

**Sustainable Development International Cooperation Program
2023 Call for Proposals**

I Scientific Objectives

The pursuit of sustainable development stands as a pivotal task in global governance and the building of a community with a shared future for mankind. Global change has become the most formidable challenge humanity has to overcome on the path to sustainable development. To achieve the 17 Sustainable Development Goals (SDGs) delineated in the United Nations' 2030 Agenda, it is necessary to understand the dynamic mechanisms of the surface Earth system composed of natural environmental systems and socio-economic systems from the perspective of Earth system science. We need a comprehensive understanding of the dynamic characteristics of environmental systems and socio-economic systems, as well as the relationships between various subsystems, Through multidisciplinary and interdisciplinary approaches.

The majority of developing countries and regions are situated within ecologically vulnerable areas, collectively facing challenges of transformative shifts within ecological surroundings and sustainable development under global changes. These regions are pivotal for achieving SDGs, addressing global challenges, and managing ecological and environmental governance. Anchored in the framework of Earth System Science, and through the amalgamation of scientific and humanistic collaboration, this program endeavors to scrutinize the architecture, composition, processes of material cycling, and the functioning of ecosystems within paradigmatic environmental-societal systems. These include arid and semi-arid desert landscapes, verdant grasslands, the interplay of agricultural and pastoral realms, lofty mountainous realms, labyrinthine karst systems, and the nexus of coastal and urban domains. The program seeks to unravel the intricacies of structure, composition, material cycling processes, and the intricate symphony of ecosystem functionality within these systems. It additionally seeks to anticipate and/or assess the paths of transformation, the limits of capability, and the enduring viability of essential

resources—namely, water, soil, and biological resources—concurrently with the dynamics of ecosystem services. Crucially, this program endeavors to discern the tipping points that punctuate the evolution of these quintessential surface-earth systems, thereby providing scientific decision-making support for achieving sustainable development in relevant countries and regions..

II Priority Research Areas

For the year 2023, NSFC and international partners aim to fund a group of international cooperation projects to conduct cross-disciplinary and integrated research on the dynamics of environmental-social-economic systems, focusing on the significant challenges facing sustainable development in the exemplary environmental-social systems of China and the Global South. Proposals applying for funding through this call should address pressing concerns, including persistent land desertification in arid and semi-arid regions, agricultural land quality deterioration, rocky desertification in karst ecosystems, resource conservation in vulnerable highland mountain ecosystems, the delicate balance between disaster prevention and regional development in these mountainous terrains, and the escalating degradation of coastal urbanization and coastal ecosystem systems.

Through collaborative research, this call aims to unveil the dynamic mechanisms of changes in the above-mentioned typical environmental-social systems. It further aims to predict the evolutionary trajectories of system structures, processes, and ecological service functionalities under global changes as well as their impact on social-economic development and propose pathways to achieve SDGs, linking ecological, resource, and socio-economic dimensions.

1. Evolution of the structure, composition, processes, and functionality of the Earth's Critical Zones (subject reference code 1: D01, D02, D03, D05 or D07)

This call aims to study the interplay between climate changes since the Tertiary era onwards, the tectonic uplift processes influencing the Qinghai-Tibet Plateau, and the genesis of the surrounding topographical features. It seeks to unravel the interconnectedness of climate, landforms, and ecosystems, tracing their historical

evolution. Additionally, the call aims to explore the historical evolution patterns of karst rocky desertification, land desertification, the degradation of plateau ecosystems, mountain-related hazards, spatial arrangement, and ecological functionality decline of coastal systems and the degradation of ecological functions in typical areas in China and the world over the past century. Proposals should examine the temporal and spatial distribution of crucial resources such as water, soil, and ecological assets, along with their far-reaching impacts on population, land use, economic changes and industrial transformations.

2. Food-Water-Ecosystem Nexus and pathways for SDGs implementation (subject reference code 1: C13, D01, D05, D07, E09 or E10)

This call aims to support dynamic monitoring and analytical simulation of the intricate interplay between water, food, and ecological components of typical environmental-social systems. It focuses on evaluating the repercussions of extreme aridity on water utilization, food production, and ecological stability, and delve into the delicate equilibrium and potential harmonies among key indicators associated with SDGs 2, 6, 13, and 15, which are closely intertwined with the pursuits of water security, food security, and ecological stability. The primary objectives of the call include predicting dynamic indicator fluctuations and influencing factors of core indicators, and establishing critical thresholds for the sustenance of environmental systems—ranging from water to soil and ecology. Furthermore, the call seeks to enrich decision-making theories and strategies aimed at addressing multifaceted challenges including poverty alleviation, intensified ecological preservation, climate mitigation, the integration of clean energy, and the advancement of sustainable agriculture (SDGs 1, 7, 13 and 15). Additionally, proposals should actively leverage collaborative partnerships, in tandem with SDG 17, to harness synergistic methods for navigating these intricate challenges. Through these collective endeavors, the call is poised to cultivate comprehensive solutions that holistically address the intricacies of these complex challenges.

3. Restoration of typical ecological systems and carbon neutrality (subject reference code 1: B06, C03, D01, D03, D05, D07 or E09)

Proposals are to address ecological vegetation restoration and carbon neutrality under global changes, and make comprehensive monitoring and evaluation of restoration endeavors targeting degraded ecological systems at various scales. The call seeks to unveil the intricate mechanisms governing carbon cycling in response to ecological restoration, encompassing pivotal environmental influencers, biological constituents, and ecological processes that drive carbon cycling within the restoration processes. Furthermore, proposals should place a quantitative focus on appraising the carbon sequestration potential of various ecological restoration measures, highlighting their contributions to the overarching goal of carbon neutrality. Additionally, proposals are to make comparative analyses of ecological optimization management models in emblematic degraded regions and put forward management approaches conducive to global sustainable development and carbon neutrality of degraded ecosystems.

4. Sustainable development of ecosystems in arid and semi-arid regions (subject reference code 1: C03, D01, D03, D05, D07 or E09)

Proposals are to address the challenge of ecosystem degradation in arid and semi-arid regions, make comprehensive strategies of long-term data acquisition and transect-based monitoring to assess degradation, explores historical extreme drought patterns over the past century and conducts an in-depth analysis of vegetation transformations within key ecological transects. Proposals may also delve into the intricate relationship between atmospheric deposition (nitrogen, sulfur, etc) and their repercussions on terrestrial ecosystem dynamics and carbon sequestration. Proposals should underscore the vital role of these depositions in bolstering ecosystem functionality. Methodologically, proposals should adopt diverse approaches, spanning varying scales, to uncover the underlying mechanisms driving the decline of natural ecological systems. Additionally, proposals should delve into the formulation of strategies for the restoration and sustainable development of these ecosystems. These tactics are underpinned by rigorous scientific support, aimed at assisting arid and semi-arid regions grappling with extreme drought and the consequences of human activities. The goal is to guide the achievement of

restoration and regional sustainability objectives by providing evidence-based solutions for these ecological challenges.

5. Impact and mechanisms of extreme climate on ecosystem stability and resilience (subject reference code 1: C03, D01, D05, D07 or E09)

Proposals are to make thorough examination of the impacts of extreme climate change on ecological system stability of the Global South using a multifaceted approach across various scales, encompassing meticulous monitoring of ecological systems' resilience, recovery, elasticity, and temporal variability in response to extreme climate events. Additionally, proposals should delve into assessing the spatial patterns that underlie ecological system stability, and quantifies the relative contributions of climate change and human activities to the stability of ecological systems. Proposals should also explore pivotal mechanisms that play a role in maintaining ecological system stability. Furthermore, the call aims to provide a holistic assessment of the impacts and risks stemming from extreme climate change events on ecological system stability, thereby establishing the foundation for conceptualizing early warning systems in scenarios of extreme climate change. By enriching the existing knowledge in this field, the call seeks to offer invaluable insights aimed at bolstering the resilience of ecological systems against the challenges posed by extreme climate conditions.

6. Exploring spatial biodiversity patterns and formulating protected area networks (subject reference code 1: C03, D01, D05 or D07)

In response to the issues related to the Kunming-Montreal Global Biodiversity Framework, this call supports the study of biodiversity distribution patterns, composition, dynamic trends, and pivotal ecological risks in ecosystems such as forests, grasslands, wetlands, deserts, and coastal wetlands across the Global South. Proposals are to comprehensively evaluate the existing state of biodiversity conservation, pinpoint key areas for biodiversity conservation, assess the efficacy of current protected area networks, identify regions where conservation efforts are lacking, establish a cohesive framework for a natural protected area system that spans the Global South, and contribute to the implementation of the Kunming-

Montreal Global Biodiversity Framework.

7. Sustainability of coastal environmental-socioeconomic systems in the context of global change (subject reference code 1: D01, D05, D07 or G0314)

Proposals are to employ interdisciplinary approaches and comparative research methodologies within a unified spatiotemporal framework, set forth its mission to achieve the following objectives across regions including China and other regions of Asia: 1) to systematically investigate the physical, biogeochemical, and pollution processes in coastal zones, and uncover their intricate interconnections with socioeconomic development; 2) to identify the dominant factors that have contributed to the deterioration of typical coastal environments over the last five decades; 3) to forge a coupled dynamic model that effectively encapsulates the intricacies of 'human-sea complex systems'. Through this model, Proposals should engage in scenario analyses encompassing socioeconomic trajectories and climate change impacts, and facilitate the prediction of coastal environment and ecosystem trends over the next three decades, 4) to construct digital twin oceanic systems, thus creating an experimental tool and platform for advancing both fundamental research and decision-making. By undertaking this comprehensive approach, the research endeavors to heighten our understanding of the intricate interactions binding coastal environmental and socioeconomic systems.

8. Optimization of decision-making through a data platform and development path for typical environmental-social systems (subject reference code 1: B0607, D01, D05, D07, E09 or E10)

This call seeks to harness cutting-edge 'air-land-sea' monitoring technology, along with collaborative multilateral observations and experiments, to forge an approach that integrates information of climate, geology, ecology, demographics, economics, land utilization, and policy landscapes from China and pertinent regions worldwide. It aims to establish a robust 'environment-society' big data platform, accompanied by integrated models and decision support systems. By juxtaposing the trajectories of sustainable urbanization, land utilization, sustainable agriculture, climate dynamics, public health considerations, bioresource regeneration, economic

dynamics, societal behavior, and ecological system preservation across diverse regions throughout the past century, this comparative analysis aims to illuminate significant patterns. This undertaking holds the potential to optimize pathways for realizing SDGs aligned with the coordination of water, food, and ecosystem elements, while concurrently refining sustainable development models.

9. Novel theoretical and methodological avenues in sustainable development science research (subject reference code 1: D01, D05, D07 or G0415)

Central to the concept of sustainable development is the optimization of shared growth benefits while minimizing potential environmental and climate change risks for present and future generations. This encompasses social, economic, and environmental dimensions. Therefore, with a specific emphasis on the distinctive environmental-socioeconomic ecosystems of the Global South, a comprehensive investigation is essential. This call aims to uncover the dynamic transformations and underlying driving forces that characterize the scientific essence and expansive scope of sustainable development. This exploration seeks to transcend the confines of conventional sustainable development theories, methodologies, and analytical frameworks. The overarching objective is to pioneer innovative theoretical approaches, construct forward-looking models, and catalyze paradigm shifts propelled by evolving foundational assumptions, particularly in the context of the Anthropocene era, climate change, and the pursuit of carbon neutrality. Furthermore, this endeavor entails devising inventive methodologies for sustainable development science. Leveraging emerging technological revolutions such as artificial intelligence, as exemplified by technologies like ChatGPT, this call strives to usher in groundbreaking advancements in cutting-edge theories and transformative research paradigms within the realm of sustainable development science.

Priority research areas may differ for different partner organizations, and can be found in the agency-specific annexes below.

III Project Selection: Criteria and Principles

1. Proposals should address the multiple dimensions of sustainability in an integrated way (meet two or more SDGs).
2. The research should focus on the scientific questions in their respective fields and also deal with the scientific challenges of sustainable development, and specifically focus on the dynamics of environmental-social-economic systems and the interplay between the environmental system and social system for achieving SDGs in developing countries.
3. Proposals should pursue research excellence, especially innovative ideas, methodologies, and approaches.
4. Proposals should give specific focus to young researcher training and international partnership building (especially multilateral cooperation).
5. Project teams must be international in composition and provide added value by working across disciplinary boundaries.

IV Funding Available and Project Duration

Two types of projects are to be supported in 2023: Capacity-building Project and Key Project:

(1) Capacity-building project provides seed money to support Chinese and foreign researchers in fostering collaborative relationships and capacity building. NSFC budget is up to 100k USD per project for 3 years, and about 10 projects are to be funded.

The following forms of research and exchange activities may be funded:

- Research stays for one to three months per year for young researchers from the "Global South", or global excellent researchers on sustainable development.
- Training courses, seminars or workshop series for young researchers in China and abroad, with topics closely related to the scientific objectives and priority funding areas of this call.

(2) Key project addresses key aspects of challenges to the SDGs through collaborative research, fosters outstanding scientific and technological talents, solves scientific questions behind regional challenges, proposes the right path to achieve

the SDGs and sustainable development strategies that balance economic development with eco-environmental protection and resource utilization, and provides scientific support to decision-making for the sustainable development of relevant countries and regions. NSFC budget is up to 300k USD per project for 3 years, and about 15 projects are to be funded.

All the projects are expected to start on January 1, 2024 and close on December 31, 2026.

V Application

1. Eligibility of Applicants

1) The Chinese principal investigator (PI) must have a senior academic rank (title) and have/had been the PI of at least one on-going or completed NSFC research project with the duration of no less than 3 years.

2) Eligibility requirements of international research partners can be found in the agency-specific annexes below (the leading researcher of the international research partners is hereafter referred to as the overseas-based co-applicant).

3) Besides the Chinese host institution, the Chinese team can include no more than 2 Chinese collaborative institutions.

4) More requirements can be found in the *NSFC 2023 Guide to Program*.

2. Limits of Parallel Application

Capacity-building projects and key projects under this call belong to the *International Research Projects under MoUs* of NSFC. The limits on application are as follows:

1) For the applicant who applies as PI, this application shall not be counted in the total number of the programs that the researcher with a senior academic rank (title) applies for (including the applicant and the principal investigator or the person who is responsible for the project).

2) As PI, an applicant shall not apply for more than one *International Research Project under MoUs* in one year.

3) A researcher who is undertaking an *International Research Project under MoUs* as PI shall not apply for another *International Research Project under MoUs* as PI.

4) More requirements can be found in the *NSFC 2023 Guide to Programs*.

3. Application

1) Online submission process

Chinese applicants must submit a completed online application to the NSFC's Grants System (<http://grants.nsf.gov.cn>). The procedure is to log into the Grants System as the PI, click the "online submission" button, then click the "new application" button, select "international (regional) exchange and cooperation program", and then the "joint research program under MoUs", and finally the "SDIC-capacity building project or SDIC-key project". Please be noted that the applicants should fill in the grant number of one of their on-going or completed NSFC research projects, as the system requires.

2) Budget justification

Chinese applicants must read carefully the *NSFC 2023 Guide to Program* for specific guidance and funding limits and make a budget for the costs directly related to implementing activities contained in the application.

3) Attachment documents

Chinese applicants must prepare an English application jointly written with their international research partners using the attached proposal template, and submit it in the "Attachment" column of the Chinese application. The English application should be signed by the Chinese applicant and the overseas-based Co-applicant. If the overseas-based Co-applicant is not able to sign the English application, the Chinese applicant may provide a confirmation letter with the signature of the overseas-based Co-applicant.

Applicants applying for NSFC-ICIMOD projects are required to submit an additional letter of support from ICIMOD, and submit it in the "Attachment" column of the Chinese application.

4) Collaborative agreement

After the announcement of the funding decisions, the PIs of funded projects must submit a collaborative agreement jointly signed with their overseas-based Co-applicants together with the *Research Plan for NSFC Awarded Project*.

5) Other materials

Applicants applying for NSFC-UNEP projects are required to submit an additional information sheet in Chinese, and send it to unep-nsfc@unep-iemp.org by the deadline of submission.

6) No hard copy of the application is needed. However, after the announcement of the funding decisions, the PIs of funded projects must submit the signature page (stamped by the host institution) together with the *Research Plan for NSFC Awarded Project*.

7) Other considerations

To promote coherent research activities, networking and sharing of knowledge between funded projects, NSFC and international partner organizations will regularly organize workshops/meetings of the funded projects to facilitate communication and coordination. The Chinese PIs should participate in such workshops/meetings and make a budget for relevant costs, and are also responsible for coordinating their international research partners to participate in such activities.

4. Responsibility of Host Institutions

The host institutions should verify each item of the electronic application package via NSFC's Grants System and submit all proposals and supplementary documents to NSFC before the deadline. Late applications will not be accepted. The host institutions should provide a list of all the applications within 24 hours after the application deadline.

5. Application Deadline

The call will close on NSFC's Grants System at 4pm Beijing Time on 13th October 2023. Applicants should leave enough time for their applications to pass through the host institutions' submission route before the deadline.

VI Announcement of Funding Decisions

NSFC will inform the applicants of projects to be funded by the end of 2023 via the NSFC's Grants System.

VII Contact

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VIII Agency-specific Annexes

1. Annex for NSFC-UNEP Program
2. Annex for NSFC-ICIMOD Program
3. Annex for NSFC-IIASA Program

IX Templates

1. Template of the English proposal
2. Template of the ICIMOD confirmation letter
3. Template of the collaborative agreement
4. Template of information sheet for application of NSFC-UNEP projects

1. Annex for NSFC-UNEP Program

The United Nations Environment Programme (UNEP) has been the global authority that sets the environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment. As custodian of 25 Sustainable Development Goal indicators, UNEP will promote integrated approaches to country planning and implementation that support the incorporation of environmental perspectives into country plans and policies while connecting to other development objectives, such as human rights, gender equality, economic growth and employment. Through the SDIC program, NSFC and UNEP will support international collaboration targeting at the challenges faced by developing countries.

1) Priority Research Areas

Research areas listed in part II.

Applicants should take into account the UN resolutions on sustainable development as well as UNEP's priorities in its Medium-Term Strategy and global environmental challenges, such as the United Nations Decade on Ecosystem Restoration, the Kunming-Montreal Global Biodiversity Framework, monitoring and evaluation of environmental indicators of the SDGs and other internationally-agreed environmental goals and etc. The research and outcomes of the projects funded should provide UN and member states with science-based policy suggestions and scientific support in terms of data, knowledge products, tools and solutions for capacity building and to achieve UN 2030 SDGs.

2) Eligibility of International Research Partners

The overseas-based co-applicant should hold the position (title) of professor or associate professor, or have the experience of leading research laboratories or key research projects. It is encouraged to include UNEP staff members into the international research partners.

3) Application Guidance Notes

a) In the abstract of the application, applicants should identify clearly the relevance of their proposed research to the priority research areas of the call.

b) Applicants should submit an Information Sheet (申请简表) to UNEP (unep-nsfc@unep-iemp.org) before the deadline. UNEP will check whether the proposed research and activities are in line with UN resolutions on sustainable development and UNEP's priorities in its Medium-Term Strategy and global environmental challenges.

4) Contact

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2. Annex for NSFC-ICIMOD Program

Through the SDIC program, NSFC and International Centre for Integrated Mountain Development (ICIMOD) will support international collaboration targeting at the challenges faced by countries of the HKH – Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan.

1) Priority Research Areas

Research areas 1, 2, 3, 4, 5, 6, 8, and 9 listed in part II. Applicants should also take into account the strategic areas of ICIMOD.

2) Eligibility of International Research Partners

The overseas-based co-applicant should hold the position (title) of professor or associate professor, or have the experience of leading research laboratories or key research projects.

International research partners should include ICIMOD researchers. Applicants are encouraged to invite researchers from other countries, especially those from the HKH countries to participate in the cooperation. ICIMOD will provide relevant funds to international researchers participating in key projects.

3) Application Guidance Notes

a) In the abstract of the application, applicants should identify clearly the relevance of their proposed research to the priority research areas of the call.

b) Applicants are required to submit an additional letter of support from ICIMOD, and submit it in the "Attachment" column of the Chinese application.

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3. Annex for NSFC-IIASA Program

The International Institute for Applied Systems Analysis (IIASA) is an international research institute that conducts policy-oriented research into problems of a global nature that are too large or too complex to be solved by a single country or academic discipline. IIASA is sponsored by its National Member Organizations in Africa, the Americas, Asia, and Europe. NSFC is IIASA's National Member Organization in China. Through the SDIC program, NSFC and IIASA will support collaboration between Chinese and IIASA researchers.

1) Priority Research Areas

Based on research areas listed in part II, NSFC and IIASA further identify the following key topic.

Resilience of Ecosystem Services provided by Intact and Sustainably managed Terrestrial Ecosystems (subject reference code 1:C03)

The call aims to develop a multidisciplinary modeling framework that accounts for biophysical feedbacks between natural ecological processes and socioeconomic aspects driving stakeholder decision making, and apply the framework to case studies of the "Global South". It aims to address research questions such as analysis of the role of plant diversity and adaptive capacity for ecosystem resilience to the impacts of climate change, natural and anthropogenic factors contributing to ecosystem degradation, the impact of biodiversity-ecosystem functioning feedback on water cycles and water resources in natural habitats and agricultural production systems, natural habitat management and land use under climate change conditions.

2) Eligibility of International Research Partners

The overseas-based co-applicant should be based in IIASA and from relevant IIASA research programs.

3) Application guidance notes

a) The applicant should highlight the visits and exchanges of young researchers (including postdoctoral researchers and doctoral students) to IIASA and provide annual visits and research plans of young researchers in the proposal.

b) Applicants should undertake network-building activities to establish and facilitate sustainable and collaborative relationships between Chinese research

community and IIASA. Applicants should provide networking plans in the proposal alongside their research plan.

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