

Intergovernmental Hydrological Programme
26th Ordinary session of the IHP Intergovernmental Council
(Paris, 5-7 June 2024)

Flagship Initiative Strategy

ISI Strategy: A Contribution to IHP IX



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ISI STRATEGY

A contribution to IHP IX





1.1 Towards a new ISI Strategy

Established in 2002, **the International Sediment Initiative (ISI)** is a global initiative to assess erosion and sediment transport to marine, lake or reservoir environments aimed at the creation of a comprehensive approach for the remediation and conservation of surface waters, intricately linking science with policy and management needs.

ISI is one of the fifteen Flagship Initiatives approved by the Intergovernmental Council of IHP, based on the needs of UNESCO Member States. Flagships work on long-term crosscutting themes related to hydrology and water management issues and their global aim is to enhance the management of water resources through science-based recommendations, education, and capacity building. From this inception, ISI has **the aim to increase awareness of erosion and sedimentation dynamics and sediment issues in all spheres of water management**. The initiative promotes sustainable management of soil and sediment resources at local, regional, and global scales.

An evaluation process was finalized in 2022 concerning all Flagship Initiatives, highlighting **ISI as one of the initiatives with best governance and management** during the Eighth Phase of IHP (2014-2021). At the same time, the Ninth Phase of IHP (2022-2029) was endorsed during the 2022 IHP Intergovernmental Council and a new Flagship Initiative Framework was put in place. These new developments require, therefore, a revision of the current ISI strategy and a closer alignment to the new phase of IHP, in accordance with the new Framework.

1.2 Previous ISI Achievements

In order to access to the vision of global sustainable sediment management, ISI has put a lot of efforts since it was established in 2002.

Previous ISI achievements are summarized in 5 groups as follows.

- 1) **Global Evaluation of Erosion and Sediment Transport (GEST Project):** The website <http://www.irtces.org/isi/> has been established and is in operational use, which provides information on sediment related news, forthcoming events, and technical papers/reports. The ISI Information System is constructed with the purpose of helping to organize and promote international information exchange and providing direct access to policy makers in Member States while activating scientific and professional communities in all regions concerned. Materials, publications and linkages of ISI and sediment related activities can be found there. The quarterly ISI Newsletter provides useful information concerning news, meetings, workshops, conferences, training courses and other events carried out. Recent publications are listed and some of them are reviewed. Furthermore, information on forthcoming symposia, conferences and training courses related to erosion, sediment transport and deposition is provided.
- 2) **Case Studies of River Basins as Demonstration Projects:** Case studies are effective means of raising awareness about erosion and sedimentation problems in different regions and comparing the problems and management response found in different river basins. These provide examples of monitoring and data processing techniques, procedures and methodologies for analysis of environmental, economic and social impacts, and evaluation of management practices. The case studies of the Mississippi, Nile, Rhine, Volga, Yellow, Haihe and Liaohe rivers have been completed. A summarization publication 'Sediment problems and strategies for their management: experience from several large river basins' was published by UNESCO and included in the UNESCO Digital Library.

- 3) **Review of Erosion & Sedimentation-Related Research:** A survey of ongoing research is an important contribution to the development of sustainable management of erosion and sedimentation. These publications include - 'Erosion and sediment dynamics from catchment to coast – Northern Perspective', 'Erosion and sediment dynamics from catchment to coast – Southern Perspective', 'The Impact of Global Change on Erosion and Sediment Transport by Rivers: Current Progress and Future Challenges', 'IAHS publication Sediment Problems and Sediment Management in Asian River Basins', 'Case study on sediment in the Mekong River Basin: Current state and future trends', 'CONTROLLING THE YELLOW RIVER: 2000 Years of Debate on Control Strategies', 'Erosion and Sediment Problem: Global Hotspots', and several journal papers.
- 4) **Education & Capacity Building for Sustainable Sediment Management:** ISI scientific conferences conduct workshops and seminars focusing on the most important issues of erosion, transport and sediment deposits. International and local experts discuss local problems at these conferences and develop proposals for solving them. Over 40 international conferences and over 10 training workshops in which ISI was involved have been organized. The first International Sediment Initiative Conference was held in Sudan in November 2006. Most recently, the 7th International Conference on Estuaries and Coasts was held in Shanghai, China from October 18-21, 2021; the ISI Online Expert Meeting on Global Databases of Sediment Loads in Rivers was held on May 25 and June 10, 2021; the ISI training workshop "River Basin Sediment Monitoring and Management" was held online from September 6- 10, 2021; and the ISI Online Training Workshop on Sediment Transport Measurement and Monitoring was held from July 5-9, 2021.
- 5) **Networking:** ISI is open to collaboration with all interested institutions – international, regional or national associations – in the interest of promoting sound and sustainable sediment management policies. Collaborative links have been established with IAHS, WASER, ICCORES, ICOLD, GEMS/WATER, IAHR, FRIEND, IFI, IDI, WLRI, GEOS, SedNet, ICHARM, ICWRGC among others.

2. OBJECTIVES OF THE ISI PROGRAMME

Sediment and erosion have significant impacts on the environment, ecosystems, and human activities. For example, sediment and erosion can lead to the degradation of aquatic habitats, including rivers, lakes, and coastal areas. Excessive sedimentation can destroy important habitats for aquatic plants and animals, disrupting the balance of ecosystems. Sediment carried by erosion can also negatively affect water quality. Excessive sedimentation can lead to increased turbidity, reducing light penetration and disrupting photosynthesis for aquatic plants. Sediment can also transport pollutants such as nutrients, heavy metals, and pesticides, which can harm aquatic life and contaminate water sources both from freshwater systems to seas and oceans.

Furthermore, climate change, by intensifying extreme weather events like heavy rainfall, storms, and flash floods, and causing sea-level rise, increases the risk of disasters such as landslides, gully erosion, and coastal erosion. Additionally, glaciers play a significant role in sediment transport and erosion, shaping landscapes through various processes, which can lead to the formation of various landforms, including moraines, drumlins, and fjords.

Based on the impacts of sediment and erosion, UNESCO ISI flagship prioritizes three thematic areas as presented in the ISI Theory of Change (Figure 1):

1. **Erosion and Sediment Transport and Management:** this thematic priority mainly builds on the earlier work of ISI in IHP Phase VIII. It will focus on understanding the processes of erosion and sediment transport in river systems and landscapes. Under this thematic area, the two pillars of work will be conducted: Hillslope Erosion and Sediment Supply, and Erosion and Sediment Transport in river basins.
2. **Sediment-related Hazard Management:** This thematic priority addresses sediment-related hazards, which encompass slope failures, debris flows, and landslides. The focus will be on effective sediment-related hazard management, with a specific emphasis on mitigating landslide and debris-flow hazards

3. **Glacier-related sediment, erosion and hazards management:** glaciers play a significant role in sediment transport and erosion. Glacier- and permafrost-related hazards, such as, Glacial Lake Outburst Floods (GLOF), represent a continuous and growing threat to human lives and infrastructure in high mountain regions. Under this thematic priority, efforts will focus on research and knowledge of glacier erosion processes, cryosphere system vulnerability reduction, Glacial Lake Outburst Floods.

The objective of ISI is to increase awareness of erosion and sedimentation dynamics and sediment issues for the three thematic priorities in all spheres of water management by linking science with policy and management needs and supporting the global agenda for sustainable sediment management.

ISI also has the mission to organize and promote international information exchange and provide direct access to policy makers in Member States while activating scientific and professional communities in all regions and countries concerned. ISI will promote the elaboration and monitoring of sediment data to develop appropriate methodologies, tools and procedures in sediment management.

This overall objective is also aligned with the priorities of the current IHP-IX phase, as well as the overall UNESCO-IHP mission, which concerns mobilizing scientific and policy-relevant expertise, knowledge and tools for informed decisions in addressing water challenges, as well as strengthening transdisciplinary water research by supporting research on methods for stakeholder involvement and knowledge integration.

To achieve this objective, the programme aims to realize its intended impact by 2029, as presented in the ISI Theory of Change Diagram (Figure 1).

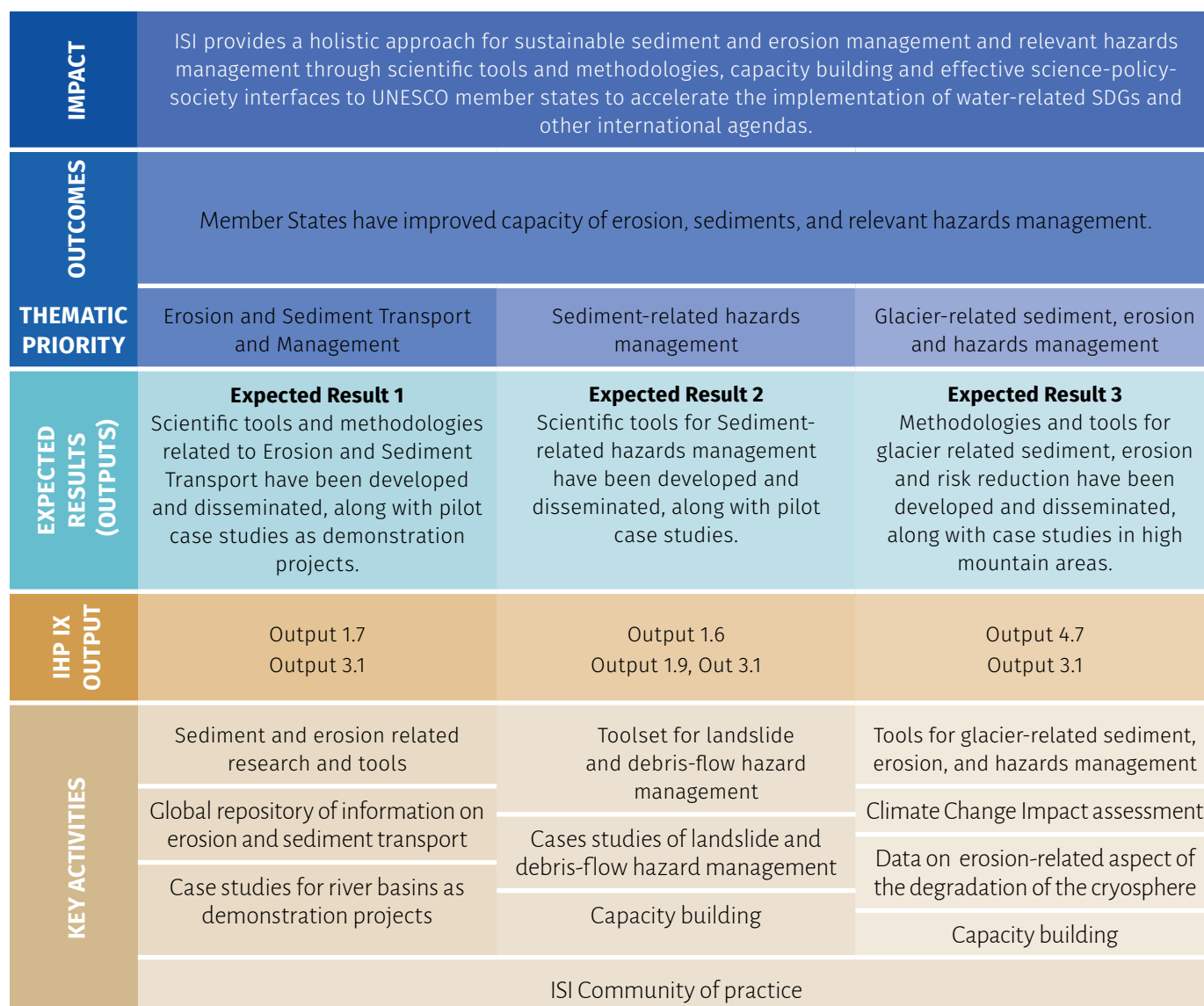


FIGURE 1 THE ISI THEORY OF CHANGE DIAGRAM

To reach the overall objective of the Programme, three specific objectives under each thematic priority were identified:

- 1) Member States have an improved capacity of Erosion and Sediment Transport and Management in river systems.
- 2) Member States have an enhanced capacity of Sediment-related Disaster Risk Reduction.
- 3) Member states have an improved capacity of glacier-related sediment and erosion hazards management.

These specific objectives are directly aligned with, and will contribute to, the outputs of **IHP-IX 'Science for a Water Secure World in a Changing Environment'**, including the following:

- i) ISI is committed to addressing water-related disaster, including GLOFs. The approach involves leveraging scientific knowledge, methodologies, and tools to achieve the objectives outlined in **Output 1.6**. Specifically, this will include improving the timely forecasts and early warning system, developing risk mapping and hazards mapping of GLOF, and organizing relevant training and workshop and so on.
- ii) ISI aims to conduct research and case studies considering assessments, enhance knowledge and practices related to sediment issues, as well as outreach and dissemination on sediment issues, which aligns with **Output 1.7**, which concerns the development and sharing of knowledge on the impacts of global change and human usage on river and lake basins, aquifer systems, coastal areas, and cryosphere and human settlements by the scientific community supported to embed it in water resources and services management plans.
- iii) ISI will support the development and sharing of new technologies using earth observation, Artificial Intelligence and Internet of Things for monitoring the cryosphere system and sediment transport and improving forecasts. This is closely linked to **Output 1.9**, Development and sharing of new technologies using, earth observation, Artificial Intelligence and Internet of Things by the scientific community and service providers are communicated to and/or used for capacity strengthening of water stakeholders to increase their use in hydrological planning and assessment as well as monitoring and distribution networks.
- iv) ISI will also develop data systems on sediment and related information, that links with **Output 3.1**, related to the development and use of scientific research methods by the scientific community supported to correctly collect, analyse, interpret, and exchange data.
- v) ISI will enhance the community of practice on sediments and water management, that is closely linked to **Output 4.7**, which concerns undertaking assessments and developing and sharing of methods to monitor changes in the cryosphere system (snow, glacier, and permafrost), runoff formation from melting glaciers erosion and sediment transport, glacier fed reservoirs such as mountain lakes, and aquifers, by the scientific community supported for improved understanding of their potential use to inform decision makers at all levels.

1.3 Implementation Plan

The ISI strategy and Theory of Change are accompanied by a detailed Implementation Plan, which elaborates on the specific objectives and the activities that ISI expects to implement over the course of the IHP Phase IX. It also highlights the performance indicators and targets the Programme has identified. A summary of the implementation plan will be provided here, while the full implementation plan can be accessed through the IHP shared workspace.

The plan is presented along its three expected results, which are aligned with the specific objectives of the Programme.

► **Expected Result 1: Scientific tools and methodologies related to Erosion and Sediment Transport have been developed and disseminated.**

The first expected result has the following three subcomponents:

Key Activity 1.1: Development of sediment and erosion related research, guidelines, and tools

A) Hillslope Erosion and Sediment Supply

The primary activity in this area involves the compilation of published methods and guidelines for sediment source fingerprinting. This will aid in the creation of a policy brief focused on transdisciplinary approaches to soil erosion and sediment source evaluation, and will identify the potential of nature-based solutions for sediment management. In addition, ISI will contribute to publications on the modelling of sediment sources and supply, particularly in the context of climate change impacts.

B) Erosion and Sediment Transport in river basins

This key activity involves summarizing guiding principles and experiences from case studies in large river basins, offering valuable insights for replication. Additionally, a comprehensive review of sediment-related research will be conducted to understand the current state of knowledge. The environmental, economic, and social value of sediments will be evaluated, highlighting its importance across various contexts. Moreover, technical criteria for sediment and erosion monitoring will be established to ensure consistent and reliable practices. Together, these efforts aim to enhance understanding, evaluation, and standardization in sediment-related research and monitoring.

Key Activity 1.2: Development of case studies for river basins as demonstration projects

The developed tools and methodologies will be applied in selected pilot case studies. These case studies will serve as demonstration projects, showcasing the effectiveness of the tools in real-world scenarios. The results from these case studies will be documented and shared with the wider community to encourage further adoption of the tools. These will provide examples of monitoring and data processing techniques, procedures, and methodologies for analysis of environmental, economic, and social impacts, and evaluation of management practices. Case studies of the Danube, Mississippi, Nile, Rhine, Volga, and Yellow River basins are under preparation. The data available from the case studies will be incorporated into the global database as indicated in Key Activity 1.3, which focuses on data of sediments and related information systems.

Key Activity 1.3: Development of global repository of available data of sediments and related information systems

This key activity will encompass the collaborative design of a sediment source database structure. This structure will be capable of harvesting and integrating data from both published works and future global studies, specifically for Pillar A) Hillslope Erosion and Sediment Supply. Additionally, this activity will concentrate on reviewing the currently available data on global river sediment and establishing a comprehensive global erosion and sediment information system for the Pillar B) Erosion and Sediment Transport in river basins. The outcomes from this activity will include detailed reports and a robust global database platform.

Key Activity 1.4: Capacity building and technical transfer of scientific tools and methodologies related to Erosion and Sediment Transport

ISI promotes scientific conferences, workshops and seminars focusing on critical issues relating to erosion and sediment transport at the local, regional, and global scale. Initially, a comprehensive mapping exercise will be undertaken to identify existing training materials and formats that align with Thematic Priority 1: Erosion and Sediment Transport and Management. Over the medium term, the initiative will bolster education and capacity building for sustainable sediment management through a variety of platforms including international seminars, workshops, and online courses. This initiative particularly aims to inspire young scientists, while also taking into account regional priorities and interests across diverse socio-economic, ecohydrological, and physiographic settings.

► **Expected Result 2: Enhanced capacity of Sediment-related Hazard Management**

This expected result will focus on sharing knowledge and experiences about Sediment-related Hazard Management

Key Activity 2.1: Development of Toolset for landslide and debris-flow hazard management, monitoring and prediction

This key activity will focus on the development of a comprehensive toolset for landslide hazard assessment, monitoring and forecasting. First, a mapping exercise will be undertaken to identify existing tools and methodologies, with the goal of publishing a comprehensive study in this field within a medium-term timeframe. It will also explore the applications of Artificial Intelligence and Machine Learning in managing, monitoring, and forecasting landslide and debris-flow hazards. In addition, susceptibility maps on a continental scale will be developed for regions including Europe, Central Asia, North America, and Africa. These maps will provide crucial insights into areas prone to landslides and related hazards.

Key Activity 2.2: Development of case studies on landslide and debris-flow hazard

The primary objective of this key activity is to pilot the methodologies and toolset that were previously developed under Key Activity 2.1. These case studies serve as demonstration projects, allowing us to showcase the practical effectiveness of the tools in real-world scenarios. By applying these methodologies to specific situations, it could assess their performance, identify strengths and limitations, and gather valuable insights. The case studies from Be-Resilient Project in Zimbabwe and Mozambique are under preparation and case studies from other regions will follow.

Key Activity 2.3: Enhancement of skills, knowledge and practices related to Sediment-related hazards management

ISI promotes scientific conferences, workshops and seminars focusing on critical issues relating to Sediment-related hazards management at the local, regional, and global scale. Within the medium term, the initiative will focus on the development of training materials on the UNESCO Open Learning Platform. Additionally, conference sessions in the World Landslides Forum will be organized.

The outcome of this key activity includes regularly recurring training courses, with support from the UNESCO Chair on Prevention and Sustainable Management of Geo-Hydrological Hazards and UNESCO Chair on Water-related Disaster Risk Reduction.

► Expected Result 3: Improved capacity of glacier-related sediment and erosion hazard management

Glaciers play a crucial role in shaping our planet's landscape. As they inch forward, they grind against bedrock, eroding mountains and producing vast quantities of sediments. These sediments are then transported to rivers and oceans, impacting global sediment and biogeochemical balances. Understanding the evolution of glacial erosion is vital, especially in the context of a changing climate. Under this Expected Result, several key activities are considered:

Key Activity 3.1. Development of research, guidelines, and tools related to erosion and sedimentation from the cryosphere system and the increased impacts due to climate change

The key activities will focus on examining the susceptibility analyses and triggers of Glacier Lakes Outburst Floods (GLOF), with an emphasis on sediments. A comprehensive review will be undertaken on the supply, transport, and monitoring of glacier-related sediments. The vulnerability of the high mountain cryosphere system to climate change will be a significant focus. This will involve investigating the impact of warming on erosion and sediment transport in high mountain regions. The social-ecological repercussions of altered sediment dynamics on downstream communities will also be assessed. This includes the potential effects on water availability, food security, and energy resources. Finally, attention will be given to climate adaptive planning for the cryosphere system. This may involve the use of Climate Risk Informed Decision Analysis (CRIDA) to evaluate the impact of climate change. This approach ensures a comprehensive understanding of the challenges and potential solutions in managing the cryosphere system in a changing climate.

Key Activity 3.2. Development of data on erosion-related aspects of the degradation of the cryosphere

This pivotal activity will initially investigate the feasibility of connecting the database on GLOFS and sediment issues. Concurrently, ISI will undertake the compilation of regional glacier lake inventories, reflecting both the present situation and potential future scenarios. Additionally, the exploration of activities associated with permafrost-related sediment supply will be conducted. This comprehensive approach ensures a data driven

approach for a thorough understanding of the current state and anticipates future changes in the cryosphere system.

Key Activity 3.3 Training of glacier-related sediment and erosion issues and enhanced relevant hazards management

The key activity 3.3 will focus on the development and organization of training and workshops based on the outcomes of key activities 3.1 and 3.2.

Key Activity 4. Community of practice with outreach and dissemination on sediment issues

ISI is open to collaboration with all interested institutions – international, regional, or national associations – in the interest of promoting sound and sustainable sediment management policies. ISI is eager to establish closer working relationships with international, regional, and national projects, programmes, and networks, such as IAHS (International Association of Hydrological Sciences), WASER, ICCORES, ICOLD, GEMS/Water, IAHR, FRIEND, HELP (Hydrology for the Environment, Life and Policy), IFI (International Flood Initiative), G-WADI, GEOSS and SedNet among others.

To achieve this, ISI will first identify stakeholders interested in erosion and sediment processes, then build a network of professionals, academics and practitioners linked to sediment management or issues.

1.4 Governance

To support the implementation of the ISI Programme, a governance structure has been set up. The programme is managed by the IHP Secretariat through the ISI Technical Secretariat, which is located at the International Research and Training Centre on Erosion and Sedimentation (IRTCES) in Beijing, China. The secretariat is supported by an Advisory Board, which is composed of representatives of each of the six regions and comprises a set of Category 2 Centres, Chairs, and other Water Family members. In Figure 3, an overview of the governance structure of ISI is presented.

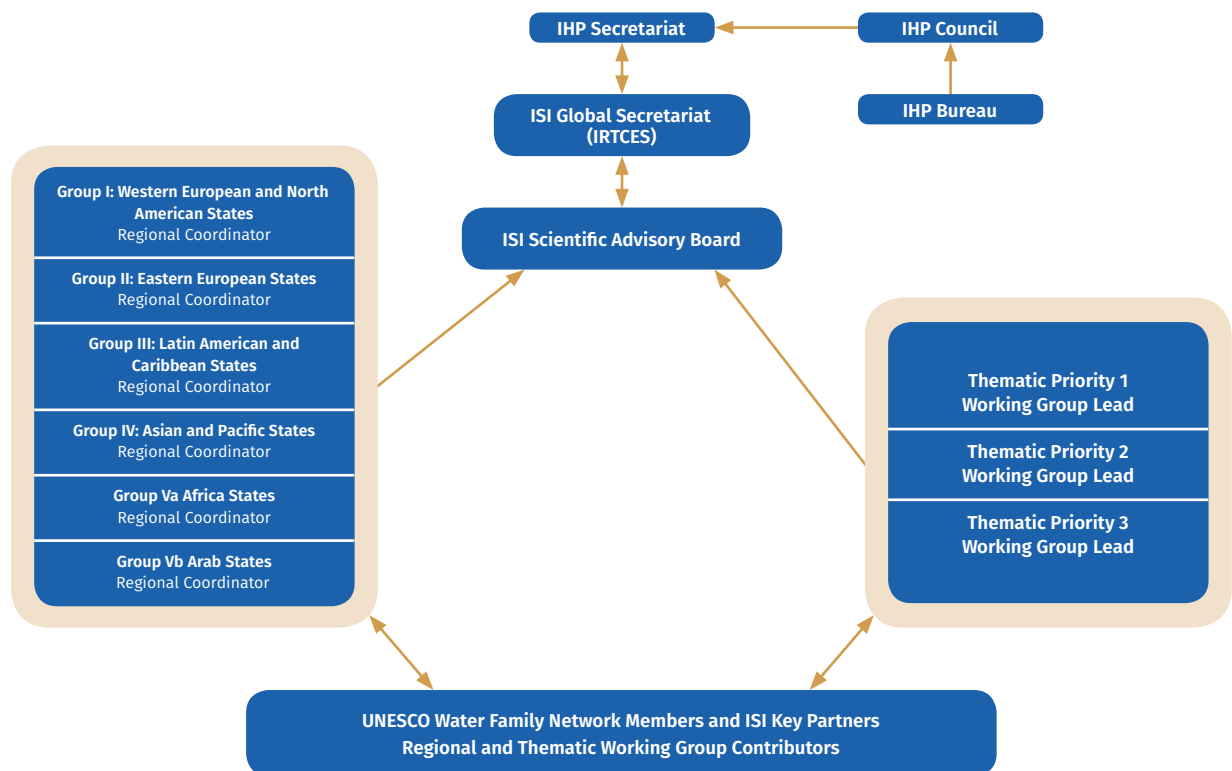


FIGURE 3 GOVERNANCE STRUCTURE OF ISI

ISI Global Secretariat

In close cooperation with the IHP Secretariat, the ISI Global Secretariat supports the implementation of the Flagship Initiative. Its tasks include the planning, delivery, and reporting of all the Initiative's activities in collaboration with the regional secretariats and focal points and guided by the Advisory Board. The Secretariat also develops and implements the outreach and communication strategy of the ISI network, prepares brochures, posters, and other materials, in consultation with other members of the ISI Advisory Committee and IHP.

Thematic Working Group Leads

For each of the expected results (outputs) of the Programme, working groups are put in place to track the progress of the Implementation (Figure 2). These working groups are overseen by a working group lead and a set of collaborators, who include the Regional Coordinators, key partners, and UNESCO IHP Water Family network members.

Advisory board

The Advisory Board is composed of the representatives of the IHP Secretariat, the Global and Regional Secretariats and the thematic working group leads. The Advisory Board holds meetings at least once a year and reviews the progress made and the activities implemented. The Advisory Board members discuss the activities for the future period and ensure that each person/institution in charge will be able to carry them out accordingly.

Key partners and network members

The ISI programme has a network with active members that play a key role in the Initiative. These are persons or organisations working on themes related to the ISI main area of interest, and who contribute to and benefit from the Initiative by participating in workshops, training sessions and conferences and/or contribute to publications and the content of workshops and/or training on specific themes. They will be involved through the work of the Secretariat and working groups.





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SC-2024/HYD/PI/13