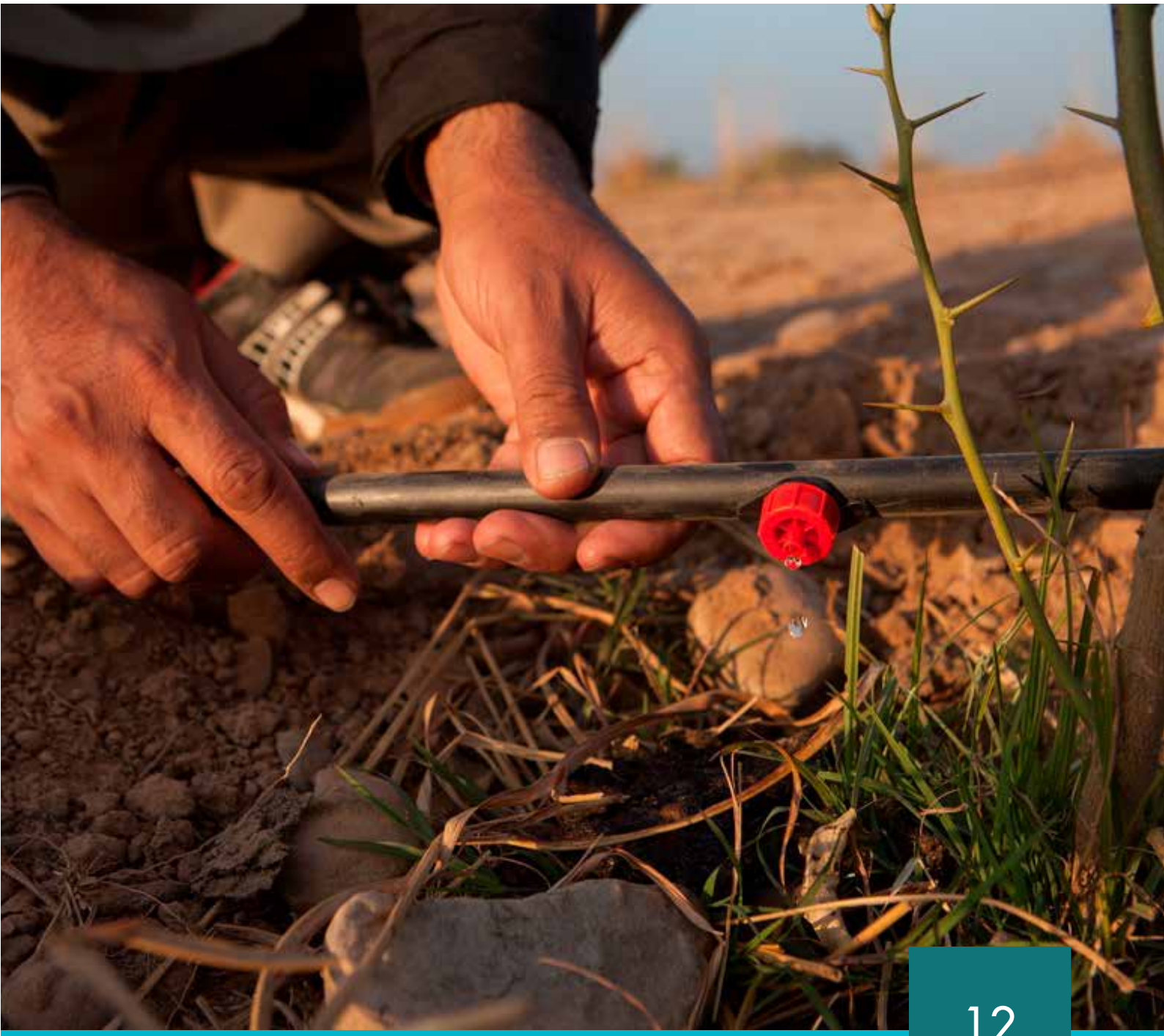
CARIAA
Collaborative Adaptation Research Initiative in Africa and Asia

HI-AWARE



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Climate Smart Water Management Vital for Sustainable Agriculture in South Asia

About HI-AWARE

HI-AWARE aims to enhance the adaptive capacities and climate resilience of the poor and vulnerable women, men, and children living in the mountains and flood plains of the Indus, Ganges, and Brahmaputra river basins. It seeks to do this through the development of robust evidence to inform people-centred and gender-inclusive climate change adaptation policies and practices for improving livelihoods.

The HI-AWARE consortium is led by the International Centre for Integrated Mountain Development (ICIMOD). The other consortium members are the Bangladesh Centre for Advanced Studies (BCAS), The Energy and Resources Institute (TERI), the Climate Change, Alternative Energy, and Water Resources Institute of the Pakistan Agricultural Research Council (CAEWRI-PARC) and Wageningen Environmental Research (Alterra). For more details see www.hi-aware.org.

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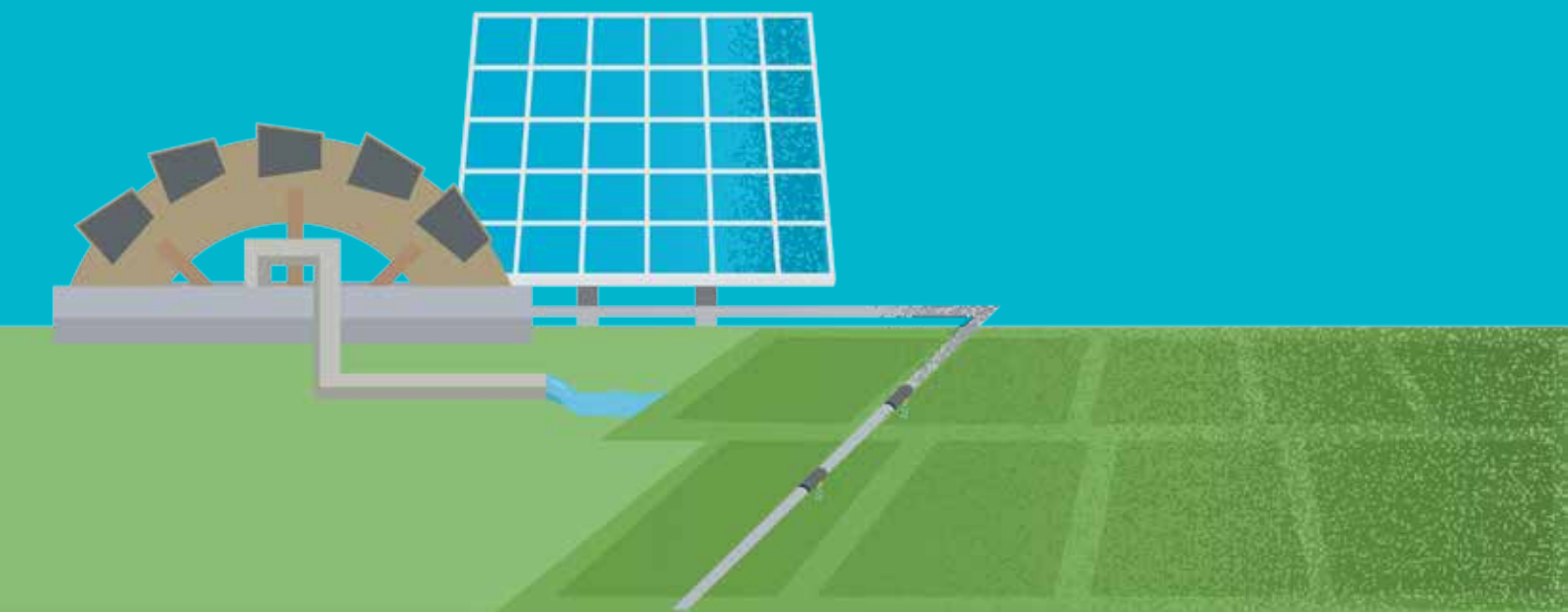
Key Message

Climate smart water management practices are important to cope with increasing climate variability and improve agricultural sustainability in South Asia.

Novel solutions like solar powered irrigation pumps can accelerate the adoption of improved irrigation methods (e.g. drip or sprinkler) and proven water saving practices (e.g. mulching), and crop diversification.

In high- and mid-altitude mountains, re-adoption of traditional crops is vital to cope with water stress induced by rapidly changing patterns of snowfall and glacier melt.



Introduction

In South Asia, more than 60% of the population still lives in rural areas, with a high dependency on agriculture for food security and livelihoods. Climate change has added to the challenges of the agriculture sector in the region. Changes such as shifts in glacier- and snowmelt runoff, erratic precipitation, changes in the break cycles of monsoon, and increased risk of critical temperatures are being experienced more frequently compared to 10 to 20 years ago. Frequent dry spells and prolonged droughts are affecting crop productivity through water shortage and loss of soil nutrients. Expected climate change induced shifts in quantity, timing and composition of upstream water supply, combined with increase in water demands due to socio-economic development, are likely to result in increased gap between demand and sustainable supply of water during the 21st century. There is urgent need to adopt smart practices in agriculture water management in the region to cope with the impacts of climate change and increased demand for water.

HI-AWARE used a multi-level approach (MLA) to study climate change adaptation in different sectors in South Asia, including water and agriculture, and identified climate smart water management options in agriculture. MLA included four levels, i.e. review of published literature on climate change adaptation in water and agriculture sectors, survey of around 2000 households in four river basins, i.e. Indus (Pakistan), Upper Ganga (India), Gandaki (Nepal and India) and Teesta (India and Bangladesh), in-depth case studies to investigate key issues identified in literature and household surveys, and developing viable solutions and piloting them in identified sites in Pakistan.

Farmers perceive climate change impacts on water resources; in our survey, nearly 30% households in river basins reported that climate change has resulted in decreased availability of water for agriculture and livestock in last ten years (2007-2017). However, there was variation (18-40%) in response of households on climate induced decline of water availability across river basins. Compared to downstream areas, a higher proportion

areas reported climate change induced decline in water availability. Case studies revealed that in high altitude mountain areas such as Hunza (Pakistan) and Rasuwa (Nepal), where water for irrigation and domestic use is mostly derived from snowmelt and rainfall, have suffered critically due to changing snowfall patterns. In Hunza, surging of glaciers has led to water scarcities and abandonment of traditional irrigation systems, resulting in a lack of water for agriculture. In the Upper Ganga basin, changing precipitation patterns (overall reduction in number of rainy days) has led to drying up of springs, the main source of water for irrigation and drinking.

Farmers are taking both autonomous and planned actions to adapt to climate change impacts on water resources. In the Upper Ganga basin, several farmers have readopted the traditional millet-pulse cropping system, which requires less water. Similarly in Upper Gandaki (e.g. Gatlang), farmers prefer to cultivate traditional crops, e.g. buckwheat, millets, barley and beans, to adapt to climate change induced water stress. HI-AWARE further explored the effectiveness of different land use options, through advanced computer modelling of water use and farm-level costs and benefits. In the Upper Ganga basin, leaving land fallow to save costs was shown to be a flexible strategy to deal with rainfall variability, especially in the south-western tributaries downstream.

In the midstream areas of the Upper Ganga (e.g. Tehri Garhwal district), solar powered pumps are being used to harness water from springs for irrigating short duration vegetables. In midstream areas of Gandaki, adaptation and coping mechanisms include water conservation methods such as drip irrigation and technologies to retain soil moisture (e.g. mulching), and changing cropping patterns. A case study conducted in midstream areas of Gandaki (Kirtipur village, Nawalparasi district) revealed that farmers adopted planned strategies with the help of public and private actors to improve water availability for agriculture by linking a 730 m long pipe to a newly built irrigation channel. In midstream and downstream areas of the Indus basin, farmers adopted planned strategies including irrigation methods such as drip, sprinkler, and furrow irrigation to improve water use efficiency, particularly in citrus orchards. Compared to conventional irrigation methods, improved methods save 30–50% water in cereal cultivation, 20–35% for fruit, and 70–75% for vegetables. In pockets in the lower Teesta basin in Bangladesh, farmers have started to replace rice with maize, which consumes less water.

HI-AWARE piloted the integration of improved irrigation systems with solar powered irrigation pumps (both portable and fixed) in pilot sites in the midstream areas of Indus (Pothohar region, Pakistan). Solar pumps were particularly designed to use surface water, particularly from nearby perennial streams, water storage and dugwells. This was followed by experimenting with cropping practices, changing from single cropping (wheat) to diverse cropping with cultivation of legumes, greenhouse tunnels for vegetables, fruit orchards including varieties of citrus, fig, guava, lemon, grapes and olives. HI-AWARE has effectively demonstrated that the risk of crop failure in mono-cropping zones can be significantly reduced through integration of solar energy, improved irrigation systems and crop diversification. Use of surface water also minimized additional pressure on ground water resources, which is important for overall sustainability of water resources and agriculture.

Policy Action

In high mountain areas, where the timing and amounts of glacier melt and snowfall are rapidly changing, there is potential to revive the underperforming or abandoned glacier/snow fed irrigation systems. Policy makers need to be aware of these options and support them.

Further downstream, promotion of improved irrigation techniques such as drip, sprinkler, and furrow irrigation methods are key to reduce water losses in irrigation. Solar powered irrigation pumps (designed for surface water) were shown to be a catalyst for uptake of such proven technologies. They reduce negative environmental impacts of existing diesel pumps, reduce operational costs, can stimulate water saving and enhance crop diversification, particularly in rainfed areas.

Introduction of alternate crops which require less water, may also add to the resilience to agriculture systems. Particularly, there is need to promote traditional crops (neglected and underutilized species) which are recently relabeled as 'future smart food' due to their higher resilience to water stress and nutritional benefits. Timely and deliberate decisions to refrain from cropping in years when water resources are extremely limited can help avoid costs.

Modern extension services, keeping track of the latest developments in climate smart water management practices, are highly important in areas with small land holdings, where individual farmers have limited capacity to keep track of the latest technologies. HI-AWARE developed pilot sites in Pakistan as 'learning centers' to showcase technologies and train farmers on climate smart water management practices. Based on success of the pilots, such sites may be developed in similar areas as a strategy for agricultural extension.

This brief is based on the following HI-AWARE publications:

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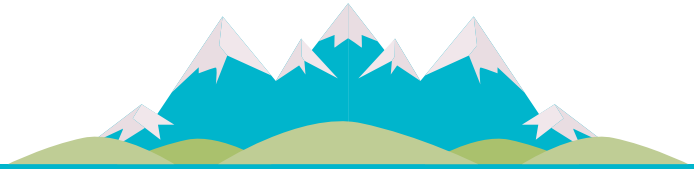

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