

Gains from trans-boundary water quality management in linked catchment and coastal socio-ecological systems: a case study for the Minho region

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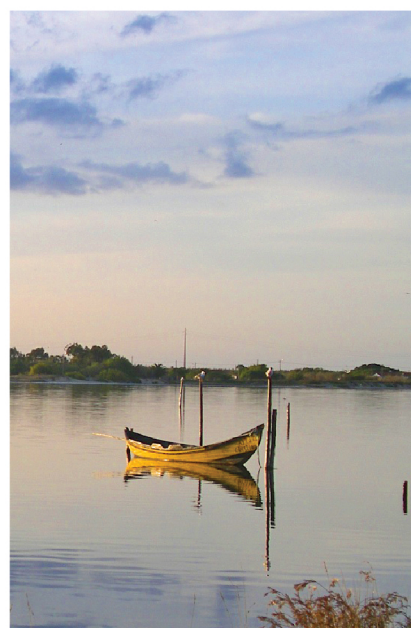
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Sustainable economic development requires balancing of marginal costs from catchment water pollution abatement and associated marginal benefits from freshwater/coastal ecosystem appreciation. Hence we need to differentiate between intra- and trans-boundary catchments because benefactors and beneficiaries from water quality improvement are not one and the same. In trans-boundary catchments, private (national) welfare maximizing rates of water quality improvement differ across nations as benefits from water quality improvement generally accrue to one nation while the costs are paid by multiple nations. In this paper we develop a deterministic optimal control approach to explore private and social welfare maximizing rates of water pollution abatement in linked catchment and freshwater/coastal socio-ecological systems. For a case study of the Minho region (Iberian Peninsula), we estimate nation-specific water pollution abatement cost functions (based on management practice adoption) to determine and compare private (national) and social (trans-national) welfare maximizing rates of water pollution abatement. Results show that some private (national) welfare gains can be obtained through adoption of win-win practices, leading to a 12% reduction in the annual rate of water pollution and a 7% increase in annual regional income. Maximum social (international) welfare gains can, however, be obtained through adoption of win-win and lose-win practices across Spain and Portugal, leading to a 36% reduction in water pollution and a 14% increase in regional income. Non-cooperation in water pollution abatement would only lead to a 16%-32% reduction in water pollution and a 8%-13% increase in regional income. Hence, social (trans-national) welfare losses from non-cooperation between Spain and Portugal would equate to between 16 and 81 m€/yr.

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