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Effects of socioeconomic development on land use and irrigation requirements

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The SCENES project is funded by EC 6th Research Framework Programme and addresses the complex questions about the future of Europe's freshwater resources up to 2050. For this purpose, the Story-and-Simulation approach was applied and four comprehensive scenarios were generated in a participatory stakeholder process. The resulting scenarios, covering all of "Greater" Europe including all Mediterranean rim countries, provide a reference point for long-term strategic planning of European water resource development. They furthermore help to alert policymakers and stakeholders about emerging problems, and allow river basin managers to test regional and local water plans against uncertainties and surprises.

Besides the qualitative description of the scenarios in form of storylines and the quantitative information of socio-economic developments, the quantification of environmental impacts with simulation models forms an essential part of the different scenarios. Socio-economic factors such as population growth and economic development affect food and feed production and as a result the extent and intensity of agricultural activities. These agricultural activities have a strong impact on freshwater resources, especially in terms of water resources spent for irrigation. Hence, knowledge on the possible development of irrigated area and the resulting irrigation water requirements is of high importance for the development of scenarios of freshwater futures.

In SCENES, a modelling framework was set up to calculate future changes in irrigation water requirements. The spatially explicit land-use change model LandSHIFT (Land Simulation to Harmonize and Integrate Freshwater availability and the Terrestrial environment) was applied to quantify the development of irrigated area. LandSHIFT calculates alterations in the location and extent of land-use activities such as rainfed and irrigated crop cultivation and livestock grazing at a grid resolution of 5 arc minutes. Driving variables, specified on country-level, include time series of crop production, human population, livestock numbers and technological progress. In order to analyze and quantify the effects of changes in irrigated area on hydrological conditions, LandSHIFT was soft-coupled with the WaterGAP model (Water - a Global Assessment and Prognosis). WaterGAP employs, amongst others, the LandSHIFT simulation results to generate information on the impact of land use and land-use changes on hydrology and irrigation water requirements.

In this paper, we present a short overview of the SCENES scenarios, of the workflow of the modelling framework for the quantification of irrigation water requirements and the simulation results for the four SCENES scenarios. Additionally, the possibilities and limitations of this modelling approach are discussed.