Annual Work Report of HIST

（2021）

I.GENERAL INFORMATION

Name (and acronym) of the Centre: International Centre on Space Technologies for Natural and Cultural Heritage （HIST）

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Ⅱ.MAJOR ACHIEVEMENTS AND ACTIVITIES

Scope of activities(*Check all that apply*)

- **Institutional capacity development**
- **Education & training**
- **Research**
- Advocacy, public outreach & awareness raising
- **Technical support and policy advice**
- Networks and partnerships development
- Production of data and statistical products
- Other-please specify below_____

Contribution to UNESCO programme areas

Browse all the options in the drop-down list and select the most relevant three areas

- **23. CLT World Heritage(1972 Convention and 2011 Recommendation)**
- **15. SC Biodiversity & climate change resilience**
- **16. UNESCO Global Networks(Biosphere Reserves, Geoparks, Transboundary sites)**

Drop-down List:

1. ED-Sector-wide policy and planning: right to education
2. ED-Technical and Vocational Education and Training(TVET)
3. ED-Lifelong learning and skills, including literacy
4. ED-Higher Education
5. ED-Teacher Development
6. ED-Education for Sustainable Development, global citizenship and health and well-being
7. ED-Gender equality in and through education
8. ED-Inclusion and education for vulnerable population
9. ED-SDG 4 coordination
10. ED-Research and foresight
11. SC-Development & monitoring of inclusive STI policy & knowledge systems

12. SC-Dissemination & application of STI
13. SC-SIDS, indigenous peoples & local knowledge systems
14. SC-Management of geological resources & geohazards risk
15. **SC-Biodiversity & climate change resilience**
16. **SC-UNESCO Global Networks(Biosphere Reserves, Geoparks, Transboundary sites)**
17. SC-Water Security
18. SC-Water Governance
19. IOC-Sustainable use of oceans, seas and marine resources
20. SHS- Public-policy based on social and human sciences, ethics, and rights
21. SHS- Youth for peaceful societies
22. SHS- Advocacy on inclusive, sustainable and peaceful societies
23. **CLT-World Heritage(1972 Convention and 2011 Recommendation)**
24. CLT-Illicit Trafficking and Museums(1970 Convention and 2015 Recommendation)
25. CLT-Heritage and Armed Conflict(1954 Convention and its 1954 and 1999 Protocols)
26. CLT-Underwater Cultural Heritage(2001 Convention)
27. CLT-Culture in Emergencies(Conflict and Natural Disasters)
28. CLT-Culture and Cultural Industries(2005 Convention and 1980 Recommendation)
29. CLT-Culture and Sustainable Development
30. CI- Freedom of expression & Safety of journalists
31. CI-Media and Diversity
32. CI-Media and communication development
33. CI-Information society and Access to information
34. CI-ICT for access to information
35. CI-Documentary heritage

Contribution to Agenda 2030

Select the most relevant SDGs to which the Institute or Centre work contributed(if possible no more than three), and explain how(not exceeding 200 words)

1. SDG 11

Based on big Earth data, HIST popularizes the monitoring and evaluation of the impact of anthrophonic activities on World Cultural and Natural Heritage sites on a global scale. The results show that the impact of anthrophonic activities on the World Cultural and Natural Heritage is small, but there are some regional differences. Thanks to the development of space technology, the evaluation of anthrophonic activities on World Heritage sites can be updated annually in line with the actual requirement of heritage conservation administrations. The proposed big Earth data based method provides the potential to timely control the situation and future trend of conservation and sustainable use of World Heritage by means of space technology. In addition, HIST tried to explore the contribution of UNESCO-designated sites to achieving the UN SDGs under the proposed holistic concept of combining site conservation (including the conservation of cultural diversity, biodiversity and geodiversity) with coordinated sustainable development of local communities.

2. SDG 13

HIST carried out the research and development of restoration technology of degraded freshwater wetlands, clarified the degradation mechanism of typical freshwater wetlands in Northeast China, and developed the key technology of cloning and rapid propagation of dominant plants in plant community distribution at climax stage and the regulation technology of nutrient limiting factors for vegetation restoration. The restoration technology

improved the carbon sequestration capacity of wetland vegetation and increased vegetation biodiversity. The key technology of clonal rapid propagation of dominant plants in the top plant community of degraded freshwater wetland was proposed for the first time. The coverage of dominant species of degraded wetland vegetation increased by more than 30%. At the same time, the key nutrient limiting factors of degraded freshwater wetland vegetation restoration were analyzed, and a complete set of control technology of nutrient limiting factors of degraded freshwater wetland vegetation restoration was proposed, which centered on three key technologies: nitrogen regulation technology, nitrogen compound technology and water nitrogen compound technology. The vegetation coverage of degraded wetland increased by more than 40%.

3. SDG 15

HIST carried out wetland biological germplasm resource survey in Heilongjiang province. HIST's researchers collected some biological germplasm resource, including 19 plant seeds, 78 plant DNA sequences and barcodes, 140 plant entities, more than 500 digital specimens, more than 800 habitat information and community survey data in Xingkai Lake Biosphere Reserve designated by UNESCO in 2007, Honghe National Nature Reserve, Naoli River National Nature Reserve, Zhalong National Nature Reserve and Lanxi Hulan River National Wetland Park and others. HIST's researchers collected trees seeds, shrubs seeds and herbs seeds which belong to short-lived plants. The Study plot had diversity of vegetation types, including *Deyeuxia angustifolia* marshy meadow, *Phragmites australis* swamp, and *Typha angustifolia* swamp etc. Through the work of this subject, HIST's researchers can reserve swamp wetland germplasm resources, complete a habitat information dataset in Heilongjiang province, provide scientific data and research reports, and complete germplasm materials for the protection and management of wetland plant diversity.

Contribution to other international development agendas

Select the most relevant global agendas to which the Institute or Centre work contributed (if possible no more than three), and explain how (not exceeding 200 words)

- African Union Agenda 2063
- Addis-Abeba Action Agenda
- **Sendai Framework for Disaster Risk Reduction**
- **Paris Agreement on Climate Change**
- Small Island Developing States Accelerated Modalities of Action (SAMOA) Pathway
- UN Youth Strategy 2030
- Other (Please specify below)_____

Sendai Framework for Disaster Risk Reduction

How/Comment：

A magnitude-7.0 earthquake hit Jiuzhaigou World Natural Heritage site in August, 2017, causing the frequent occurrence of landslides and the ecological degradation. Characterized by steep landforms, the post-seismic landslide activities in Jiuzhaigou earthquake-struck area generally last for several years. In order to assess impacts of geohazards on the entire site, HIST firstly established multi-temporal post-seismic landslide databases through an integrated space-air-ground remote sensing monitoring technology. Then, HIST accurately calculated the post-seismic susceptibility of landslides in sequential stages to analyze their spatiotemporal characteristics in each phase for the exploitation of the changing conditions. After the large seismic event, the susceptibility of Jiuzhaigou area decreased with time. The correlation between landslides and earthquakes gradually weakens, and the new post-seismic landslides are mainly affected by influencing factors such as the spatial distribution of loose deposits and the intensity of seasonal rainfall. Therefore, post-seismic landslide prevention needs to be focused on the sites

and areas surrounding original landslides, especially large ones triggered by rainfalls. Moreover, HIST recommends to clean up the landslide deposits in time and reasonably dredge the debris flows to avoid secondary geological disasters. The mitigation of geohazards is in turn beneficial for the local economic development linked to the tourism industry.

Paris Agreement on Climate Change

How/Comment:

Mapping forest height, biomass and carbon sink with high spatial resolution is of great significance for better understanding terrestrial ecosystem carbon cycle. Space-borne LiDAR systems (ICESat-2/ATLAS and GEDI) have denser data sampling, providing a reliable data source for mapping forest height, biomass and carbon sink with high spatial resolution on a large scale. To explore the possibility of ICESat-2/ATLAS and GEDI data in estimating forest height, biomass and carbon sink with 30m spatial resolution, HIST firstly conducted the research on the processing methods of space-borne LiDAR data, including waveform decomposition, noise photons removal and signal photons classification. Secondly, some feature parameters of GEDI data and ICESat-2 data were designed and the forest height models were established to obtain forest heights in relation to varying scales of ecological footprints. Thirdly, taking space-borne LiDAR as the main data source and combing with multi-source remote sensing images, the forest height extrapolation models were built to realize global forest height mapping with a spatial resolution of 30m. Finally, forest height products and multi-source remote sensing data were used to map forest biomass and carbon sink. These global products will provide scientific data for coping with global climate change and ecological environment governance.

Major achievements

Major outcomes, results and impact of the Institute or Centre activity of the year, in relation to the objectives stated in the Agreement (Not exceeding 200 words)

With regard to academic research, HIST completed a report on the monitoring of Human Intervention Degree of global World Natural Heritage, a global knowledge map on World Cultural Heritage sites, built a dataset on environmental changes on World Cultural Heritage sites, and published more than ten SCI papers. Moreover, HIST's project in Jiuzhaigou revealed that the environmental condition has recovered back to the normal before the Earthquake of 2017; risk assessment of the Badaling section of the Great Wall and Acropolis was conducted in partnership with Harokopio University of Athens. In addition, the climate change impact for the habitat suitability of Asian elephant and the altitudinal belts of the Tianshan Mountain were periodically monitored. On capacity building, two training courses "Satellite Receiving Station and Remote Sensing Application" and "Remote Sensing Data Processing and Applications" were organized to enhance remote sensing application skills of heritage site managers and technicians from 18 developing countries. On academic communications, five seminars were hosted, for example, a side event during 44th Session of the World Heritage Committee to strengthen the role of space technologies in enabling World Heritage sites to achieve their sustainable development. On education, 20 students are pursuing their master's and doctorate studies.

Gender equality

Explain how gender equality considerations were integrated or featured in the Institute or Centre work (Not exceeding 200 words)

HIST always respects gender equality, and has created a gender-friendly work environment. First, HIST's male and female staff members enjoy equal voting rights, freedom of speech and belief. Second, equal access to high-quality education is ensured at HIST. For example, more female students are seeking their graduate studies than

are their male counterparts. Third, men and women are equally entitled to apply for, conduct their research projects and receive equal remuneration for work of equal value. Fourth, there is no discrimination and violence against women at HIST. Fifth, the sex ratio of HIST's staff members is closer to 1:1. At HIST secretariat, this ratio is 3:1. Sixth, many events hosted by HIST are equally open to female and male participants. In summary, HIST promotes gender equality in various ways and builds a sustainable future for both women and men.

Beneficiaries of activities

1-Activity	2-Type of Beneficiary	3-Country	4-Number of beneficiaries	5-Percentage of women	6- Percentage of young people
"Space Technologies Towards Sustainable Development of World Heritage" Side Event of the 44th Session of UNESCO World Heritage Committee	Government officials, site managers, technicians, researchers, students	Spain, Italy, Britain, Greece Tunisia, Korea, Australia, Indonesia, Cameroon, Pakistan, Nepal, Bangladesh, Sri Lanka, Thailand, Cyprus, Oman	153	40	30
HIST 10th Anniversary Symposium	Government officials, site managers, technicians, researchers, students	Zimbabwe, Tunisia, Sri Lanka, Australia, Pakistan	100	40	35
Campus Science Communications Course on World Heritage and Space Technology	Students	China	150	60	90
Seminar on Sustainable Development of UNESCO-Designated Sites	Government officials, researchers	China	240000	40	20
International Training Course on Satellite Receiving Station and Remote Sensing Application	international students, young professionals	Pakistan, Egypt, Cameroon, Ethiopia, Myanmar, Rwanda, Nigeria, Morocco, India	104	15	5
Training Course on Remote Sensing Data Processing and Applications	international students, researchers	Greece, Italy, Brazil	82	30	15

1- *Activity: Organized/supported by the Centre (examples "Training", "Workshop", Symposium", etc.)*

2- *Type of beneficiary: Examples "Government officials", "Students", "Farmers", etc.*

3- *Country(ies): country of origin of the beneficiaries; not necessarily the country of the event; if list, separated by commas (example "Country 1, Country 2, Country 3")*

4- *Number of beneficiaries: Indicative total number of beneficiaries in each category*

5- *Percentage of women: Indicative percentage of women*

6- *Percentage of young people: Indicative percentage of young women and men (15-24 years)*

Institutional partners

Indicate the name of the main institutional partners and the role played by each one (Not exceeding 200 words)

Partner	Role
Harokopio University of Athens	Jointly conducted the monitoring of Badaling section of the Great Wall and Acropolis
International Union for Conservation of Nature	Cooperated with HIST to host a side event "Space Technologies towards Sustainable Development of World Heritage" during the 44th session of the World Heritage Committee
Heritage Science, part of *Springer Nature*	Partnered with HIST to publish a special issue "Space Technologies for Sustainable Heritage" at *Heritage Science* to present the latest academic achievements from HIST researchers and its international partners to commemorate 10th anniversary of HIST
Jiuzhaigou World Heritage Administration	Jointly conducting space-air-ground integrated monitoring and evaluation of the Jiuzhaigou World Heritage Site
China Association of National Parks and Scenic Sites	Working together to provide suggestions on the Badain Jaran Desert—Towers of Sand and Lakes to be inscribed on World Heritage List

Collaboration(s) with UNESCO network/partners

List of UNESCO partners/networks (UNESCO Field Offices, Category 1 institutes/centres, National Commissions for UNESCO, UNESCO Chairs, Associated schools, other Category 2 institutes/centres) with which the Institute or Centre worked during the year and on what (Not exceeding 200 words)

Collaboration with (name of institution)	Activity/Project
UNESCO World Heritage Center(WHC)	HIST contributed one article "Space Technologies for Heritage: two case studies" to *World Heritage Review.* Dr. Guy Debonnet, Chief of Natural Heritage Unit, UNESCO WHC, was invited as the moderator of HIST-IUCN side event during 44th session of the World Heritage Committee; Dr. Feng Jing, Chief of Asia and the Pacific Unit from UNESCO World Heritage Centre was invited to speak at the session of Sustainable Development of UNESCO-designated sites during 2021 edition of International Forum on Big Data for Sustainable Development Goals.
UNESCO Beijing Cluster Office	Prof. Shahbaz Khan, Director of UNESCO Beijing Cluster Office delivered pre-recorded video remarks at HIST 10th Anniversary Symposium.
National Commission of China for UNESCO	Mr. Tian Xuejun, Vice Minister of Education and Chairperson of the National Commission of China for UNESCO, Chairperson of the extended 44th session of World Heritage Committee was invited to deliver opening remarks in a pre-recorded video at HIST-IUCN side event during 44th session of the World Heritage Committee; Mr. Qing Changwei, Secretary General of National Commission of China for UNESCO, delivered opening remarks at HIST 10th Anniversary Symposium; One of HIST's young experts delivered introductory remarks at International Youth Forum on Creativity and Heritage along the Silk Roads: Special Dialogue on Youth Leadership in Creativity, Heritage, and Resilience jointly organized by UNESCO and the National Commission of China for UNESCO.

III.BUDGET

Financial resources

Financial resources received during the year (in US dollars) dedicated to programme implementation (not operational costs)

Source (name of Institution)	Amount Received
Chinese Academy of Sciences	600,000

Ministry of Science and Technology, PRC	200,000
Ministry of Industry and Information Technology, PRC	100,000
Jiuzhaigou World Heritage Administration	100,000

IV. MAIN CHALLENGES, LESSONS LEARNED AND FUTURE PLANS

Main challenges

List of main challenges faced in implementation of activities and how they were addressed (Not exceeding 200 words)

HIST faced two major challenges: the impact of the pandemic, and the mismatch between the growing demand for space technology application and less funding to meet the demand. First, the COVID-19 pandemic has restricted international visits and impeded the implementation of HIST's international projects. For example, HIST can monitor and analyze changes in the forest cover loss in Asian elephants' habitats through remote sensing, but the field mission of HIST's scientists to those habitats is much difficult. However, HIST continues to pursue international cooperation via web-based platforms such as ZOOM. For example, HIST successfully launched a special issue with *Heritage Science*, part of Springer Nature, focusing on space archaeology, heritage monitoring, evaluation and management. Second, the rising demands for space technology to monitor natural and human-induced risks of UNESCO-designated sites are recognized, especially in the context of the pandemic, but some heritage sites need more investment in using space technology and other cutting-edge technology to promote their sustainable development. However, HIST employs its own resources to conduct pilot projects in some sites, and calls for more stakeholders to make more investment.

Lessons learned *(Not exceeding 200 words)*

HIST will make more efforts to strengthen cooperation with UNESCO World Heritage Center, Division of Ecological and Earth Sciences as well as its Member States, and employ UNESCO's global network to conduct international research and expand its global influence to make space technologies benefit more UNESCO Member States.

Plans and/or prospects

Future plans and/or development prospects of the Institute/Centre (Not exceeding 200 words)

The year 2022 sees the 50th anniversary of the *World Heritage Convention*(the *Convention*) and the beginning of HIST's second decade development. HIST will focus on the utilization of space technologies to conduct research projects, enhance knowledge and skills of UNESCO-designated sites, strengthen international academic communications, and host international conferences to contribute to sustainable development of heritage sites in line with the *Convention* and other relevant international landmark agreements. First, HIST will continue to conduct China-Greece project for the monitoring and assessment of cultural heritage vulnerability, space-air-ground integrated monitoring of the Jiuzhaigou, and also initiate cooperation with IUCN on the nomination, monitoring and evaluation of natural and mixed World Heritage site. Second, HIST will further promote the cutting-edge multidisciplinary development of space archaeology by theoretical research, methodology designing and cultural applications. Third, HIST will organize a training workshop to strengthen capacities of World Heritage sites in developing countries and a side event during the 15th meeting of the Conference of the Parties to the Convention on Biological Diversity to advance sustainable development of oasis biosphere reserves. Meanwhile, it will host an international conference to commemorate the *Convention*'s 50th anniversary.

V. OTHER INFORMATION DOCUMENTS

Other relevant information

Additional information or comments not provided above (Not exceeding 200 words)

HIST strengthens its governance via the Governing Board and convenes annual session of the Board in line with the *2019 Strategy for Category 2 Institutes and Centres under the Auspices of UNESCO*. Now it has a nine-member Governing Board chaired by Prof. Zhang Yaping, Vice President of Chinese Academy of Sciences. It convened the 9th session of its Governing Board in June 2021 to review and adopt Annual Work Report for 2020 and the implementation priorities for 2021 in accordance with the Biennial Work Plan (BWP) for 2020-2021, received many valuable suggestions from board members, and plans to reconstitute its Governing Board in 2022 before the next session.