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## Cost-Effective Options of Climate Change Adaptation for Sustainable Agro-Ecosystem Enhancement in the Aral Sea Basin

MAKSUD BEKCHANOV

*University of Bonn, Center for Development Research (ZEF), Germany*

### Abstract

Growing water scarcity driven by climate change and consequent ecological degradation problems challenges researchers and policy makers for finding more effective yet affordable ways of water management. Especially in arid regions with heavy reliance on irrigated agriculture, such as the Aral Sea basin of Central Asia, water scarcity is an enormous threat for income and environmental security. Despite availability of a wide arsenal of tools to combat water scarcity their investment costs often prevent their wider implementation by water users and managers. This study assessed the water conservation potential and implementation costs of various water augmentation options in the Aral Sea Basin where unaccountable use of scarce water resources led to gradual depletion of one of the largest lakes in the world. For economic appraisal of potential technological improvements in irrigation sector, this research used a basinwide hydro-economic model that comprises a detailed water balance accounts across the sub-regions within the basin and relationships between water use and crop production. Modelling outcomes underlined the economic relevance of improving water distribution (conveyance) efficiency through canal lining and effective operational management in the lower reaches of the Amu Darya basin. Improved efficiency of water application in rice production was found out essential under growing water scarcity conditions, especially in the lower reaches of both Amu and Syr Darya basins. Meantime improved water application efficiency of gardens and orchards became recommendable in the upstream mountainous zones in Fergana Valley of the Syr Darya. The study argues that cooperation among state agencies (water management and coordination institutes, Finance Ministry, banks) and agricultural producers (private and cooperative farms) could be essential for the success of these economically relevant technological transformations.

**Keywords:** Amu and Syr Darya, environmental degradation, Fergana Valley, water application efficiency, water conservation