RESEARCH PROGRAM ON Water, Land and Ecosystems

Led by IWMI International Water Management Institute

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A novel subsurface solution to controlling floodwater impacts & improving livelihoods in the developing world

A focus area within the CGIAR Research Program on Water, Land & Ecosystems

THE CHALLENGE

Flooding is a common occurrence across the developing (and developed) world that incurs large social and economic costs. As a result of these events, large volumes of water in excess of environmental requirements flow out to sea that cannot be economically captured with conventional engineering approaches.

In some cases this can be followed soon after by seasonal or prolonged drought.
With climatic variability becoming increasingly apparent in many regions of the world, solutions to the problem of floods and droughts are being sought that are innovative, but at the same time, of a 'no' or 'low' regrets nature.

Water surpluses and deficits are highly inter-linked problems, and when seeking to find an optimal solution various trade-offs emerge among sectors and consumers that must be given due attention.

In the last five decades or so, during which time integrated water resources management (IWRM) has emerged, we have not yet fully reconciled how it can be completely applied from the perspective of mitigating extreme events whilst maximizing water security and water productivity at the river basin level.

In most, if not all river basins, the interconnectivity between upstream and downstream parts of the basin, urban and rural water demand, surface and groundwater resources, and current and future sectorial uses make this extremely challenging.

Solutions to flooding issues can, if chosen wisely, yield significant benefits for drought protection, agricultural production and the functioning of ecosystems.

OBJECTIVES

To implement and test a novel approach to capturing and recharging 'excess' wet season flows in upstream areas via distributed small-scale structures to protect urban infrastructure downstream and enable local productive use of the stored floodwater to enhance water security and improve livelihoods during the dry season .To our knowledge, there are no such cases where this has been undertaken at scale, and hence we have given this idea the term 'Underground Taming of Floods (UTF)

SOLUTIONS: THE APPROACH

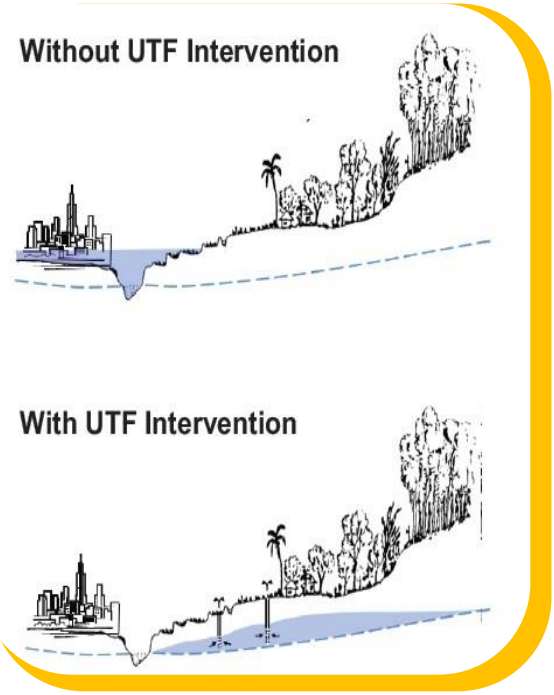
The research would first involve mapping the extent and magnitude of the opportunities to utilize UTF and the surface and subsurface characteristics that most favor its implementation. This would be carried out for the major hydrological basins in Africa and Asia.

Demonstration sites at the watershed or sub-basin scale would be established within one or more of those prospective basins to evaluate the technical performance of UTF in terms of the mitigation of flood risks, enhanced groundwater storage and new irrigation potential created.

In parallel, we would quantify the investments needed to upscale UTF to the basin scale and the costs and benefits associated with the impacts that arise from those investments.

Improved models, technical guidelines and institutional and governance arrangements that will ensure the economic viability and sustainable use of surface water resources and groundwater resources would then be developed.

One critical question is how to devise effective benefit sharing mechanisms that facilitate the effective and sustained collaboration between farmers (individually or collectively) in upstream rural areas together with flood management authorities in downstream areas.



CASE STUDY

Currently, we have analyzed UTF potential for the Chao Phraya River Basin in Thailand*. It has been estimated that, on average, 28% of the wet season discharges to the sea (3370 MCM) could be harvested without significantly impacting existing large-medium storages or the gulf and deltaic ecosystems.

Results from pilot recharge trials reveal that this water could be readily recharged and accommodated within the vast shallow alluvial aquifers situated within, and upstream of the flood prone areas. Capturing peak flows takes place in all but the dry years and requires dedicating around 200 km^2 of land to groundwater recharge within the basin. This would reduce the magnitude of flooding and generate USD 140M/year to boost livelihoods for thousands of farming households.

There is enormous application potential which would contribute to making significant inroads into the billions of dollars of losses caused by droughts and floods each year, if the UTF approach can be technically and economically verified, particularly given the major investments needed in the most vulnerable cities exposed to coastal flooding in Asia and other parts of the developing world.

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