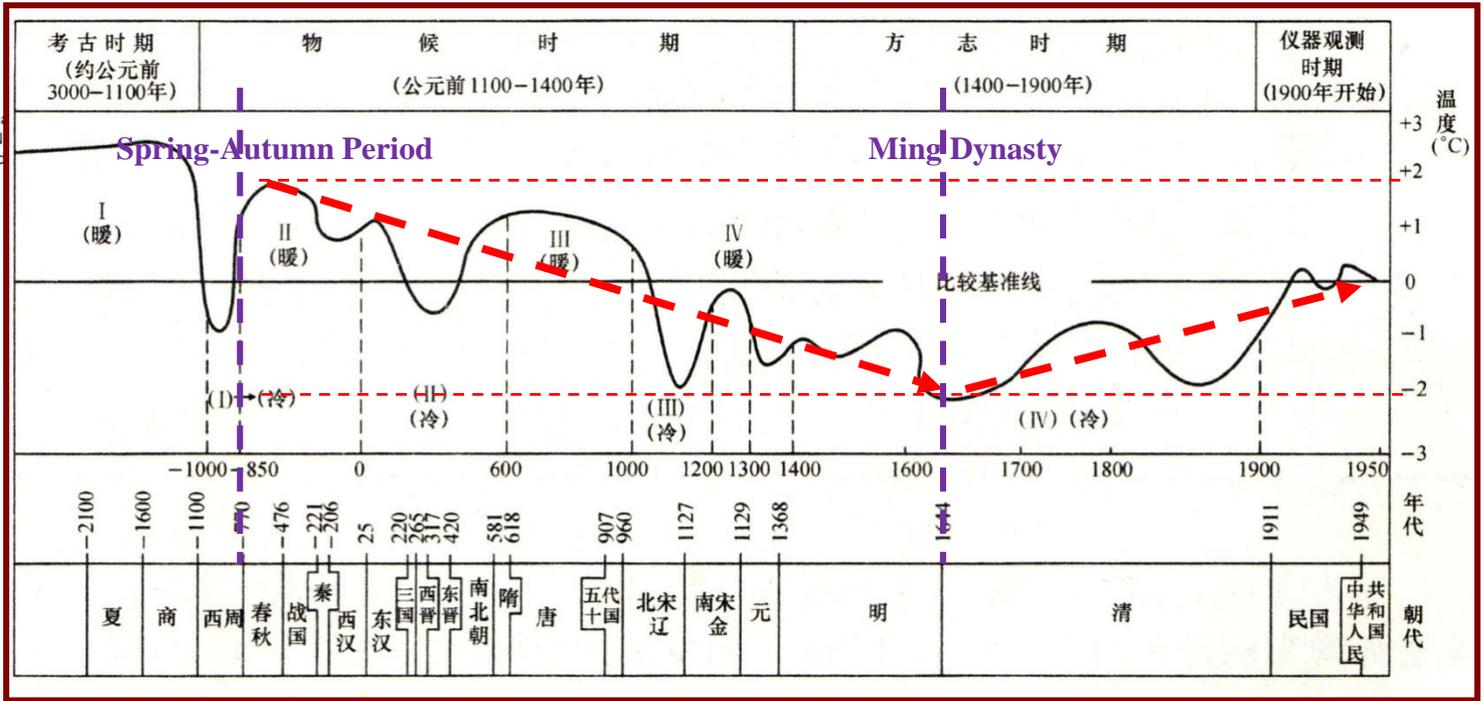


图2 一万年来挪威雪线高度(实线)与五千年以来中国温度(虚线)变迁图

雪线高度以米计,目前挪威雪线高度在1600米左右。
温度以摄氏度,以0线作为目前温度水平。
横线时间的缩尺是幂数的,越至左边缩尺越小。

From Spring-Autumn Period to Ming Dynasty(from B.C.770 to AD1640),the temperature is reduced down , then turn to up.

from: The preliminary research on climate change in China of past five thousand years (Zhu 1973, Science China)

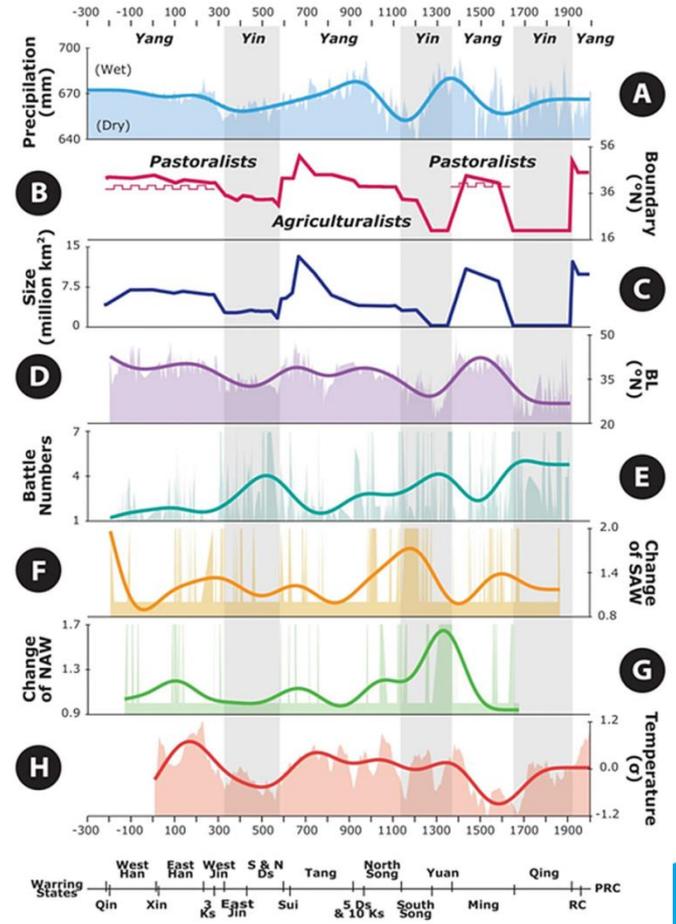
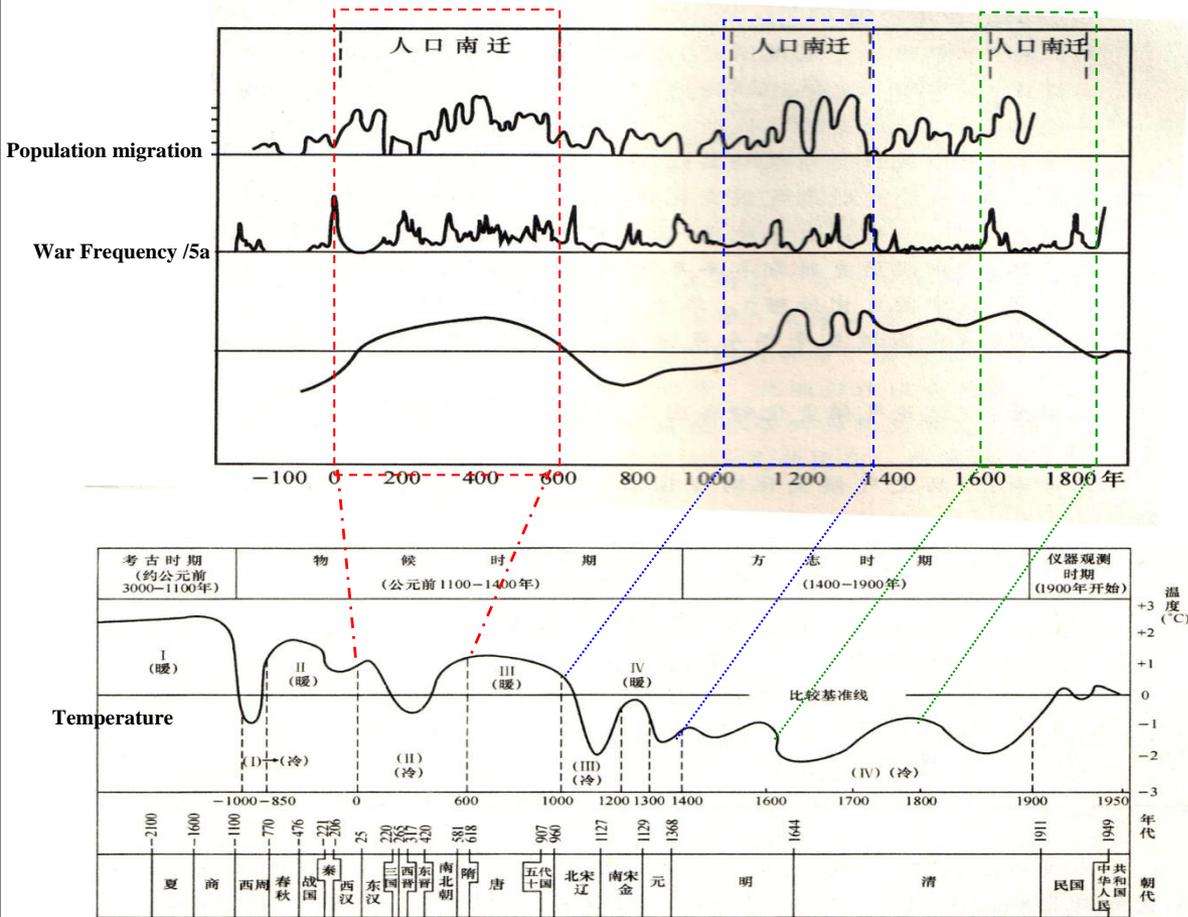


United Nations
Educational, Scientific and
Cultural Organization

International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Cold → Southward Migration → War → New the Great Wall

The invasion of the northern nomadic tribes



Case 2: Silk Road



- Legend
- Cultural Heritage
 - Natural and Cultural Heritage
 - Natural Heritage
 - Maritime Silk Road
 - Land Silk Road

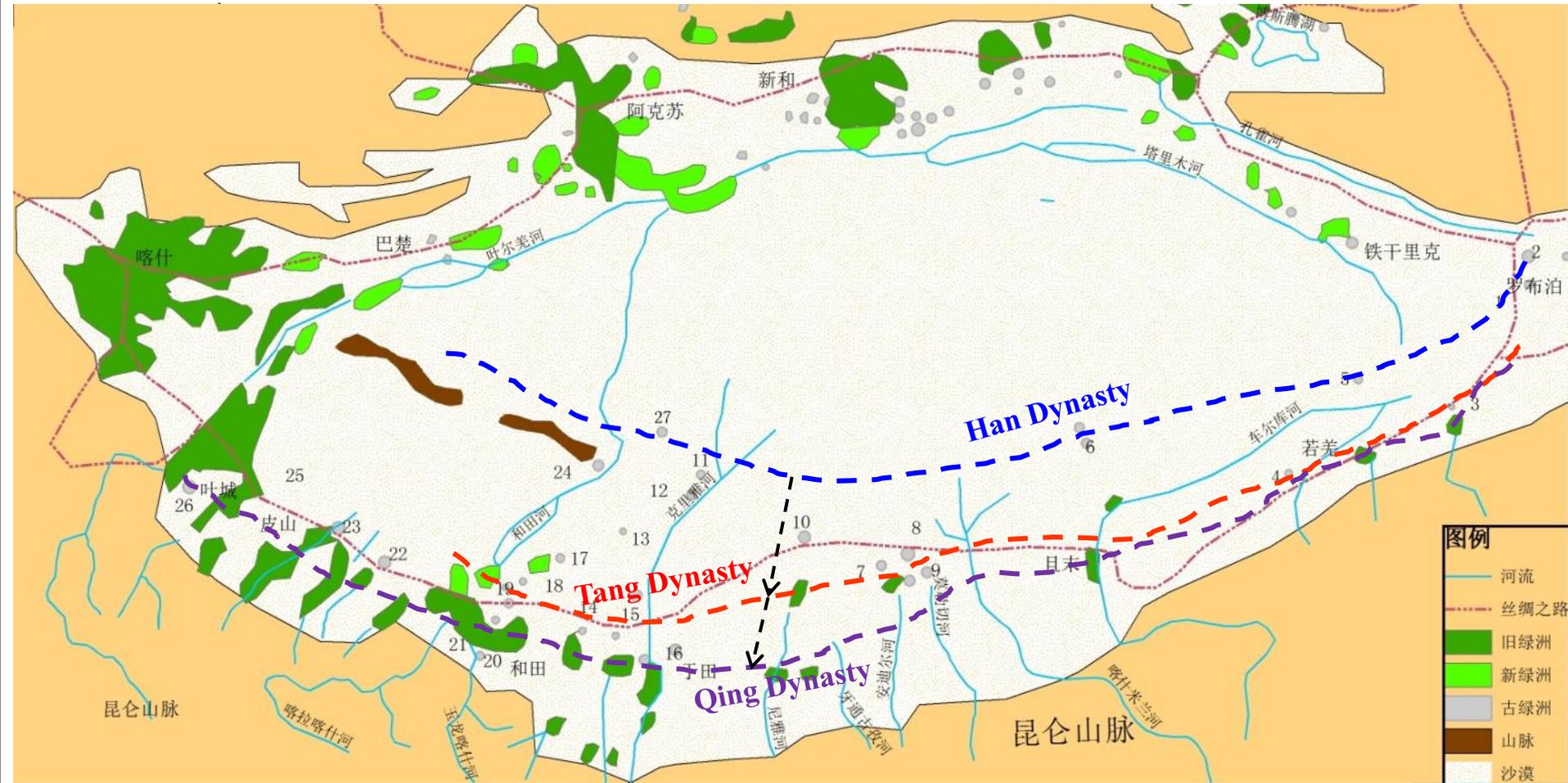
“一带一路”跨越东亚、东南亚、南亚、中亚、西亚、非洲、欧洲等地，其沿线拥有世界文化遗产400多项，数量众多，占全球世界文化遗产总数的近55%。



Distribution of oases and some abandoned ancient cities at the southern margin of Tarim Basin.

United Nations
Educational, Scientific and
Cultural Organization

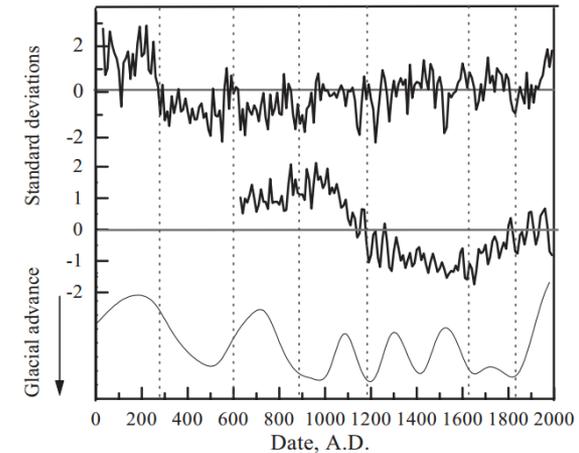
International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO



The numbers represent major ancient cities: 1 Loulan, 2 Turin, 3 Miran, 4 Waxxari, 5 Luobuzhuang, 6 Qemo, 7 Andir, 8 Tiran, 9 Dawuzlek, 10 Niya, 11 Kelaton, 12 Magalek, 13 Dandanwulik, 14 Wucentoti, 15 Damogou, 16 Mohas, 17 Lafak, 18 Bugaiwilik, 19 Akspir, 20 Marikawoti, 21 Yuetgan, 22 Canggui ruins, 23 Pishan, 24 Mazartag, 25 Kehan, 26 Qipan, 27 Yuansha

Climate change → Snow/Glacier cover → Water Supply → Irrigated Oasis → Silk Road Migration

Cultural Organization under the auspices of UNESCO



glacier fluctuations in the Tibetan
(Yang et al., 2003)

White lines indicate the paleochannels

Case 3: Giant Panda Sanctuaries

was inscribed on the World Heritage List in 2006

CHINA

Current range

Prehistoric range

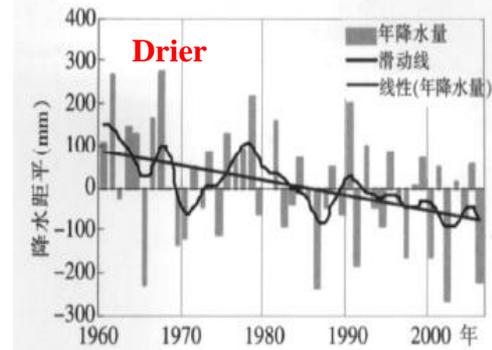
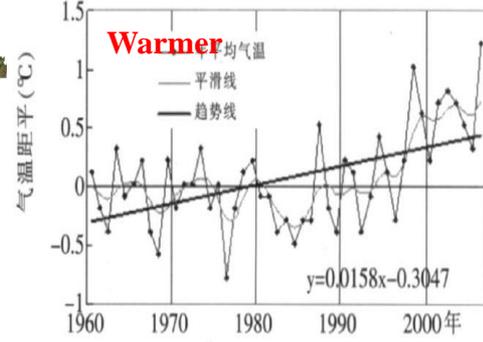




United Nations
Educational, Scientific and
Cultural Organization

International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Habitats of Giant Panda



Giant panda no longer 'endangered'

Its status has been upgraded to 'vulnerable' in the IUCN's latest Red List

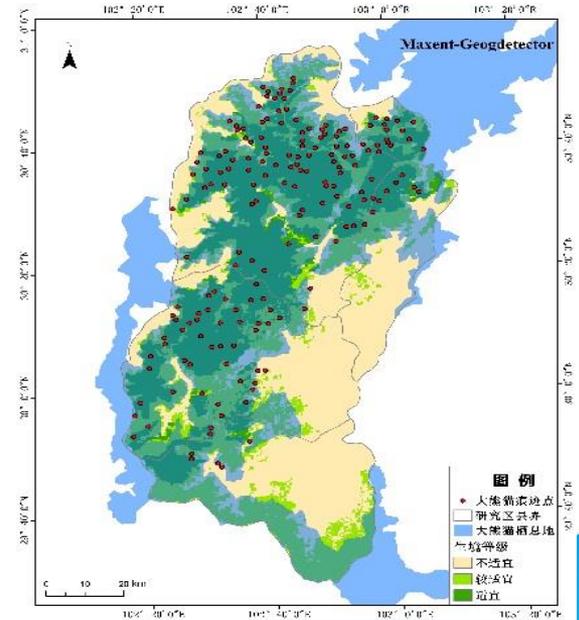
Population in the wild: **approx. 2,060** mainly in China

- Size: up to 1.20 m (on all fours)
- Weight: 100-140 kg
- Food: bamboo
- Genetic background is similar to the bear

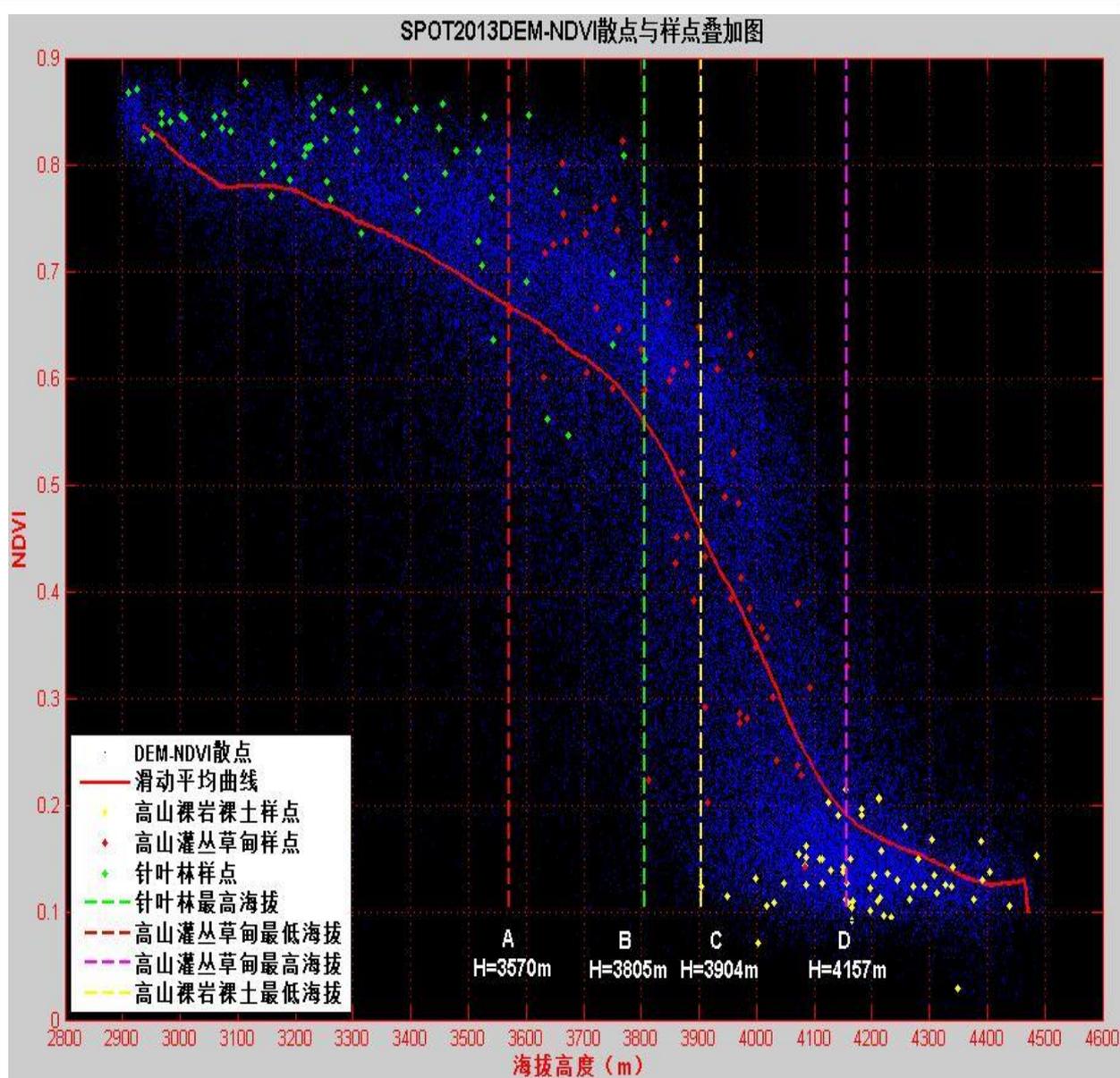
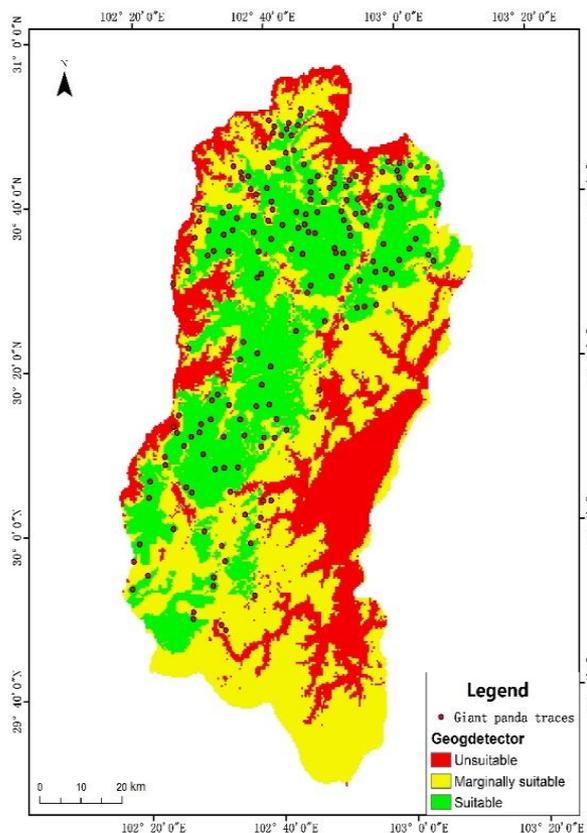


Climate change threatens 35% of its habitat with destruction within 80 years

Source: IUCN



A quantitative characterization method for alpine vegetation zone based on DEM and NDVI



基于NDVI—DEM模型，刻画植被种类变化

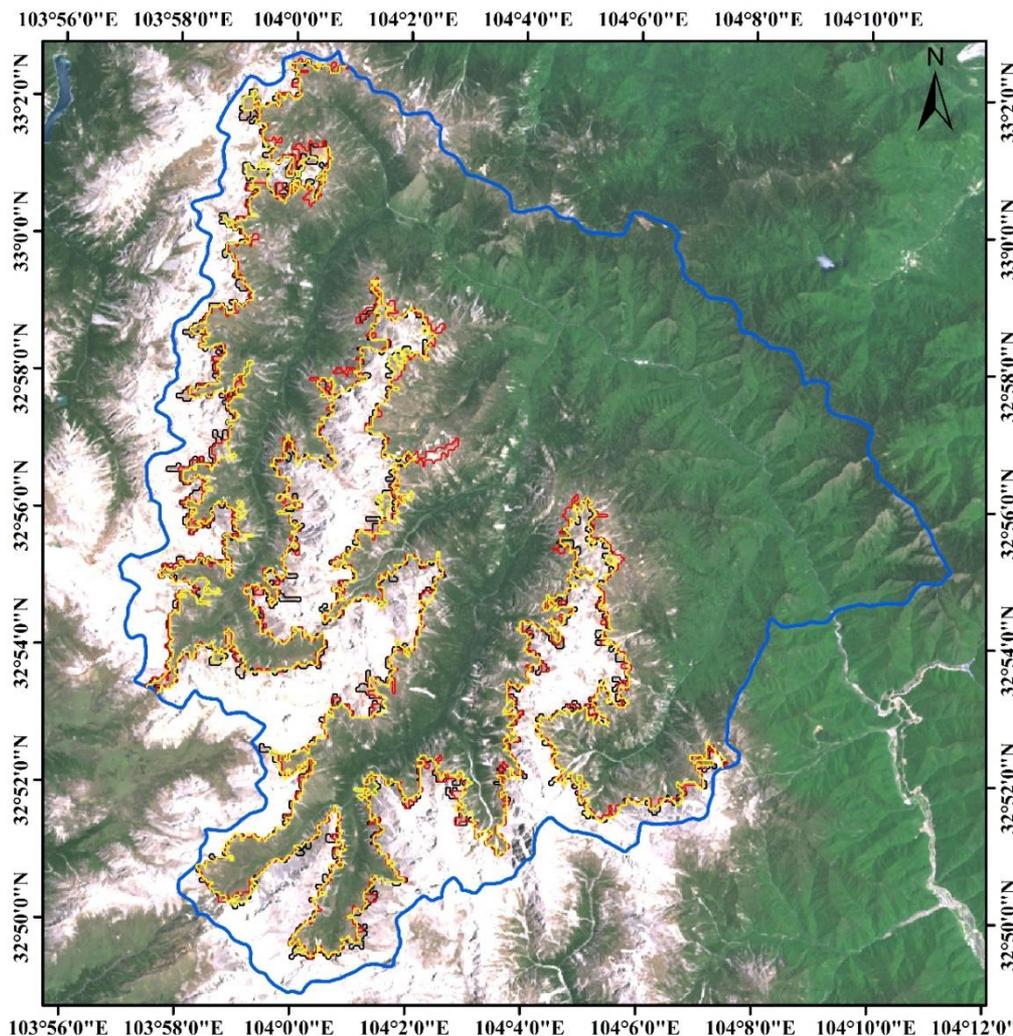
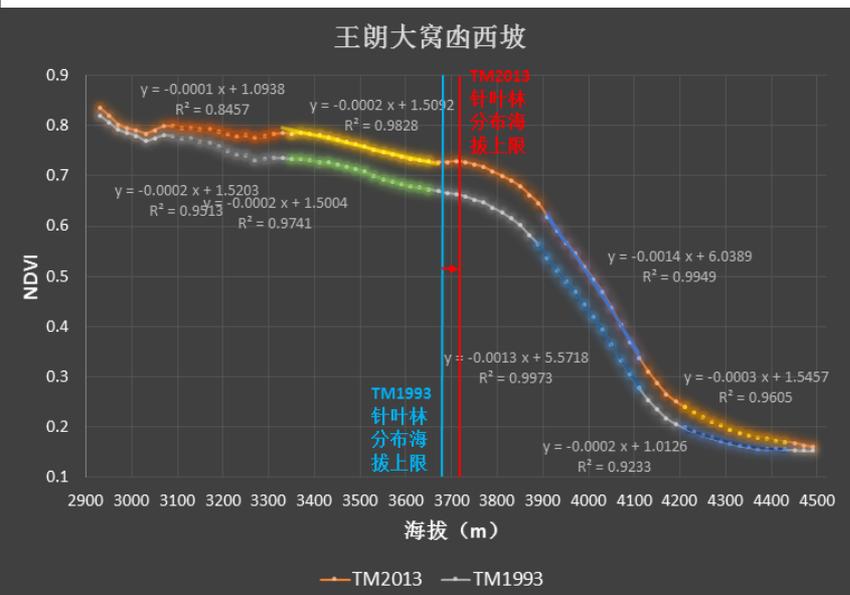


United Nations
Educational, Scientific and
Cultural Organization

International Centre for Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Timberline of Coniferous Forest

基于1994-2001-2014年TM的树种线动态变化图



Duo to **climate change**, suitable habitats of giant pandas will lose dramatically.

Giant pandas have to migrate towards **high altitude**.



Case 4: Sumatra and Ha Long Bay

93° E 95° E 97° E 99° E 101° E 103° E 105° E 107° E 109° E

N 5°

N 3°

N 1°

S 1°

S 3°

S 5°



United Nations
Educational, Scientific and
Cultural Organization

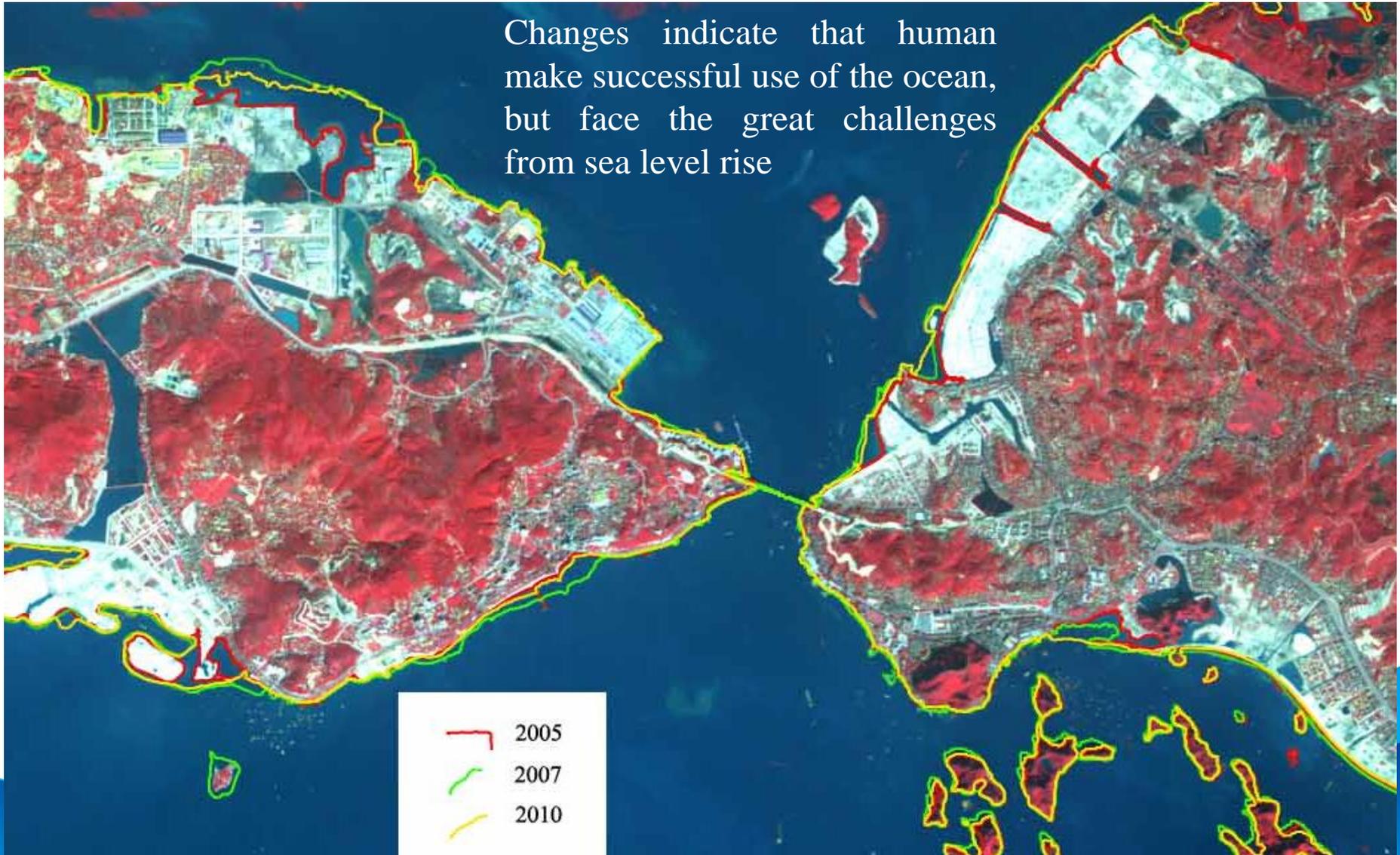


International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Coastline changes of Ha Long recorded by RS image

in Vietnam

Changes indicate that human
make successful use of the ocean,
but face the great challenges
from sea level rise



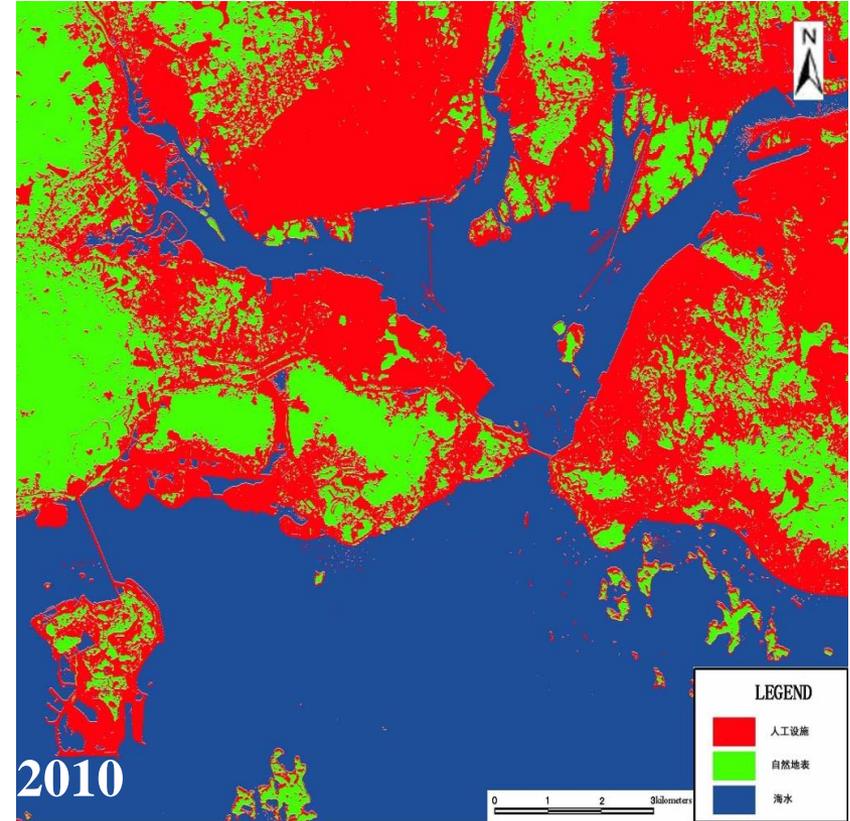
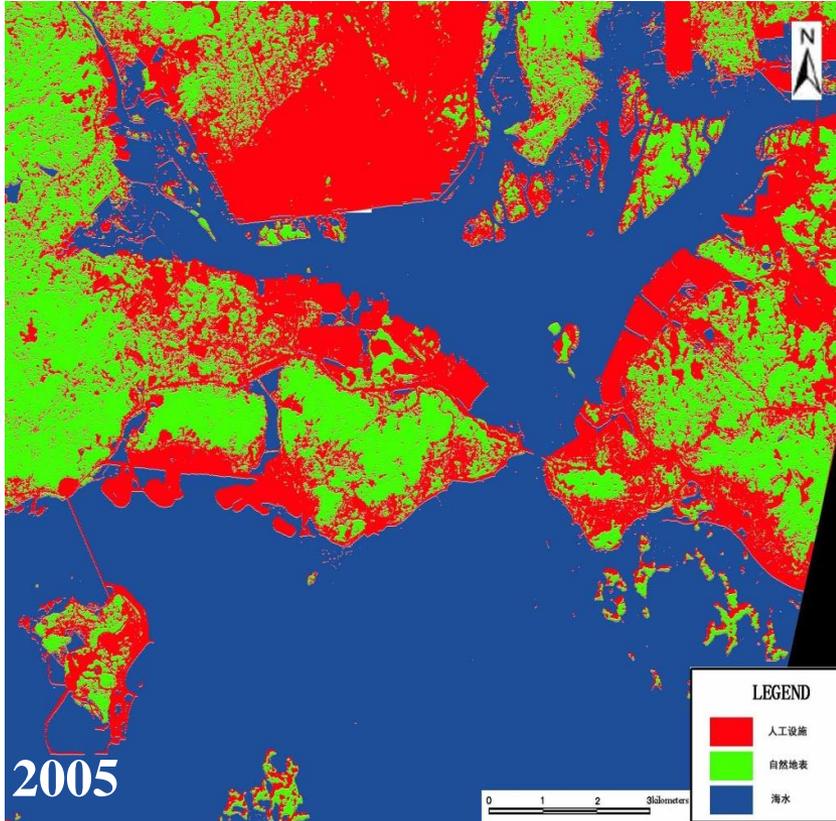


United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Urbanization sprawl of Ha Long City



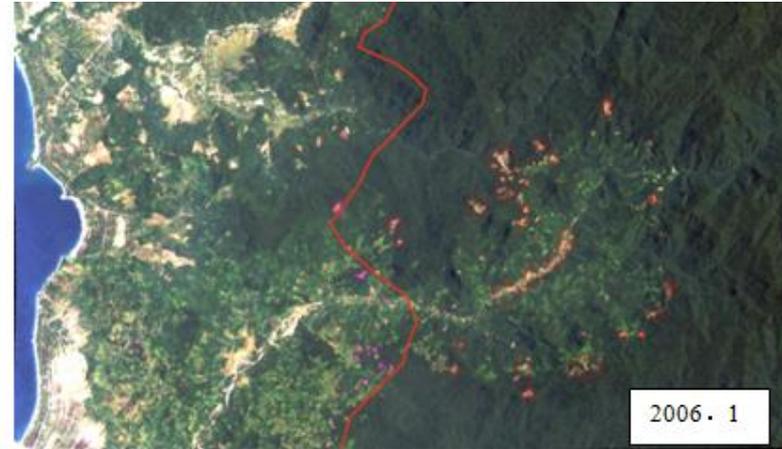


United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Multi temporal remote sensing data reveal the self-restoring capacity of tropical forest



Sumatra in Indonesia



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

4. Countermeasures for preserving WH against global changes

Preserving world heritage is very important .
It is the **keys** to understanding the evolutionary
history of the earth we live on, the evolution of
the human being, and the cultural diversities of
different nationalities.

Countermeasures...



United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

(1) promoting global common actions to global changes



US and China ratify Paris climate
deal ahead of G20 summit

◆ UPDATED





United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

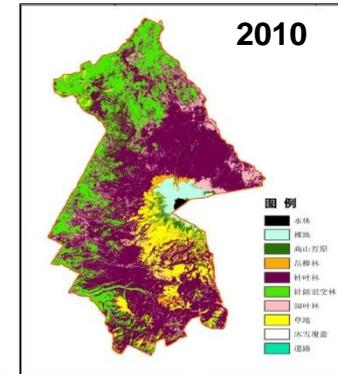
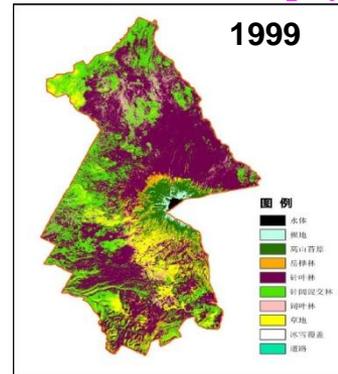
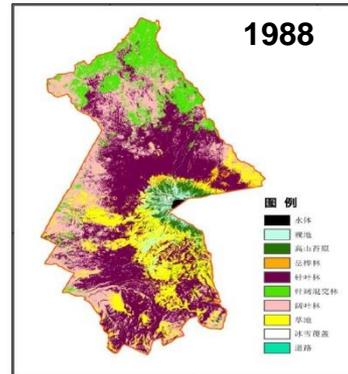
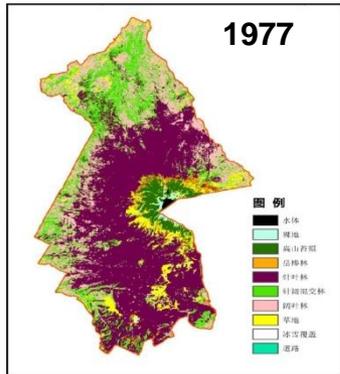
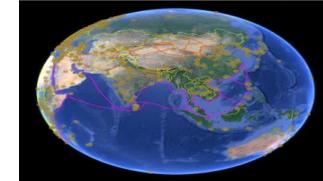
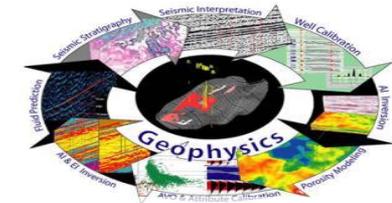
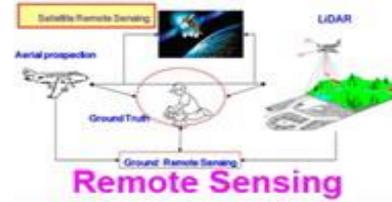
(2) fully play the roles of spatial information technologies in heritage protection and monitoring

Detection

Monitoring

Conservation

Management

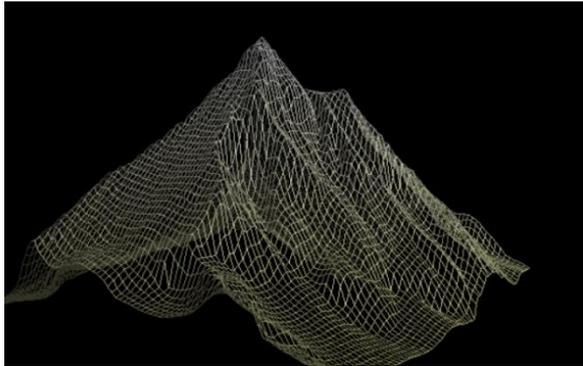
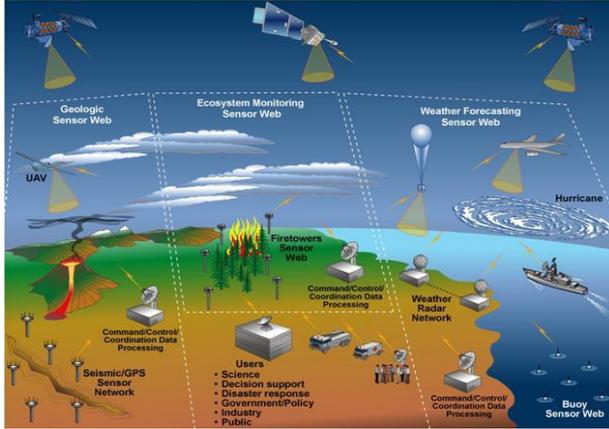




United Nations
Educational, Scientific and

International Centre on Space Technologies for
Natural and Cultural Heritage

(3) building a Geo-platform to achieve Digital Heritage, completely realize digital documentary



digital documentation could be:

- Extended functionality
- Growing number of object in studies → digital tools for analysis essential
- (spatial) combination of data from different disciplines
- Data from various sources
- Availability and functionality of GIS-systems





United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

(4) strengthening international cooperative academic research on world heritage



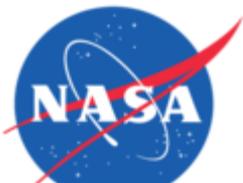
International Council on
Monuments and Sites

Conseil International
des Monuments et des Sites



United Nations
Educational, Scientific and
Cultural Organization

World
Heritage
Convention





United Nations
Educational, Scientific and
Cultural Organization



International Centre on Space Technologies for
Natural and Cultural Heritage
under the auspices of UNESCO

Thanks !