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

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**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.**



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# 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**



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# 1. World Heritage and Functions



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# 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.



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## 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。



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## 2. Impact of global change on the world heritage site



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# 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





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# Impacts—NH



Galapagos Island



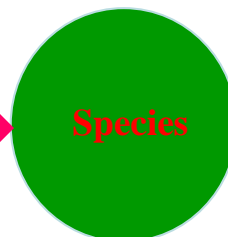
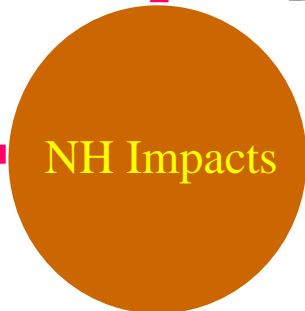
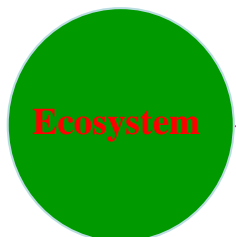
Himalayan



Wolong



Bwindi





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# Impacts—CH



**Temple-Nepal  
(Earthquake)**



**Old City of Jerusalem**



**Venice  
(sea level rise)**



**Shakhrisyabz**



**Imperial Palace  
(air pollution)**







World heritage sites distributed in all over the world faces great challenge from Global change . They could be as a special documentor for Global change

Educational

1052

Properties

34

Transboundary

2

Delisted

55

In Danger

814

Cultural

203

Natural

35

Mixed

165

States Parties

## WORLD HERITAGE 2015-2016



From the vast plains of the Serengeti to historic cities such as Vienna, Lima and Kyoto from the prehistoric rock art on the Borien Peninsula to the Statue of Liberty from the Kaibab of Algeria to the Imperial Palace in Beijing — all of these places, as varied as they are, have one thing in common. All are World Heritage sites of outstanding cultural or natural value to humanity and are worthy of protection for future generations to know and enjoy.

**Key**  
Cultural property  
Natural property  
Mixed property (cultural and natural)  
Properties currently inscribed on the List of World Heritage in Danger  
The World Heritage Committee meets annually in session to review the World Heritage List and to decide on the inscription of new properties and the deletion of properties in danger. The Committee also decides on the extension of the World Heritage List to include new properties and on the deletion of properties in danger. The Committee also decides on the extension of the World Heritage List to include new properties and on the deletion of properties in danger.





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### 3. WH is of a documentor of global change



## The Great Wall

China



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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           | <a href="#">(i)(ii)(iii)(iv)(vi)</a>    |
| Core zone          | 2151.5500 Ha                            |
| Buffer zone        | 4800.8000 Ha                            |
| Multiple locations | <a href="#">Display in Google Earth</a> |

# Case 1: Great Wall





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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 Northern China in Chinese history







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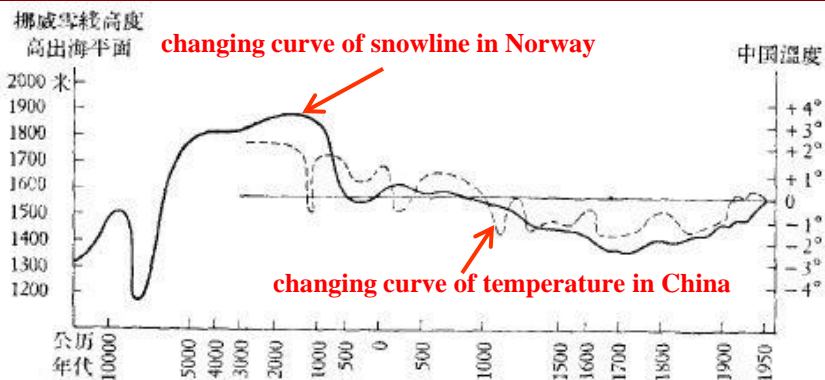
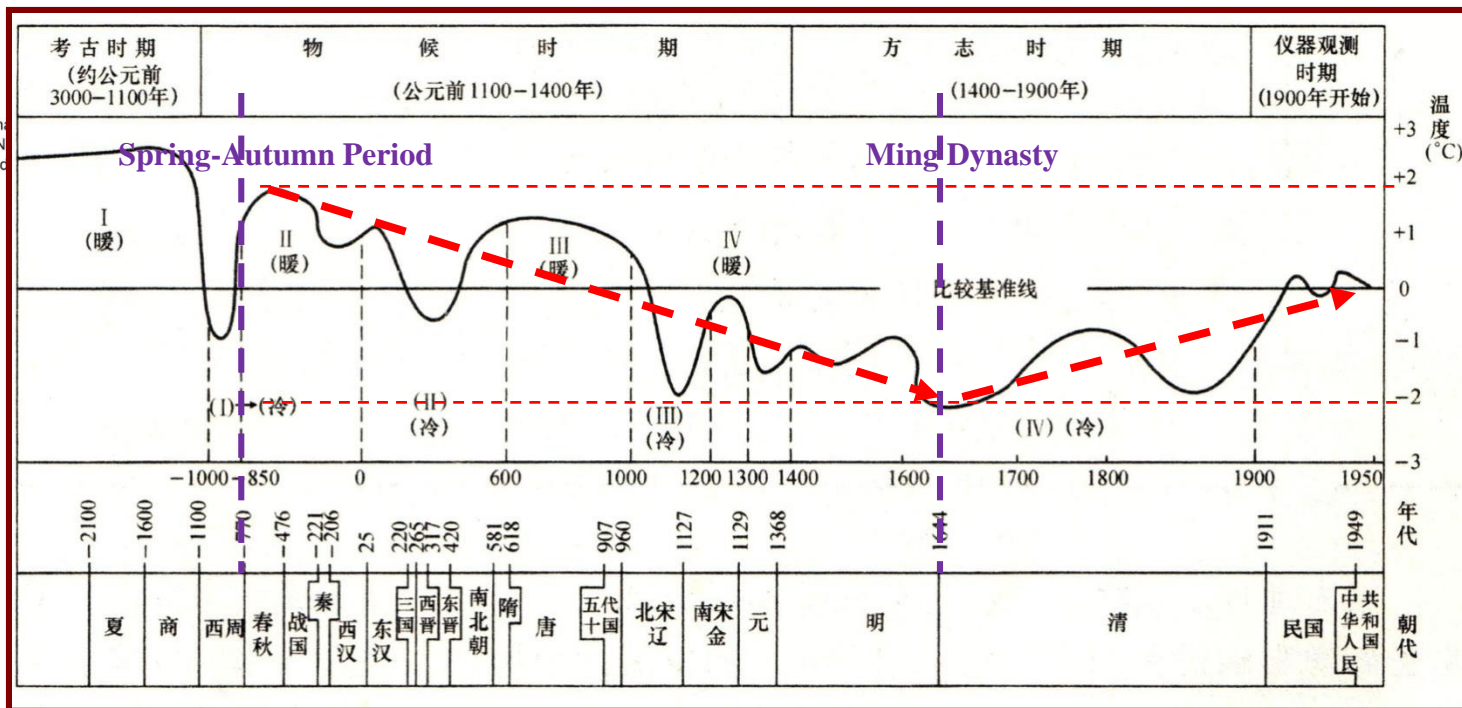


图2 一万年来挪威雪线高度(实线)与五千年来中国温度(虚线)变迁图

雪线高度以米计,目前挪威雪线高度在1600米左右。  
温度以摄氏计,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)





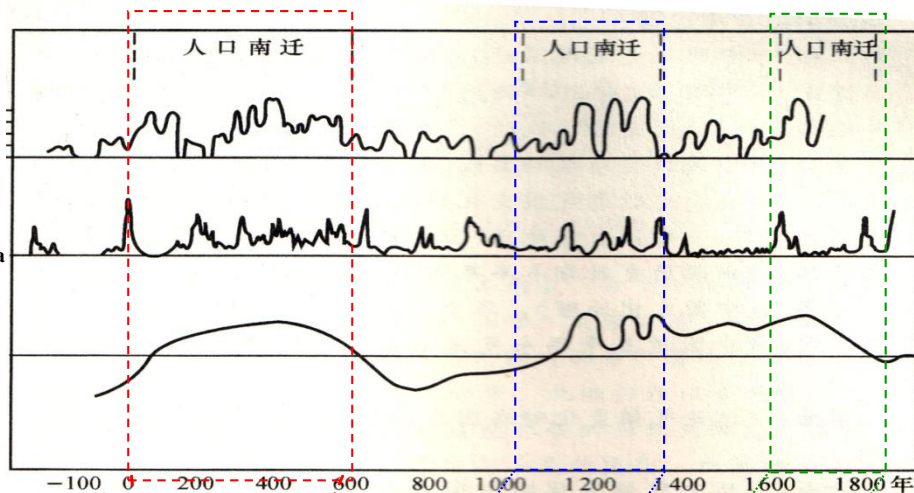
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# Cold → Southward Migration → War → New the Great Wall

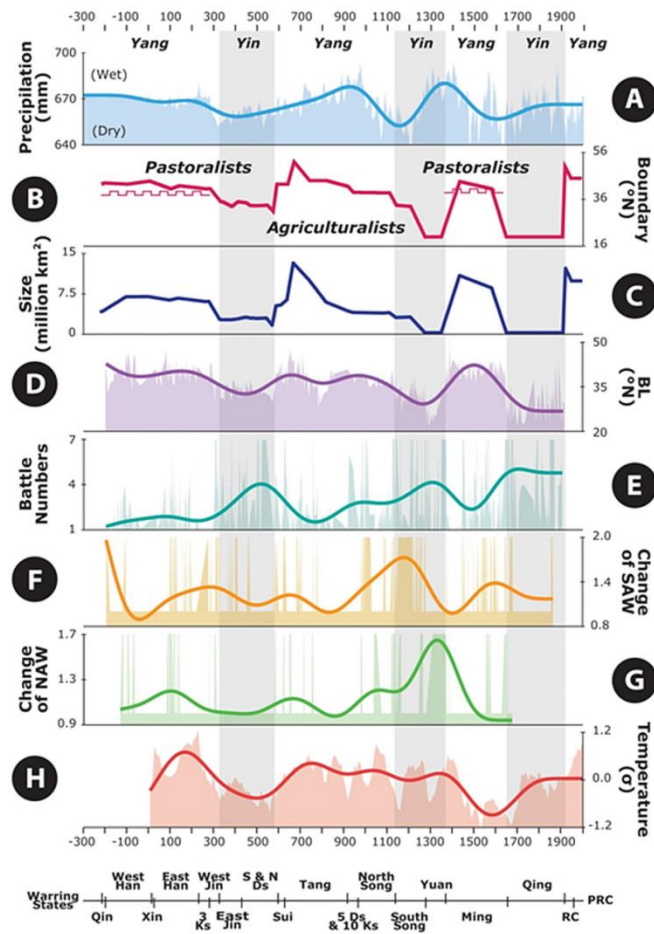
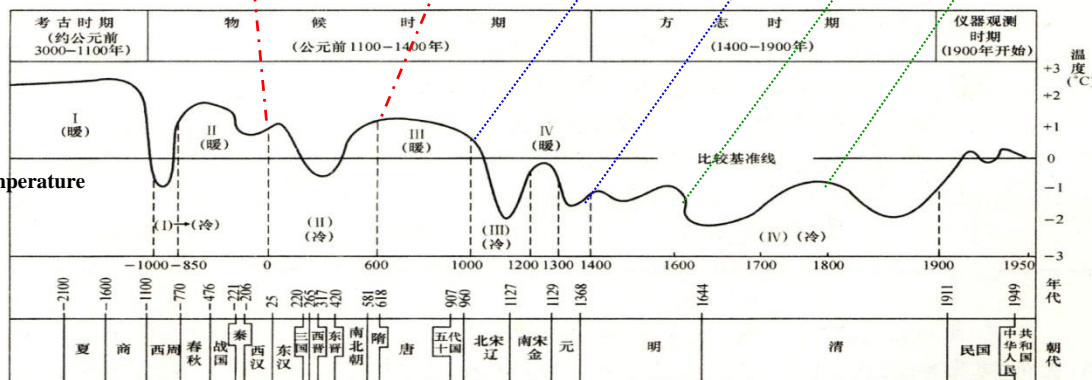
## The invasion of the northern nomadic tribes

Population migration



War Frequency /5a

Temperature





## Case 2: Silk Road



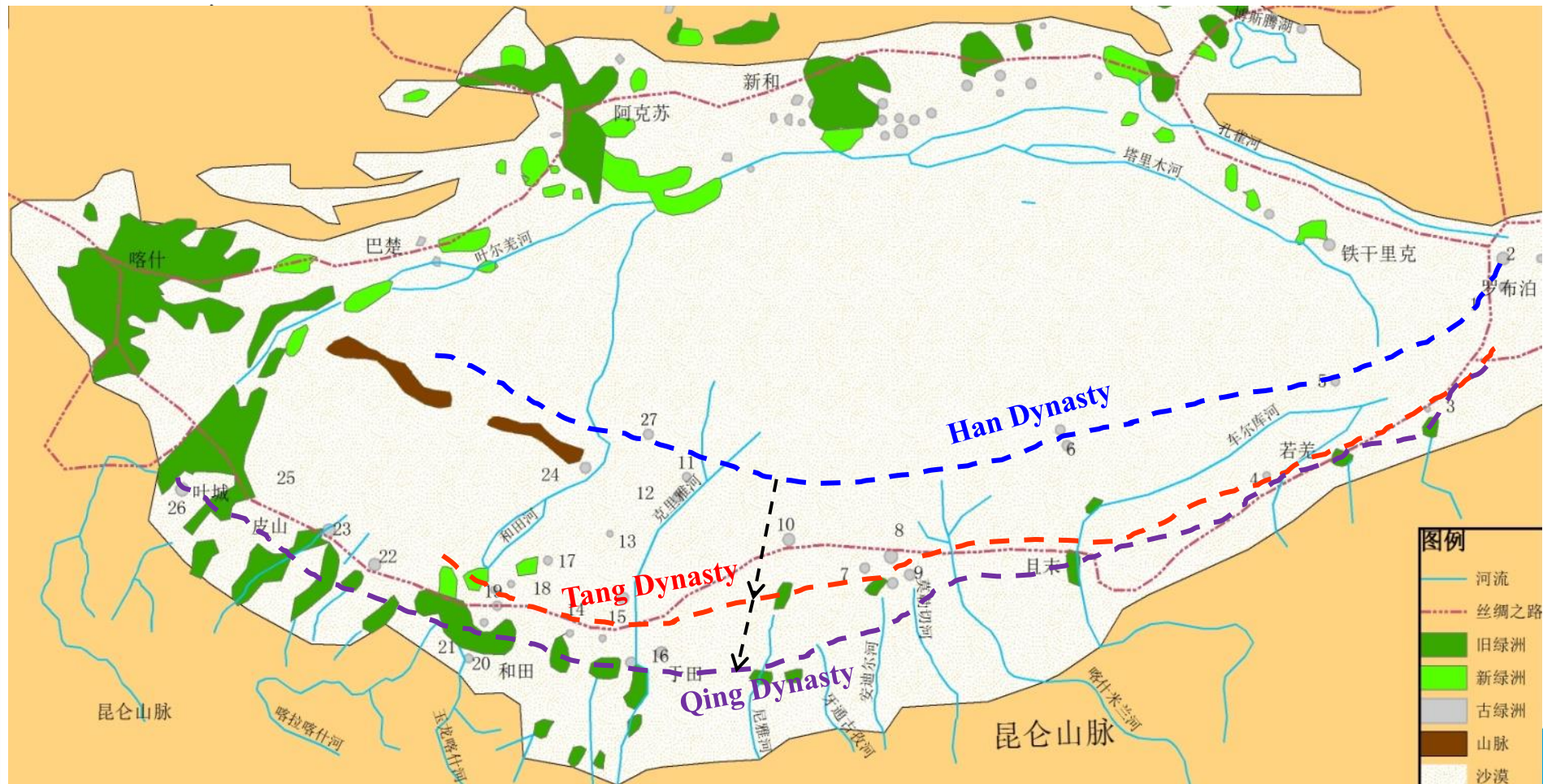




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# Distribution of oases and some abandoned ancient cities at the southern margin of Tarim Basin.

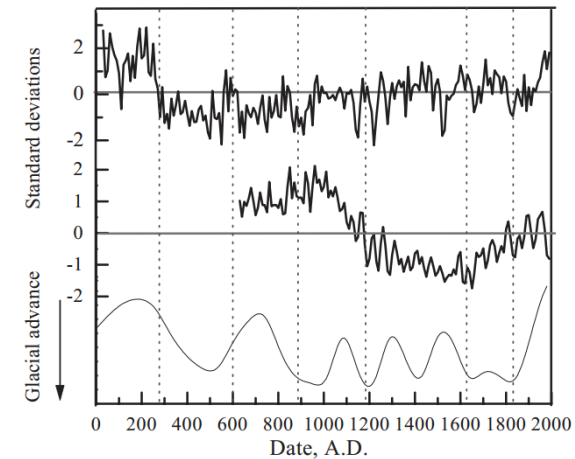
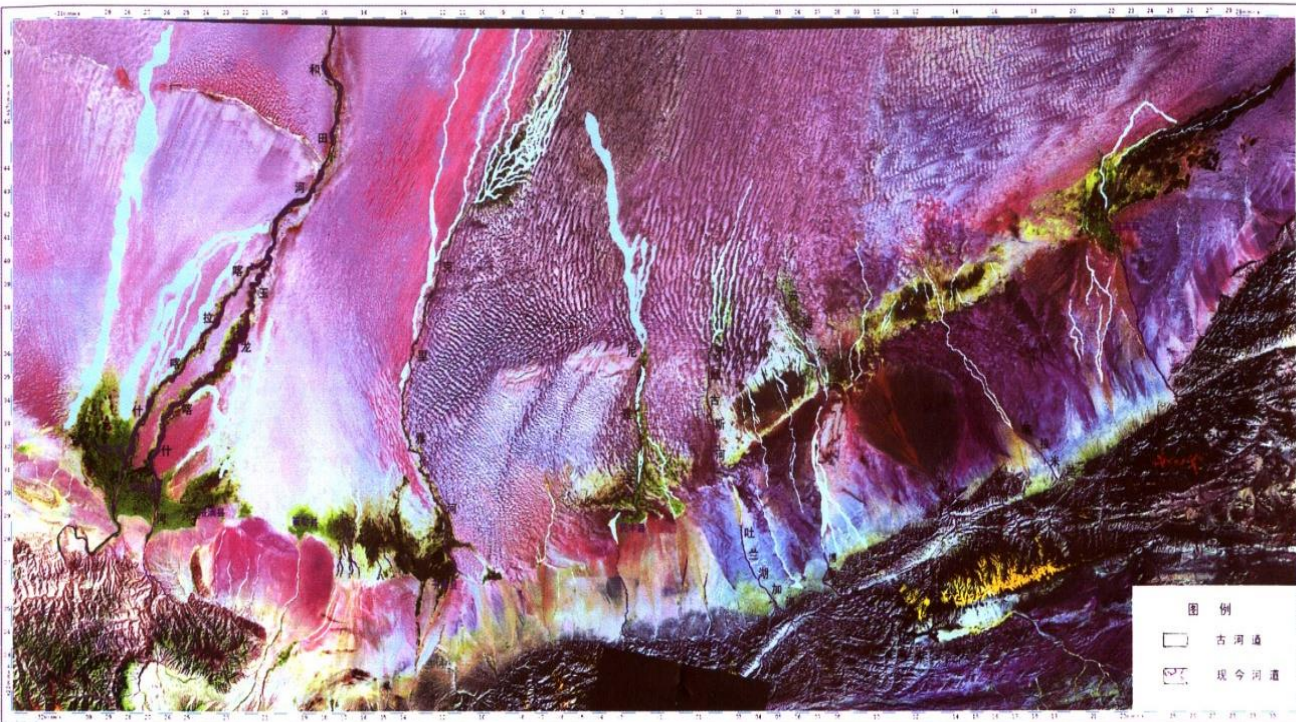


The numbers represent major ancient cities: 1 Loulan, 2 Turin, 3 Miran, 4 Waxxari, 5 Luobuzhuang, 6 Qiemo, 7 Andir, 8 Tiran, 9 Dawuzlek, 10 Niya, 11 Kelaton, 12 Magalek, 13 Dandanwulik, 14 Wucenototi, 15 Damogou, 16 Mohas, 17 Lafak, 18 Bugaiwilik, 19 Akspir, 20 Marikawoti, 21 Yuetgan, 22 Canggui ruins,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



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

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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



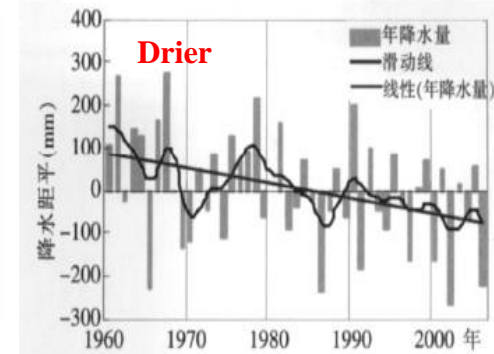
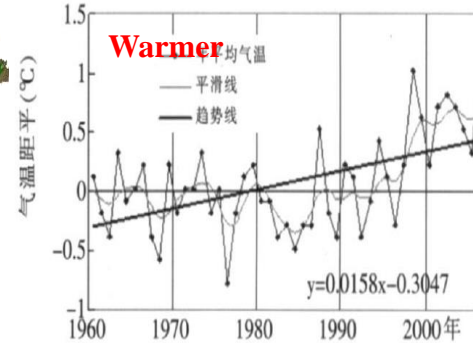
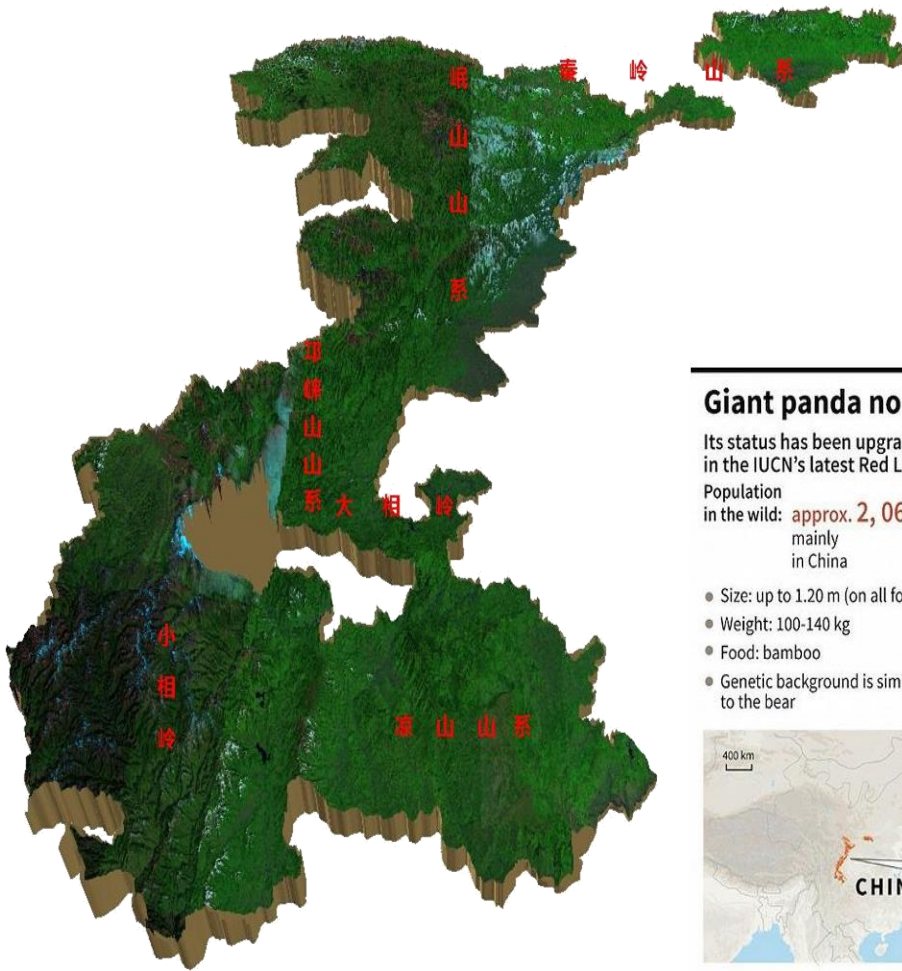




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# Habitats of Giant Panda



## 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

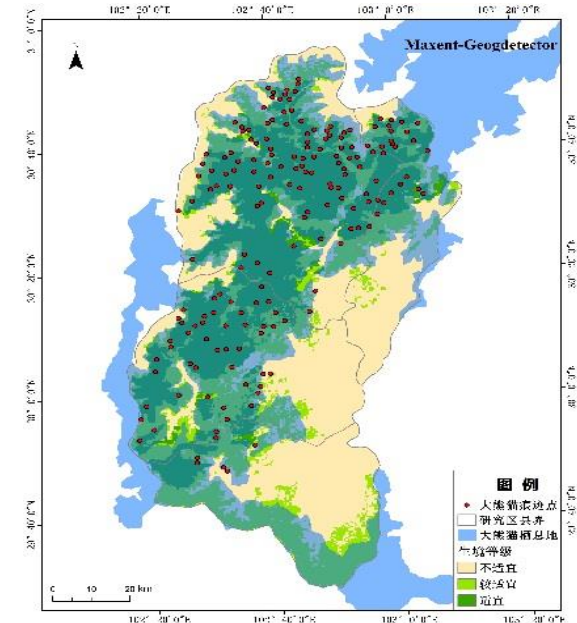
- Size: up to 1.20 m (on all fours)
- Weight: 100-140 kg
- Food: bamboo
- Genetic background is similar to the bear



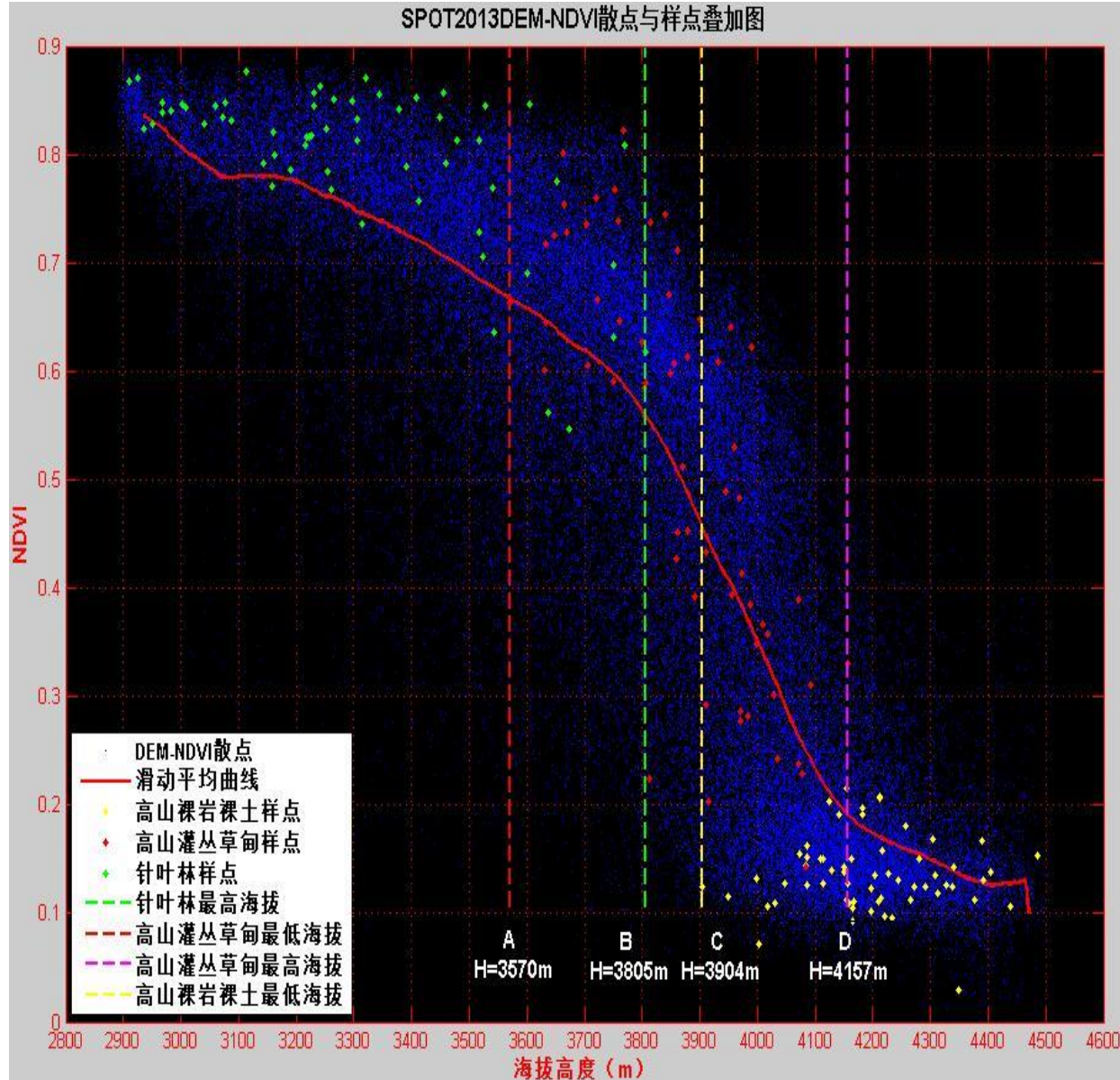
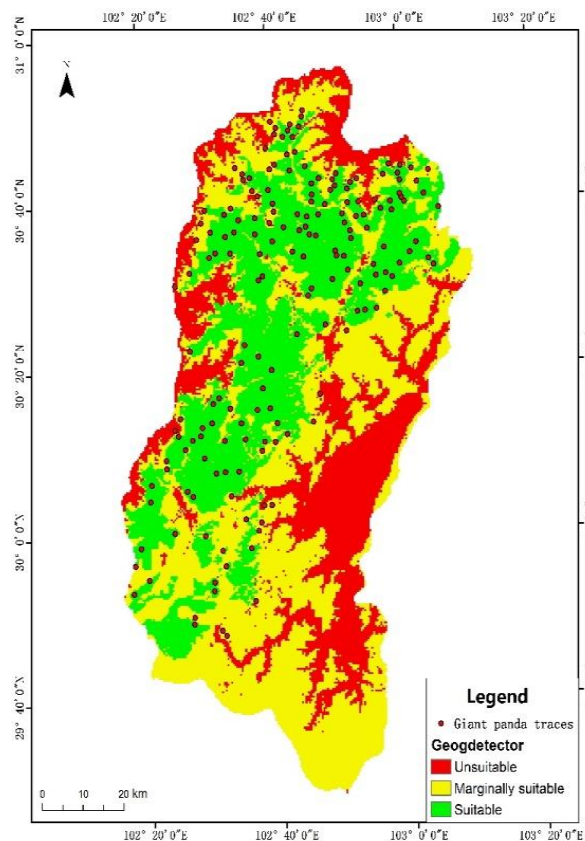
Climate change threatens  
35% of its habitat with  
destruction within  
80 years

Source: IUCN

© AFP



# 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



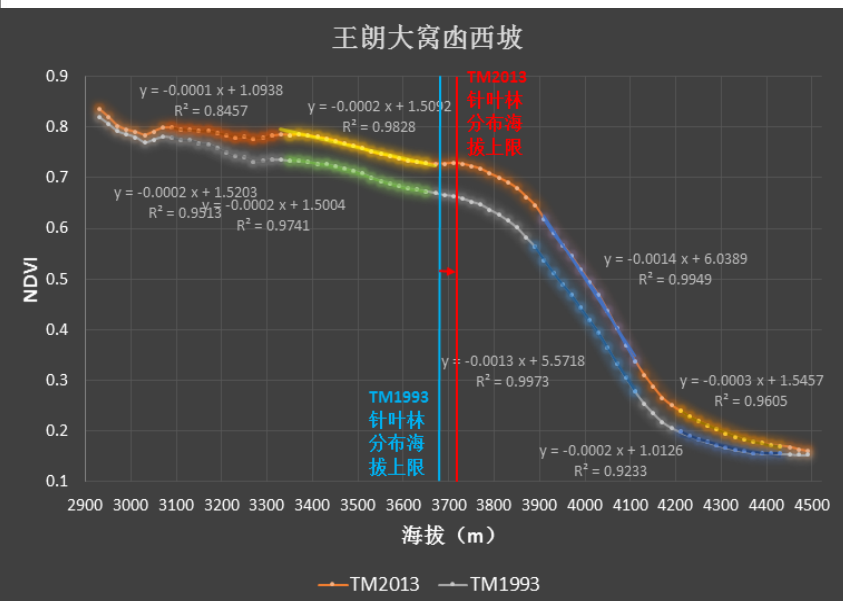


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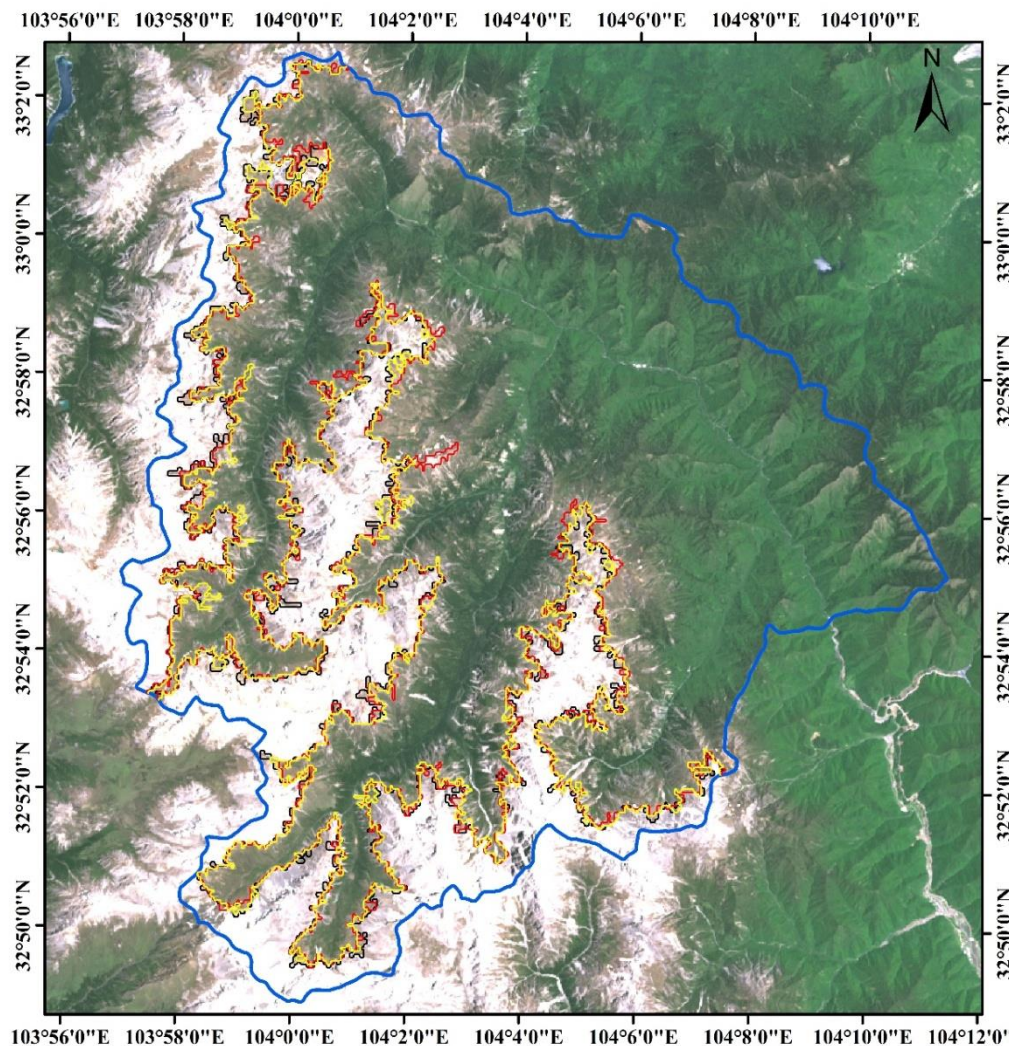
# Timberline of Coniferous Forest

## 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





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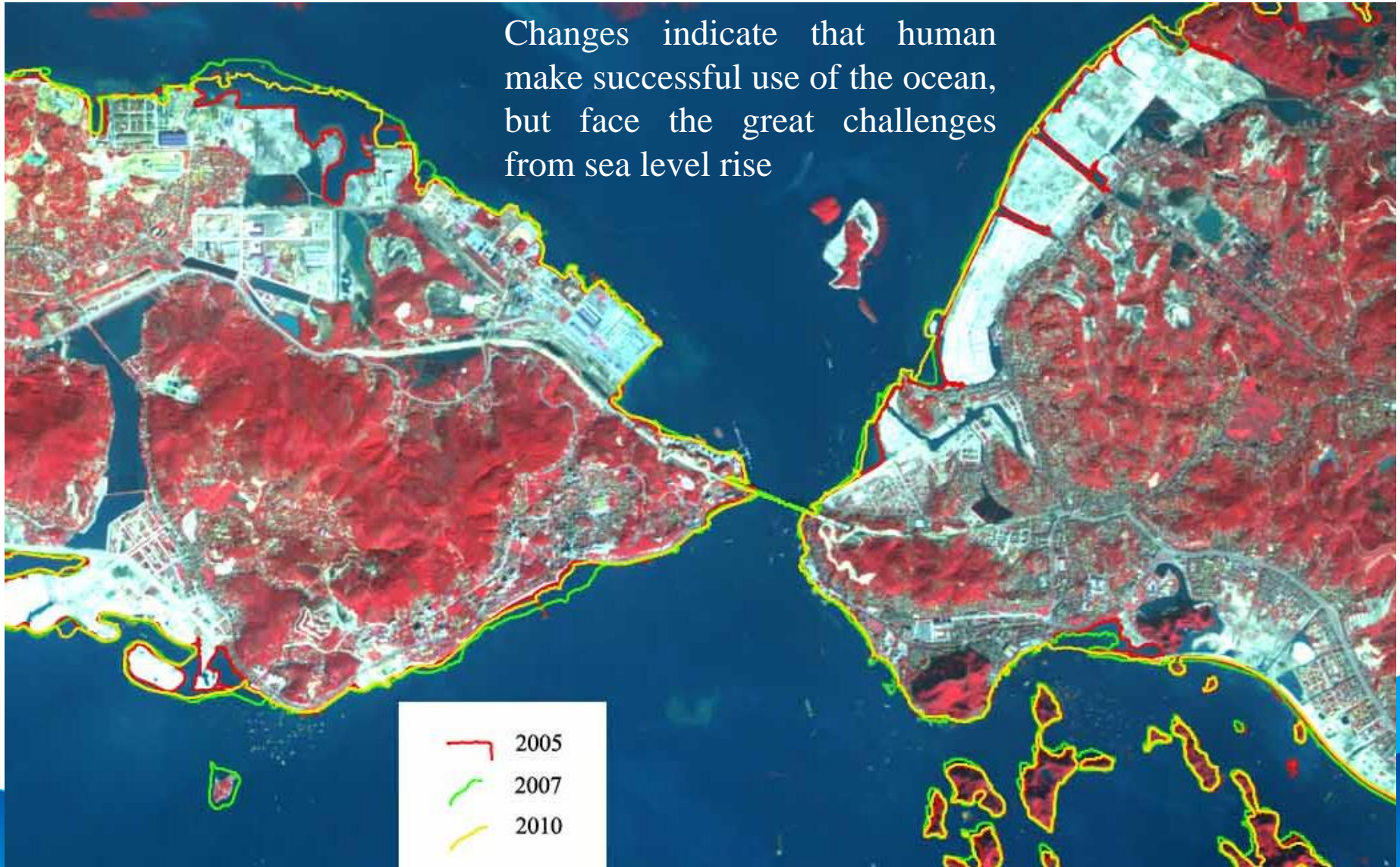


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# Coastline changes of Ha Long recorded by RS image

## in Vietnam

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





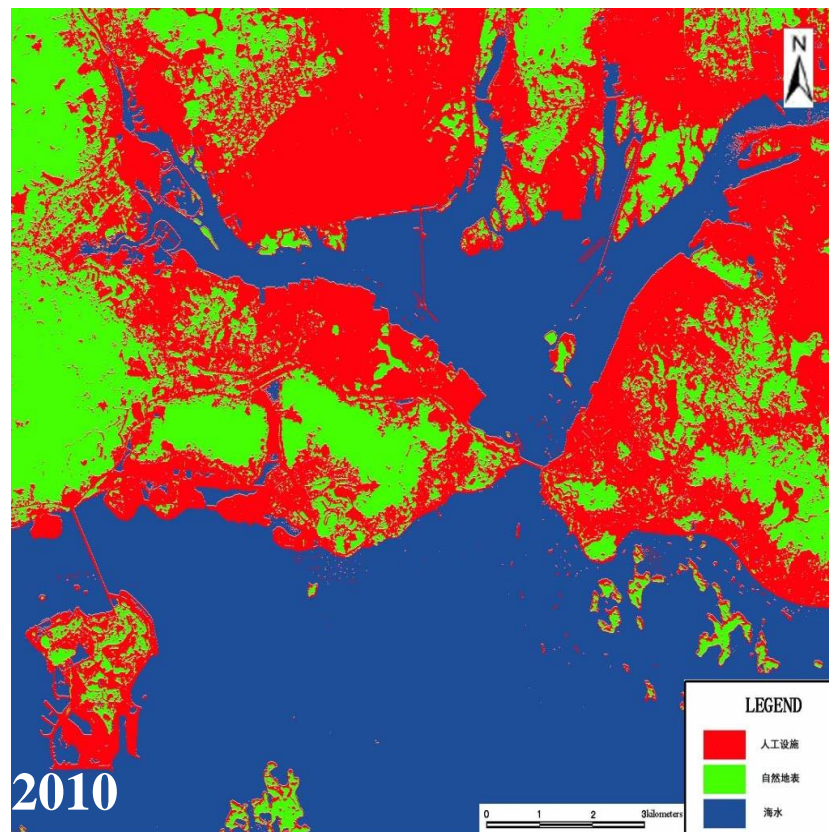
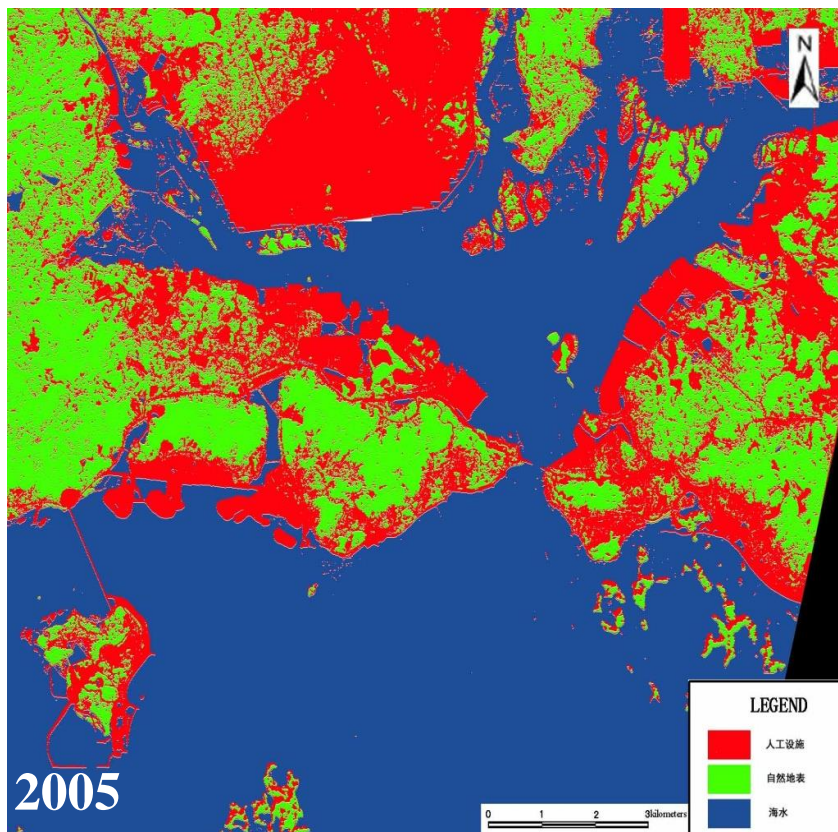


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# Urbanization sprawl of Ha Long City





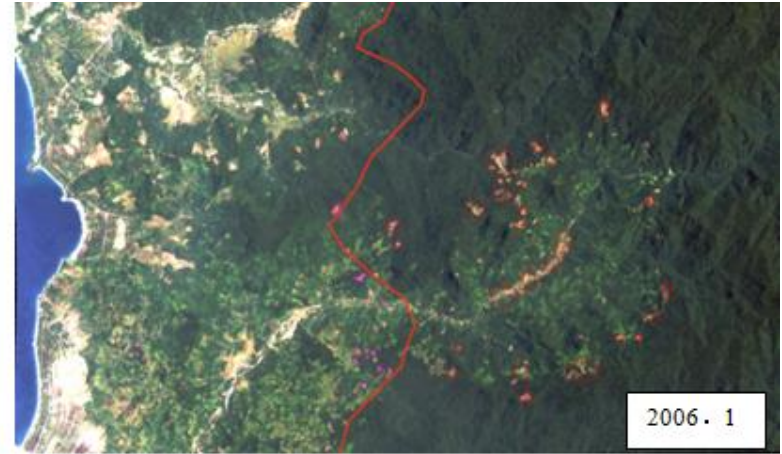


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# Multi temporal remote sensing data reveal the self-restoring capacity of tropical forest



## Sumatra in Indonesia



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## 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...**





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# (1) promoting global common actions to global changes



US and China ratify Paris climate  
deal ahead of G20 summit

UPDATED





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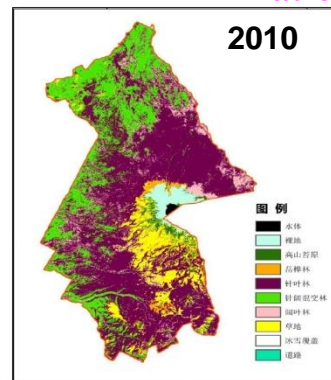
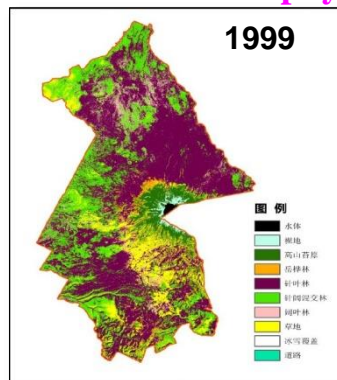
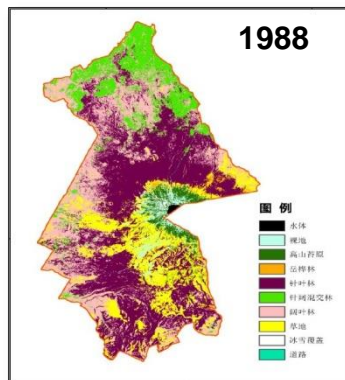
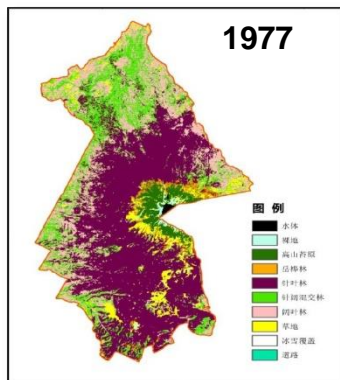
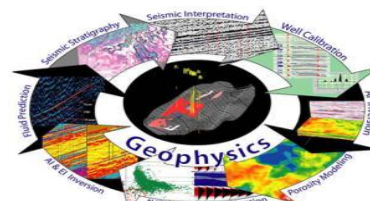
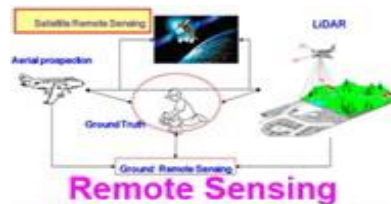
## (2) fully play the roles of spatial information technologies in heritage protection and monitoring

Detection

Monitoring

Conservation

Management



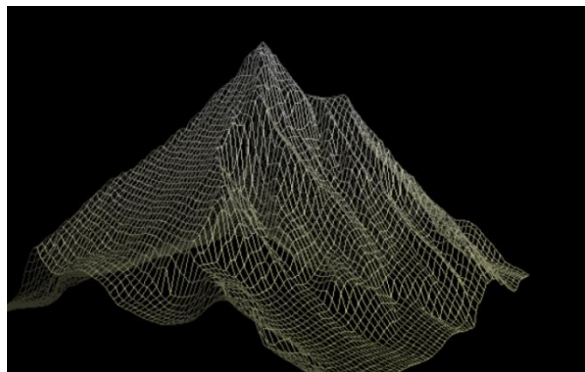
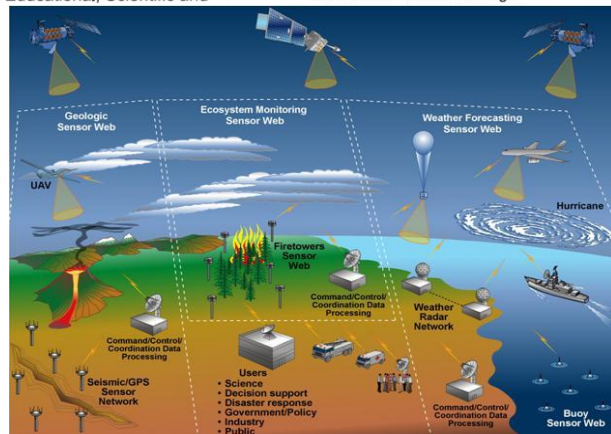




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### (3) building a Geo-platform to achieve Digital Heritage, completely realize digital documentary



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







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## (4) strengthening international cooperative academic research on world heritage



International Council on  
Monuments and Sites

Conseil International  
des Monuments et des Sites



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World  
Heritage  
Convention



Information from imagery





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# Thanks !