

CLIMATE AND WATER IN THE UPPER INDUS BASIN

AN URGENT NEW RESEARCH AGENDA

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Executive Summary

The Upper Indus Basin (UIB) is an extraordinarily significant social-ecological system that supports hundreds of millions of people.

Water resources in the UIB are extremely vulnerable due to climate change, and as a result of historic lack of demand management. New knowledge, based on interdisciplinary and transdisciplinary research is needed to deal with the resulting challenges.

We conducted a systematic exercise to identify 100 research questions which, if answered, would contribute to the effective and equitable management of water resources under conditions of climate change in the UIB.

These questions cover research within the natural sciences, social sciences and humanities.

Together, they suggest the need for long-term funding that emphasises interdisciplinary research, transdisciplinary approaches, bilateral and multilateral grant programmes and locally-embedded research programmes.

Note:

We invite readers to access the full academic paper on which this brief is based:

Orr, Andrew, Bashir Ahmad, Undala Alam, ArivudaiNambi Appadurai, Zareen P. Bharucha, Hester Biemans, Tobias Bolch et al. "Knowledge priorities on climate change and water in the Upper Indus Basin: A horizon scanning exercise to identify the top 100 research questions in social and natural sciences." *Earth's Future* 10, no. 4 (2022): e2021EF002619.

This publication is freely accessible at this link:

<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2021EF002619>

Cover Image credit: Marcus Nüsser, 2009. Glaciers, meltwater and irrigated cultivation, Ladakh.

Introduction

In a major recent study, we identified 100 research questions that will be important for research, policy, and practice in climate and water resources in the Upper Indus Basin (UIB).

The UIB is the region from the high-mountains of the Hindu-Kush Karakoram Himalaya (HKH) to the merger of the Upper Indus, Kabul, Jhelum, Chenab, Ravi, Beas and Satluj rivers (see Figure 1).

Together, these rivers are of exceptional economic, social, cultural and political importance. They support hundreds of millions of people in Afghanistan, Pakistan, India and China. A significant proportion of this population experiences endemic poverty, precarious livelihoods and increasing vulnerability to social and environmental change. This vulnerability is driven by a combination of environmental stress, deepening climate change and historic lack of demand management of existing water resources.

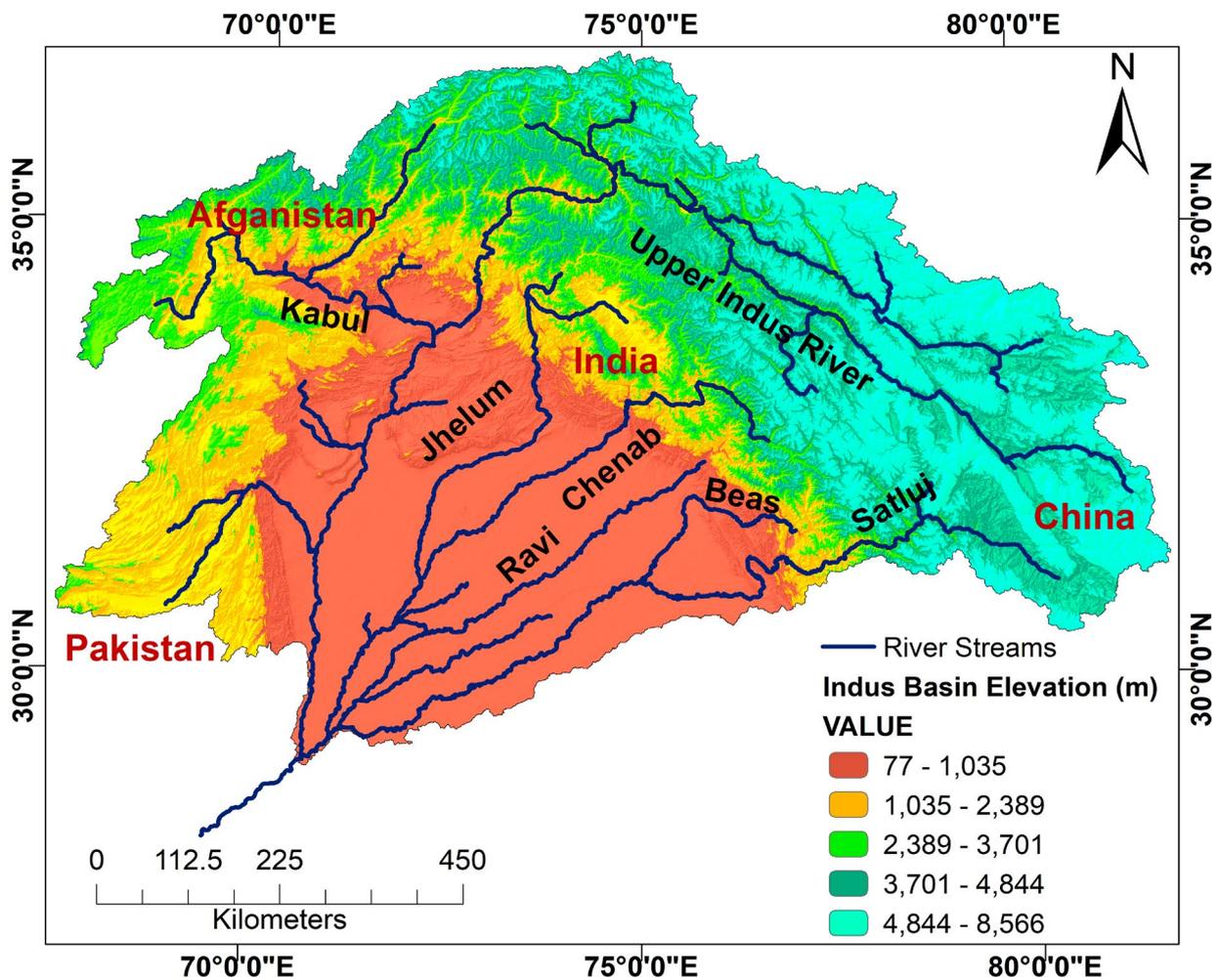
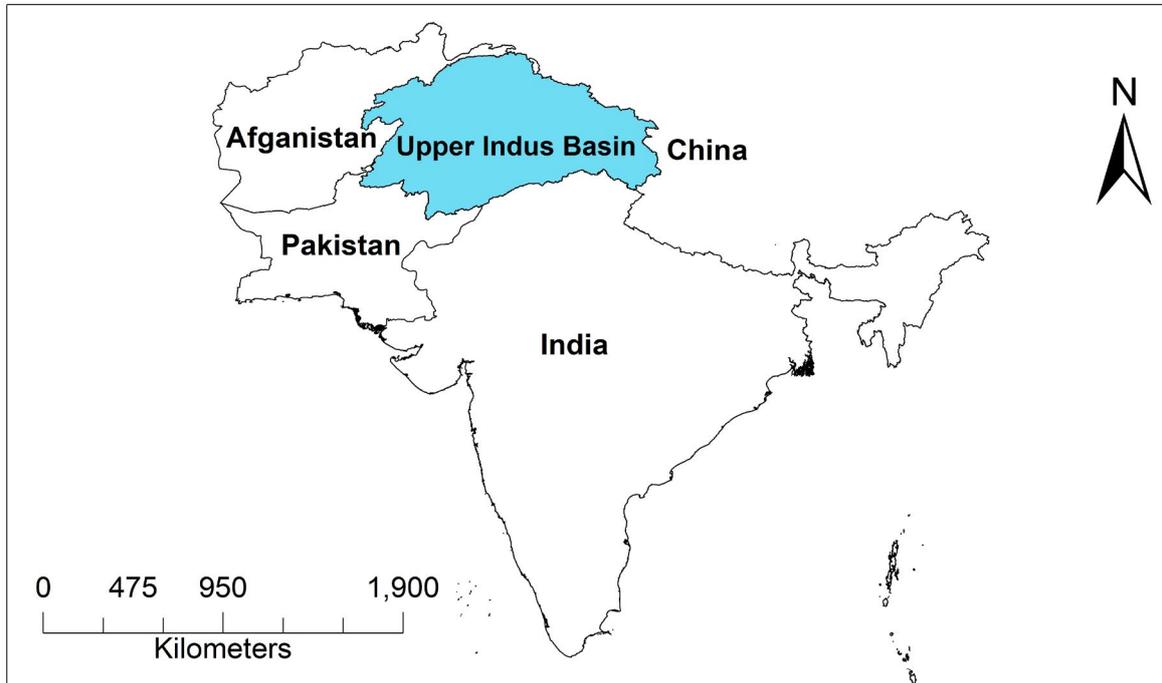
Dealing with these interacting challenges requires new forms of knowledge and new linkages between knowledge and policy making.

Existing approaches have tended to focus on the physical geography of the basin, while failing to account for the social, cultural, political and economic influences that determine how much water is available, to whom, how it should be used and with what impacts for other communities. This has resulted in major gaps in knowledge, and suggests the need for a comprehensive new research agenda that emphasises the social sciences and humanities as much as the natural sciences.

To address this need, we brought together 50 experts from the natural sciences, social sciences and humanities, each with an established track record of relevant expertise, to identify 100 research questions which, if answered, would facilitate a better understanding of the changing climate and water resources of the UIB and improve outcomes for the people who depend on it.

In this policy brief, we summarise the results of this work and outline the broad scope of the questions we identified. These fall under three main interdisciplinary themes: governance, policy and sustainable solutions, socioeconomic processes and livelihoods, and integrated Earth system processes. We propose that the 100 questions identified form a significant new research agenda that should be supported by existing and future research funding initiatives, and should feed into new policy making on the UIB. This research agenda builds on a strong record of international scientific collaboration in the Basin, from organisations such as the International Centre for Integrated Mountain Development (ICIMOD).

Figure 1. (top) Map showing the geographical limits of the Upper Indus Basin (shaded blue) used in the scan, which is shared by Pakistan, Indian, Afghanistan, and China. (bottom) Zoom-in of the Upper Indus Basin region (shaded blue), defined as the region from the high-mountains of the Hindu-Kush Karakoram Himalaya (HKH) to the confluence or merger of the Upper Indus, the Kabul, the Jhelum, the Chenab, the Ravi, the Beas, and the Satluj rivers. Source: Orr et al. 2022.



Surveying the the knowledge landscape to identify research priorities

The challenges of climate and water in the Upper Indus are complex, involve significant uncertainties and both social and environmental conditions in the Basin are undergoing rapid change.

Horizon Scanning is a research method that has been used in comparable contexts to identify research priorities under conditions of social and environmental change. It is a well-established method for surveying the cutting edge of a discipline, or the frontiers of complex fields and regions, in order to clearly identify priorities for research funding, policy making and programme development.

There are a number of different ways to conduct a horizon scan. Our method involved bringing together a group of experts who each sent out a short survey to their professional networks. This survey asked respondents to nominate 3-5 research questions on climate and water in the Upper Indus basin. We then followed a systematic, iterative process for narrowing down the candidate questions until this list was achieved. This group of questions can be used both as a broad research agenda, and as a menu for more focused problem and project-driven research.

50 researchers were actively involved in our project. These included a core group of facilitators (the 'Steering Group', 12 members) and 38 Working Group members.

These 50 researchers were carefully chosen to represent a diverse mix of gender, geographic location, academic discipline, and seniority.

Represented were experts from India (11), Pakistan (9), Afghanistan (2), and China (2). The remaining 26 experts were located in nine other countries. All chosen participants had recognized expertise and background in research on the Upper Indus basin.

Of the 50 participants involved in the study, 19 (38%) identify as female and 31 (62%) as male, 9 (18%) are so-called 'frontrunners' who are pushing forward the boundaries of their field and 41 (82%) are 'gatekeepers' who have established track records within their field, while 29 (58%) are affiliated with various social science and humanities (SSH) disciplines and 21 (42%) in the disciplines of science, technology, engineering, and mathematics (STEM) (see Figure 2).

Figure 2. Sankey diagram illustrating the diversity of the 50 participants involved in this study in terms of their location, gender, discipline, and whether they are frontrunners (i.e., new entrants) or gatekeepers (i.e., already established). Here SSH refers to 'social sciences and humanities', and STEM refers to 'science, technology, engineering, and mathematics'. Source: Orr et al. 2022.

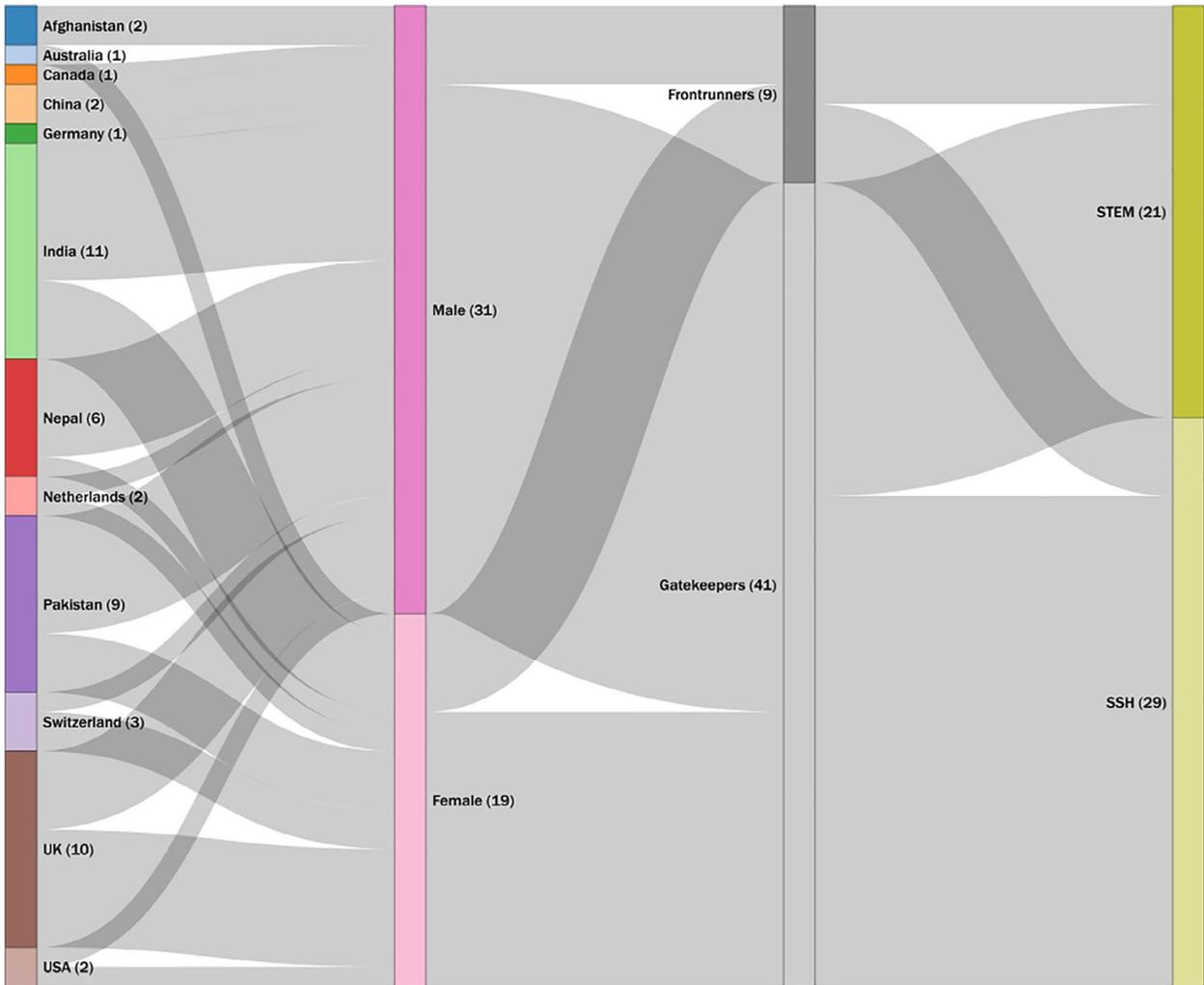
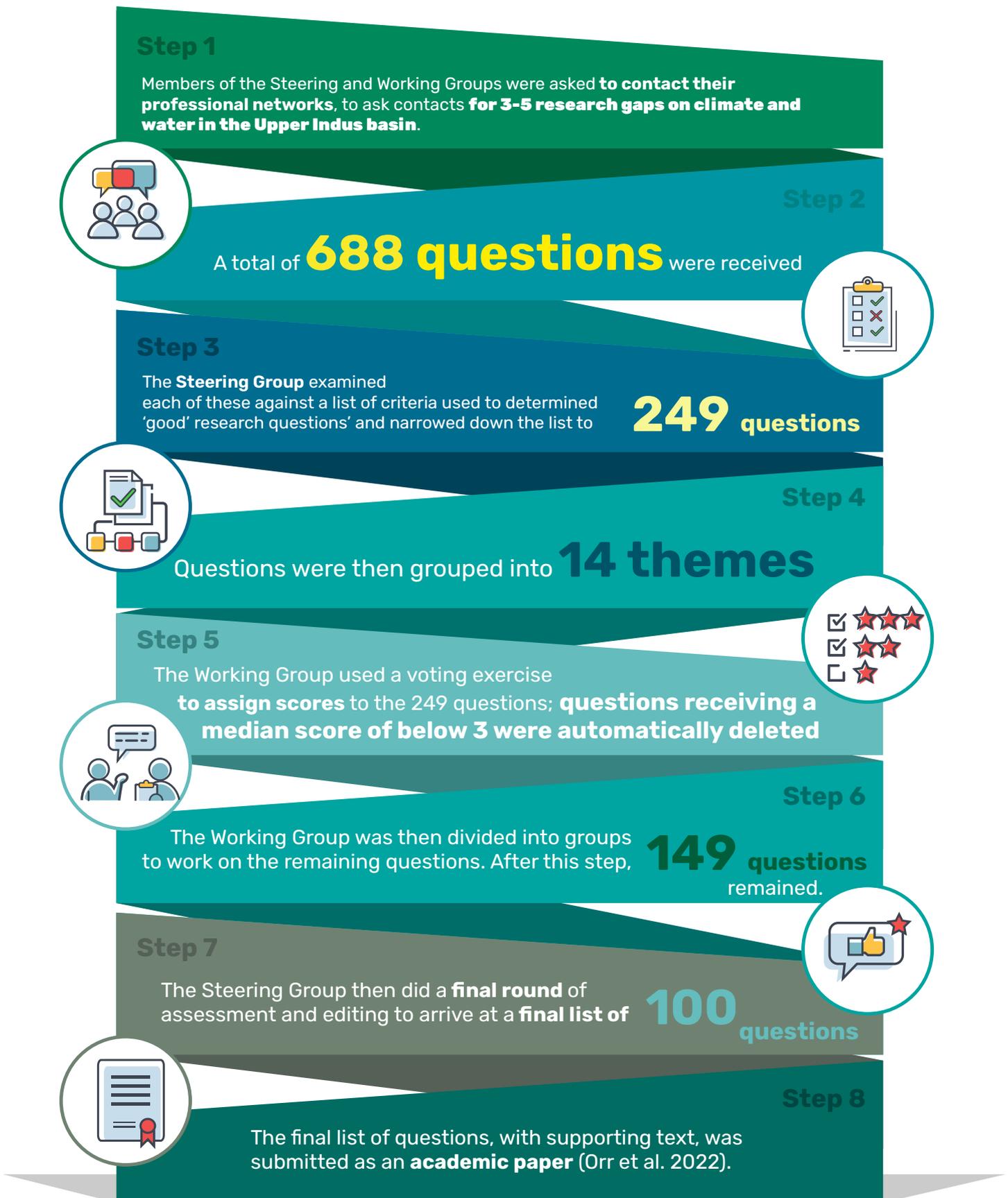


Figure 3. Horizon scanning methodology used to arrive at Top 100 research questions.



Knowledge priorities

We identified 100 priority research questions on climate and water in the Upper Indus Basin that we grouped into fourteen themes. These themes were further grouped into 3 main categories. In this section, we broadly describe the scope of the specific questions within these categories. We suggest that these thematic areas should be the focus of further funding initiatives and should be the focus of policy initiatives focussing on climate and water in the UIB. For the specific research questions identified under each category, we invite readers to access our full paper:

1. Governance, policy and sustainable solutions:

This theme addresses the social and political influences on water resources in the Upper Indus basin. It focuses on governance and innovation, geopolitics, water resource management and adaptation.

Research in this area needs to focus on the best ways to enhance the work of grassroots organisations and local water management, improve opportunities for cross-country agreements on water management and develop sustainable solutions and adaptations for water management, in particular using traditional knowledge and involving local communities.

2. Socioeconomic processes and livelihoods:

This theme addresses the transitions and transformations within the Upper Indus Basin in terms of land use change, cropping systems, digital and physical connectivity, demographic shifts, urbanization, and changes to human mobility. Research is needed to better understand the impact of these changes on water resources within the context of climate change, and to identify the best ways for different communities and stakeholders to adapt.

Research questions proposed in this area address the impact of water management on migration and connectivity (and vice-versa), the question of how climate change will affect people in different locations or in different socioeconomic groups, cultures and genders, and the question of how agricultural practices will need to change in order to adapt to future climate-driven water resource changes.

3. Integrated earth system processes:

This theme addresses the hydroclimate, cryosphere, hydrology and ecosystems of the Upper Indus Basin. It focuses on how the multiple and interacting changes brought about by a changing climate will influence the hydrology of the basin, and its terrestrial and aquatic components.

Research questions proposed in this area include those focussed on understanding natural hazards, their effects, and building resilience to these hazards, understanding the effects of increased greenhouse gas emissions and air pollution on climate, glaciers, snow and permafrost, and improving data collection to enhance this understanding.

Funding priorities for new knowledge generation

The research priorities identified by our scan have a number of important implications for research funding mechanisms and programmes. We briefly summarise these implications here.

1. Encouraging interdisciplinary and transdisciplinary research:

Funding mechanisms need to prioritize interdisciplinary projects where researchers can integrate the insights of a variety of academic disciplines from across the natural and social sciences and humanities. This is important because the research questions identified by us focus in large measure on the linkages between complex and dynamic earth system processes and ongoing social, cultural and political change. Transdisciplinary research goes beyond existing academic disciplines to integrate the understanding and knowledge of stakeholders on the ground. This is required not just for the design of effective management or adaptation programmes, but for an accurate understanding of the processes which drive change in the UIB. Research funding needs to specifically prioritize projects which deliver synthesis between different disciplines and involve local stakeholders from different communities in all levels of research, from project design onwards.

2. Supporting social sciences and humanities:

Two of our three main categories of questions are focussed on questions that can best be answered by the various academic disciplines classed as social sciences and humanities. These disciplines have been under-represented in research on climate change in general. Within the UIB, research on the social, cultural, political and economic dimensions of change is urgently needed, and funding programmes should prioritise programmes which give prominence to these disciplines.

3. Integrating research into climate and green finance:

It is important that financial investment in climate adaptation and sustainable development recognise that there are still significant gaps in our understanding of the UIB. Efforts to mobilize and scale-up climate and green finance from a wide variety of sources (public and private, bilateral and multilateral) should consider areas where new or expanded research is required to ensure that the interventions supported are both effective and sustainable. Where possible the funding of such interventions should include, or be aligned with, enhanced support for interdisciplinary research.

4. Enabling locally tailored research that focuses on the UIB's unique political contexts:

Research calls need to be framed so that projects are sensitive to the unique political contexts of the UIB. Research divorced from these contexts does not produce impact that can be embedded within local communities and existing governance structures and is rendered irrelevant. Funding calls should make clear that research has to be linked to these contexts, involve robust stakeholder participation and be made relevant to questions of poverty, marginalization and development, which have political traction.

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