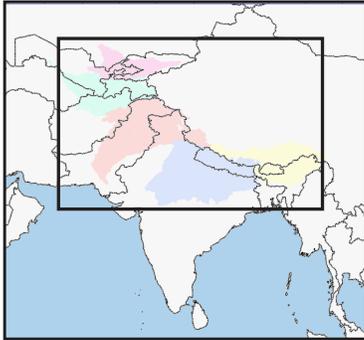


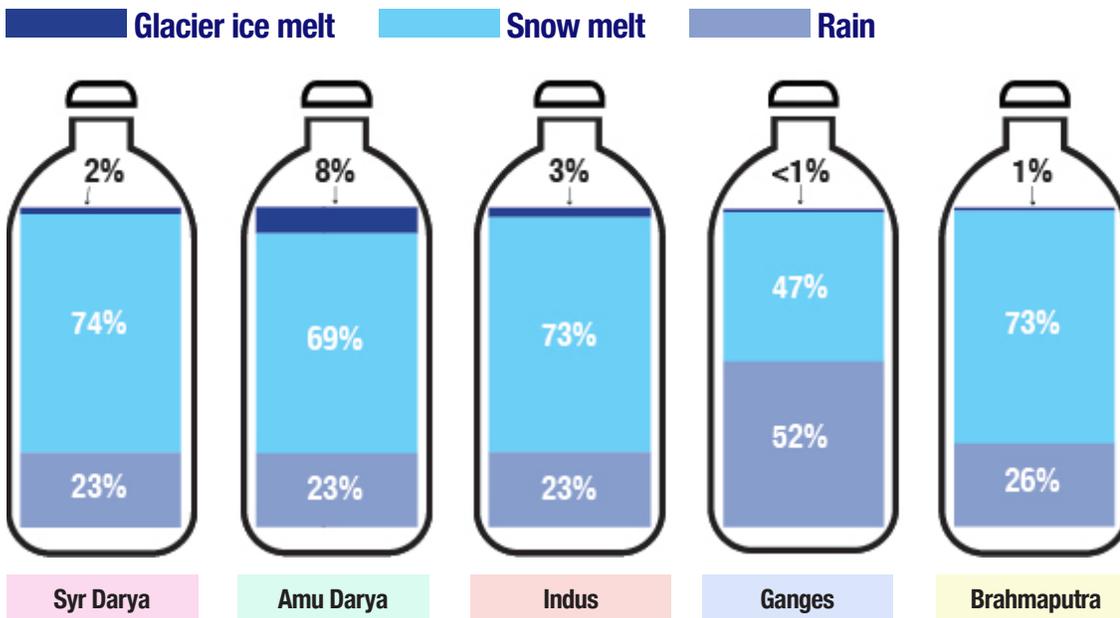
# Impact of High Asian glaciers and snowpack on water resources



A warming world is having a negative impact on the glaciers and snowpack across High Mountain Asia. To predict how future climate conditions will affect glaciers and snow, it is necessary to better understand the current contributions of both glacier and snow melt to downstream water supply. The CHARIS project has accomplished this task.

## WHERE THE WATER COMES FROM, BASIN BY BASIN — ANNUAL AVERAGES

Figures rounded to nearest %



### GLACIERS

contribute little to river flow, and less in the east (Ganges and Brahmaputra) than in the west (Syr Darya, Amu Darya, Indus).

### SNOW MELT

contributions drive river flow in all basins but the Ganges.

### MONSOON RAIN

dominates inputs in the Ganges.

### KEY POINTS: WESTERN BASINS

Water stress is expected to increase due to limited resources, high economic reliance on irrigated agriculture, choice of water-loving crops like cotton and rice, and an absence of regulated upstream-downstream water agreements between neighboring countries.

### KEY POINTS: EASTERN BASINS

The overall volume of water available in the monsoon-dominated Himalaya is an order of magnitude larger than in arid Central Asia. Monsoon rain and snow are annually renewable.



University of Colorado  
Boulder

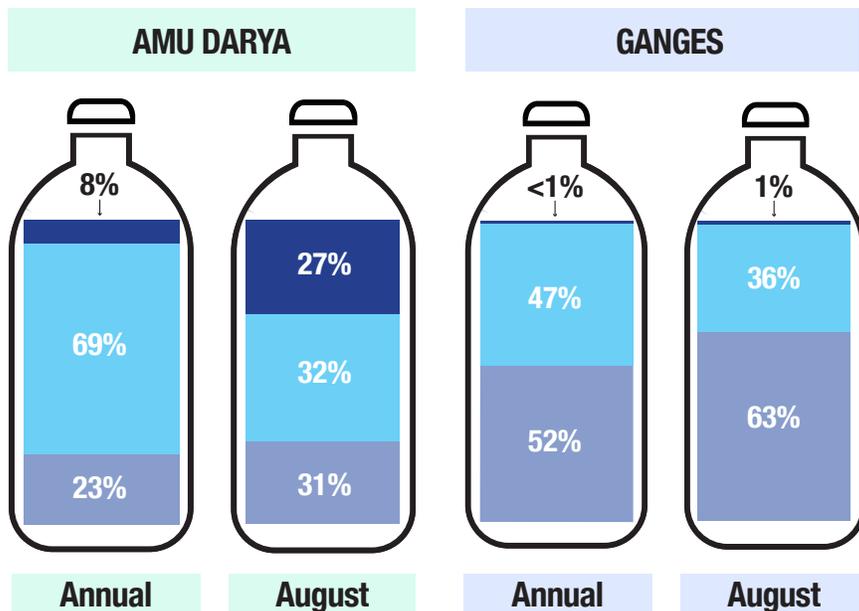
## SEASONAL PATTERNS OF MELTWATER SOURCES

■ **Glacier ice melt**

■ **Snow melt**

■ **Rain**

While annual water supplies may not be highly dependent on glacier melt, late summer river flow can be. For example, in the Amu Darya River, 27% of August river flow is sourced by glacier ice melt. In contrast, Ganges River flow is primarily dependent on snowmelt and rainfall.



## CAPACITY BUILDING

The CHARIS project is a collaboration among 11 Asian research institutions in 8 countries. These partnerships provide a two-fold benefit to regional research capabilities through capacity building and data sharing, including:

- An extensive network of **field studies and monitoring sites** across High Mountain Asia (see map below)
- Six annual **training workshops** (237 attendees, including 29 women)
- **Funding for students** in Kathmandu University's M.S. in Glaciology program (7 graduates) and single semester glaciology coursework for others
- **Training courses** in Asia, including field data collection, water chemistry analysis, reanalysis data downscaling, remote sensing for glacier mapping, digital elevation model evaluation and application, and snow/ice melt modeling

## PARTNERS

CHARIS partner institutions are in:

Bhutan	Afghanistan
Nepal	Kyrgyzstan
India	Tajikistan
Pakistan	Kazakhstan

For more information, see [www.nsidc.org/charis](http://www.nsidc.org/charis).

Find the full CHARIS project results at this doi:  
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