United Nations
Educational, Scientific and
Cultural Organization

Division of Ecological and
Earth Sciences

SCOPE
Scientific Committee
on Problems of the Environment

UNEP
United Nations
Environment Programme

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Policy Briefs

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Third POLE ENVIRONMENT

Together with the Arctic and the Antarctic, the Tibetan Plateau and surrounding mountains, also called the Third Pole, carry one of the largest ice masses of the Earth.

The melt water from 12,000 km^3 of glaciers of the Third Pole ensures permanent flow of Asia's major river systems.

The current and future environmental changes at the Third Pole are likely to have major impacts on the lives of more than 1.5 billion people living in the region.

Chinese Academy of Sciences
Institute of Tibetan Plateau Research
United Nations Educational, Scientific and Cultural Organization
International Hydrological Programme

The Third Pole

The unique atmospheric and hydrological processes vary highly across the Third Pole and are shaped by the dynamics of glaciers, permafrost, persistent snow and water. These processes directly impact the geological, ecological and climate features of the region.

Variation of the Ata glacier
Since the early 20th century, glacier variations have greatly changed regional ecosystems and affected the hydrological cycle and climate over the Third Pole.
© 1933: Photo by F.K. Ward. 2006: Photo by Yao T.D. and Xu B.Q.

They also ensure permanent flows of Asia's major river systems, thus significantly influencing the social and economic development of a fifth of the world's population with more than 1.5 billion people living downstream in the river basins of the region.

As a consequence of global environmental changes, the currently observed ecological changes in the Third Pole influence social and economic development in the region, while also driving the climate and environmental changes at local, regional and global scales.

However, the data necessary to precisely assess the environmental, societal and economic changes caused by alterations in the Third Pole dynamics are either lacking or insufficient. There is an increasingly urgent need for a comprehensive coordinated international research, monitoring and capacity building initiative to address the influence of such changes on human populations and to provide timely options for mitigation and adaptation strategies.

Glacier retreat is one of the most significant environmental changes observed at the Third Pole. Over the past decade, most of the glaciers in the region have undergone considerable retreat, though the extent differs according to location. Rising temperatures, changing precipitation patterns and black carbon depositions are currently under discussion by scientists as major causes of strong glacier melt.

The challenges

The Third Pole is a unique high mountain region centred on the Tibetan Plateau stretching over 5 million square kilometres, from the Pamir and Hindu Kush in the west to the Hengduan Mountains in the east, from the Kunlun and Qilian mountains in the north to the Himalayas in the south.

With an average elevation higher than 4,000 metres above sea level, the Third Pole is characterized by complex interactions of atmospheric, cryospheric, hydrological, geological and environmental processes that bear special significance for the Earth's biodiversity, climate and water cycles. These processes are critical for the well-being of the people inhabiting the plateau and the surrounding regions of Afghanistan, Bangladesh, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Myanmar, Nepal, Pakistan, Tajikistan and Uzbekistan.

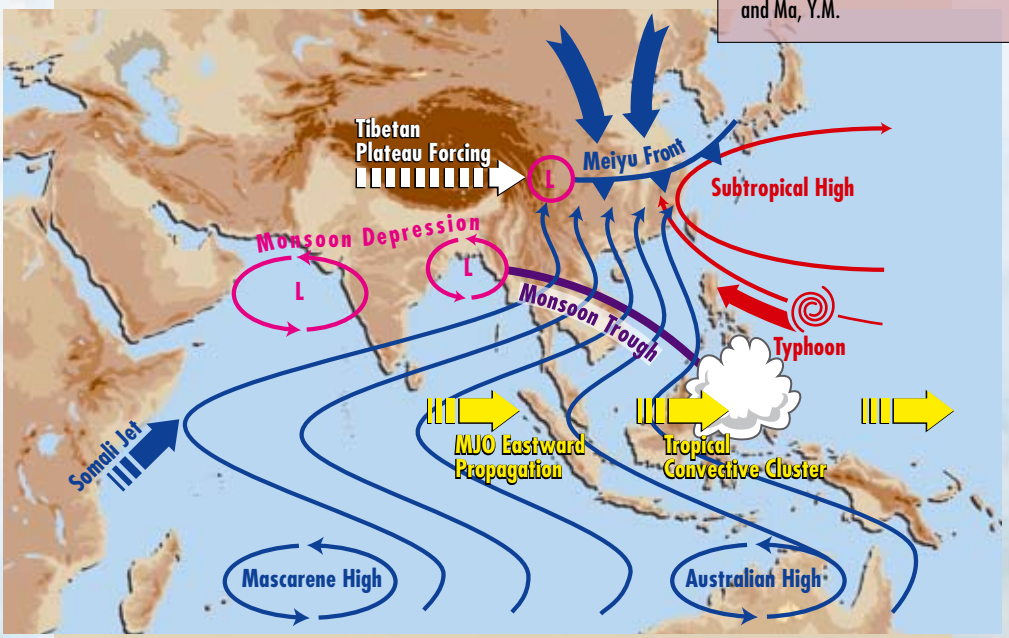
Most of Asia's major river systems depend on glacier melt water from the Third Pole region to ensure permanent flow.

Climate Impacts and Feedbacks

The Third Pole plays a prominent role in the evolution of the Asian monsoon system which is critical for the moisture fluxes and precipitation patterns in the region. Heavy snowfall over the Tibetan Plateau can both weaken and prolong the stay of the summer monsoon system in the region.

While the glaciers of the Third Pole respond to global climate variations, their presence and interaction with other Third Pole features are critical in the regulation of the global climate system. For example, conditions in the Third Pole affect the atmospheric circulation patterns in Eurasia and thus significantly influence the climate system in the northern hemisphere. Moreover, the observed thawing of permafrost in the Third Pole can result in the release of greenhouse gases, such as methane and carbon dioxide, to the atmosphere with significant potential contribution to global climate change.

The Asian monsoon system
Zhang, Z.Q., Li, W.J., Ding, Y.H. and Ma, Y.M.



Biodiversity Changes

The high altitude ecosystems of the Third Pole region are particularly fragile and dependent on climatic and hydrological conditions. Even slight environmental changes can result in degradation and loss of biodiversity.

The current biosphere changes in the Third Pole are characterized by ecosystem degradation and land cover changes. Although the ecosystems of the Third Pole benefit from increased precipitation in some regions, the overall condition of ecosystems is deteriorating under the cumulative effect of various impacts of climate change and increased human activity. Adverse effects on ecosystem services, including flood control, water supply and livestock feed, have been observed.

Changes in water supply can further lead to decrease of marine biodiversity in some of the highly distinct coastal seas of Asia.

Hydrological Hazards, Social and Economic Impacts

The most significant hydrological hazards in the Third Pole region are the floods caused by the recent glacier melt-supplied lake expansion and outburst. These floods pose a threat to habitats and human constructions downstream.

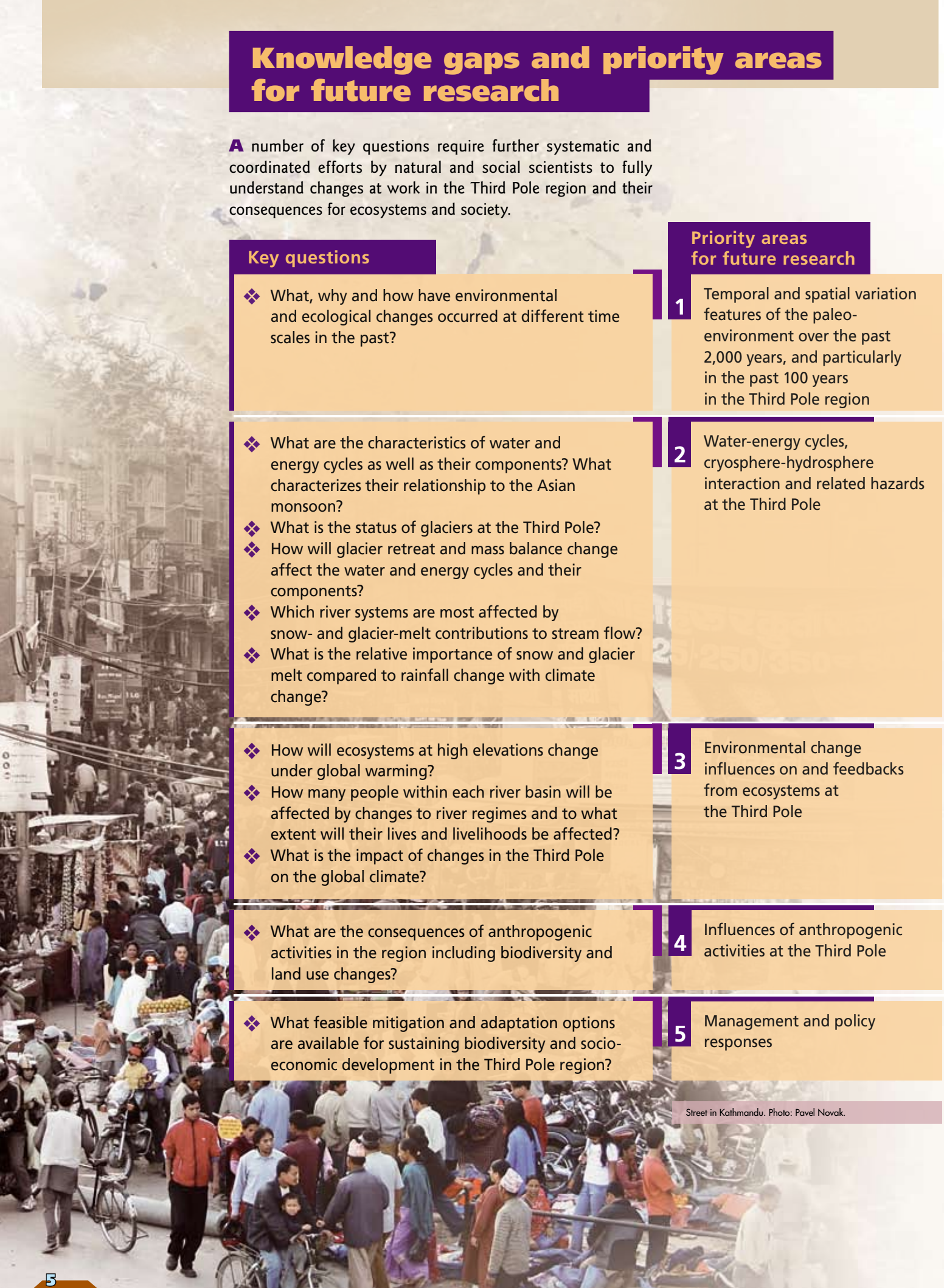
The fluctuation of glaciers has a far-reaching effect not only on the behaviour of glaciers and lakes in the Third Pole but also on water supply and social stability in the wider region.

Increased glacier melt augments flows at the present time, but in the longer term will result in diminished water flow with consequences on pastures, livestock, agriculture and human populations living within river basins. As glaciers retreat, water volume and flow are likely to decline and might become seasonal rather than year-long in the dry regions of the Third Pole. Ensuing water shortages will add to the already existing pressure on water supply with far-reaching impacts on the economy and society.

Knowledge gaps and priority areas for future research

A number of key questions require further systematic and coordinated efforts by natural and social scientists to fully understand changes at work in the Third Pole region and their consequences for ecosystems and society.

Key questions	Priority areas for future research
❖ What, why and how have environmental and ecological changes occurred at different time scales in the past?	1 Temporal and spatial variation features of the paleo-environment over the past 2,000 years, and particularly in the past 100 years in the Third Pole region
❖ What are the characteristics of water and energy cycles as well as their components? What characterizes their relationship to the Asian monsoon? ❖ What is the status of glaciers at the Third Pole? ❖ How will glacier retreat and mass balance change affect the water and energy cycles and their components? ❖ Which river systems are most affected by snow- and glacier-melt contributions to stream flow? ❖ What is the relative importance of snow and glacier melt compared to rainfall change with climate change?	2 Water-energy cycles, cryosphere-hydrosphere interaction and related hazards at the Third Pole
❖ How will ecosystems at high elevations change under global warming? ❖ How many people within each river basin will be affected by changes to river regimes and to what extent will their lives and livelihoods be affected? ❖ What is the impact of changes in the Third Pole on the global climate?	3 Environmental change influences on and feedbacks from ecosystems at the Third Pole
❖ What are the consequences of anthropogenic activities in the region including biodiversity and land use changes?	4 Influences of anthropogenic activities at the Third Pole
❖ What feasible mitigation and adaptation options are available for sustaining biodiversity and socio-economic development in the Third Pole region?	5 Management and policy responses



Street in Kathmandu. Photo: Pavel Novak.

The Third Pole way forward

Policy implications

Environmental changes at the Third Pole have important implications for the high-elevation ecosystems and the heavily populated regions that are subsequently affected. Universal, cohesive and accredited policies that are based on scientific assessment at the regional level need to be developed in order to enable sustainable development in this region. Policies should bring together current and past research to foster the establishment of a platform for future research to inform decisions affecting regional environments, economies and inhabitants.

In order to encourage regional cooperation for policy development through the advancement of relevant knowledge on the environmental changes occurring at the Third Pole, UNESCO, SCOPE and the Chinese Academy of Sciences (CAS) are launching an international scientific programme, entitled the Third Pole Environment (TPE).

The TPE Programme is designed to involve countries in and around the Third Pole region, as well as any other country that wishes to contribute to its mission. It will focus on the development of international, interdisciplinary and integrated studies involving natural and social scientists, as well as experts and practitioners with long-term experience, institutional mandates and functions to assess past, ongoing and future environmental change processes and mechanisms at local, regional and global scales.

The primary objectives of TPE are to:

- Undertake research on changes in ecosystems, glacier mass balances and their impacts on water and energy cycle, livelihoods, hydro-hazards and socio-economic development.
- Establish an integrated TPE environmental science database to support decision making and policy planning concerning the environment and ecological security.
- Strengthen integrative monitoring through existing research stations and establishment of new research stations.
- Develop education, scientific training and capacity building to raise awareness of environmental changes at the Third Pole among decision makers.
- Formulate adaptation strategies and provide options for policy actions in the light of past and present changes at the Third Pole.

As the TPE Programme responds to scientific and policy needs, it will develop as a forum for science-policy dialogue. Its outputs and capacity building initiatives are expected to significantly contribute to regional development planning and elaboration of mitigation, adaptation and management options and strategies.

This policy brief draws on the results of two international workshops on the Third Pole Environment. The first was held in Beijing, China in August 2009 and the second in Kathmandu, Nepal in October 2010. These workshops have formulated proposals regarding the establishment of a long-term research programme dedicated to the Third Pole. The policy brief is also based on a series of consultation meetings between CAS, SCOPE and UNESCO.

Further reading

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Useful TPE links

Third Pole Environment: http://www.tpe.ac.cn/
Chinese Academy of Sciences: http://english.cas.cn/
United Nations Educational, Scientific and Cultural Organization (UNESCO): http://www.unesco.org/water/
Scientific Committee on Problems of the Environment (SCOPE): http://www.icsu-scope.org
United Nations Environment Programme (UNEP): http://www.unep.org

UNESCO TPE focal point

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