How resilient are waterways of Asian Himalayas? finding adaptive measures for future sustainability

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The waterways of the Asian Himalayas have faced critical sustainability challenges during the 21st century. The high-mountain system, the areas of global freshwater source supporting important ecosystem services to more than two billion people, is facing unprecedented rates of climate warming. The impacts include seasonal variations in precipitation, glacier melting and snow avalanches. Climate warming together with urbanization, industrialization, and engineering works for hydropower and irrigation have transformed most natural waterways in the region. These changes have caused tremendous setbacks in water resource development including the natural lake, river, and wetland systems. More drier areas are facing absolute water scarcity with limited access of water for household water supplies, irrigation, hydropower generation, and ecosystem functioning. The areas with adequate quantities of water are not providing clean supplies however left unattended with prolonged eutrophication and pollution. The increased summer snow melts have altered downstream flow regimes causing direct and indirect flood related disasters. Floods have intensified water pollution by mixing nutrients and other chemicals from agriculture, household wastes and industries, releasing into the waterways and causing public health crisis. With the projected future climate warming, the waterways in some areas of high mountain system have already witnessed niche ecological shifts endangering the societal resilience. The relative increase in water demand reflects substantial challenges that the freshwaters will face in future for the maintenance of infrastructure and associated water services. Increased investments in the strategies such as expansion of better infrastructure facilities, new water pricing policies, innovative technology, a part of waterways development program, will further intensify the impacts. The fundamental challenge of waterways of the Asian Himalayas today is therefore how to tackle this hydro-meteorological transformation caused by climate change and anthropogenic perturbation and find avenues for sustainability. Detailed accounts of knowledge on sustainability of waterways in the region is however scant. This requires a framework which can potentially diagnose threats at temporal and spatial scales and provide strong adaptive measures to future sustainability of waterways in the region. Failure to tackle these challenges can have larger consequences in the people’s lives. Provision to economic benefits brought upon by managing the waterways such as by avoiding the crossing critical hydrological and ecological thresholds through various actions such as research and development, technological advancement and adaptive management strategies can ensure resilience. The UN’s 2030 Agenda for Sustainable Development Goals (SDGs) provide a shared blueprint for peace and prosperity for people and the planet, where water resources, energy and food in the high mountain systems have received an urgent call for action through a global partnership. This paper will present the researches focusing on waterways management in the Asian Himalayas addressing some of the key questions such as, how recent climate warming has threatened natural waterways, and how the society have reacted to rapidly changing waterways in the region. Given the key drivers of waterways changes are identified, how the society be configured or adapted to changes by providing effective measures through people’s participation and integration of knowledge.