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.
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
1. World Heritage and Functions
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.
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.
2. Impact of global change on the world heritage site
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
Impacts—NH

Himalayan

Habitats Shrunk

Wolong

Galapagos Island

Diversity Risk

Habitats

Glacier Retreat

Gorillas Endangered

Ecosystem

Species

Landscapes

Bwindi

NH Impacts
Impacts—CH

- Temple-Nepal (Earthquake)
- Old City of Jerusalem
- Urbanization
- Seismic Risk
- Climate Change
- Over Tourism
- Pollution
- Shakhrisabz
- Venice (sea level rise)
- 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 donecumentor for Global change.
3. WH is of a documentor of global change
Case 1: Great Wall

In c. 220 B.C., under Qin Shi Huang, sections of earlier fortifications were joined together to form a unified 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)(v)(vi)
- Core zone: 2151.5500 Ha
- Buffer zone: 4800.8000 Ha
- Multiple locations: Display in Google Earth
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...

- **Qin Dynasty**: B.C. 221 -- B.C. 206
- **Han Dynasty**: B.C. 206 -- A.D. 220
- **Ming Dynasty**: A.D. 1368 -- A.D. 1644
The Great Wall forms the boundary between the agriculturalist and pastoralist. The sites reflect the changes of boundaries between agriculture and animal husbandry in Northern China in Chinese history.
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)
Cold → Southward Migration → War → New the Great Wall

The invasion of the northern nomadic tribes
“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.

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 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 Qihan, 27 Yuansha
Climate change $\rightarrow$ Snow/Glacier cover $\rightarrow$ Water Supply $\rightarrow$ Irrigated Oasis $\rightarrow$ Silk Road Migration

White lines indicate the paleochannels

glacier fluctuations in the Tibetan (Yang et al., 2003)
Case 3: Giant Panda Sanctuaries

was inscribed on the World Heritage List in 2006
Habitats of Giant Panda

Warmer

Drier

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
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
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.
Multi temporal remote sensing data reveal the self-restoring capacity of tropical forest in Indonesia.
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…
(1) promoting global common actions to global changes

US and China ratify Paris climate deal ahead of G20 summit
(2) fully play the roles of spatial information technologies in heritage protection and monitoring.
(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
(4) strengthening international cooperative academic research on world heritage
Thanks!