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A parsimonious hydroeconomic modeling approach for data scarce dryland areas with application to western India

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A parsimonious hydroeconomic model for a data scarce dryland area is presented. It features a basin level decentralized water allocation mechanism which is adapted to incorporate sustainable water use and to deal with the externalities from upstream-downstream linkages. We formulate the profit maximization problem of various agents in a basin, each identifying a subbasin, who operate within the boundaries of a spatially explicit model that describes the dominant hydrological processes. We address issues of non-convexities and non-steady state conditions and elicit the dependence of a decentralized water allocation on geophysical properties of the basin. In particular, the approach describes how the competition between the drying and drainage functions of subbasins in dryland areas manifests itself in the optimal valuation of water. The application to an area of over 500,000 km2 and 34 subbasins in western India indicates that intra-basin (between constituting subbasins) cooperation could be beneficial; valuation of interbasin flows as a percentage of respective subbasin income is on an average around 30% when each subbasin includes downstream valuation as well.