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Hydrol. Earth Syst. Sci., 13, 1091-1101, 2009
www.hydrol-earth-syst-sci.net/13/1091/2009/

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Agricultural-to-hydropower water transfers: sharing water and benefits in hydropower-irrigation systems

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Abstract. This paper presents a methodology to assess agricultural-to-hydropower water transfers in water resources systems where irrigation crop production and hydropower generation are the main economic activities. In many countries, water for crop irrigation is often considered as a static asset: irrigation water is usually allocated by a system of limited annual rights to use a prescribed volume of water, which remains to a large extent independent of the availability of water in the basin. The opportunity cost (forgone benefits) of this static management approach may be important in river basins where large irrigation areas are present in the upstream reaches. Continuously adjusting allocation decisions based on the hydrologic status of the system will lead to the temporary reallocation of some (or all) of the irrigation water downstream to consumptive and/or non-consumptive users. Such a dynamic allocation process will increase the social benefits if the sum of the downstream productivities exceeds those of the upstream farmers whose entitlements are curtailed. However, this process will be socially acceptable if upstream farmers are compensated for increasing the availability of water downstream. This paper also presents a methodology to derive the individual contribution of downstream non-consumptive users, i.e. hydropower plants, to the financial compensation of upstream farmers. This dynamic management approach is illustrated with a cascade of multipurpose reservoirs in the Euphrates river basin. The analysis of simulation results reveals that, on average, the annual benefits obtained with the dynamic allocation process are 6% higher than those derived from a static allocation.

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Citation: Tilmant, A., Goor, Q., and Pinte, D.: Agricultural-to-hydropower water transfers: sharing water and benefits in hydropower-irrigation systems, Hydrol. Earth Syst. Sci., 13, 1091-1101, 2009. [Bibtex](#) [EndNote](#) [Reference Manager](#)



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