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On Conjunctive Management of Groundwater and Rainwater

Abstract

We consider groundwater managed by a sole owner and where a perfect substitute, rainwater harvesting, is physically connected with the primary water source. This generates a marginal opportunity cost of using rainwater, since harvested water does not infiltrate. We first discuss the conditions that lead to a switch toward rainwater harvesting, then look at long term rainwater harvesting systems. Due to limited storage capacity, long-term use of rainwater is only possible in conjunction with groundwater. We show that this only arises if the price of water is higher than the full marginal cost of rainwater harvesting. We also provide comparative statics related to this configuration, especially concerning the long-term water table. These results are finally illustrated by numerical examples.

Key words: groundwater management, rainwater harvesting, optimal control, conjunctive use

JEL: Q15, Q25, C61, D61

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