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Impact of climate change on water needs and nitrogen cycling in European agricultural areas

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The European Common Agricultural Policy reform by decoupling subsidies from production levels and linking them to the protection of the environment is promoting a cleaner agriculture and a more sustainable use of resources in Europe. Agricultural subsidies are now linked to application of statutory minimum requirements and cross compliance. Modelling tools to help managers decide appropriate strategies in reducing the impact of agriculture on soil and water resources are needed. These models must be responsive to management practices, and should be flexible enough to allow the evaluation of the environmental and the crop production response to various forcing functions including policy, farmer personnel initiatives such as the implementation of best management practices, but also to uncontrollable factors such as climate change.

To this purpose, the Joint Research Centre of the European Commission developed a versatile tool allowing the assessment of the fate of agrochemicals at continental level using available and derived data linked to the EPIC model. For the baseline, the model was validated across Europe by comparing predicted and reported crop yield for the major crops. The model was then run to evaluate the potential impact of climate change on nutrient cycling. Eighteen high-resolution climate change scenarios coming from the combination of five Global Climate Models (GCMs) and four emission scenarios were linked to the EPIC model. The model outputs analysed include water stress, nitrogen crop requirements, crop uptake, mineralisation from soil organic matter, nitrate leaching and denitrification. Clear regional patterns emerged with Nordic

countries being more favourable to crop growth with the combination of higher precipitation and milder temperatures leading to higher mineralisation from the soil and lower application of nitrogen fertilisers. It is further shown that in these areas the nitrogen use efficiency will increase and will be higher than in southern countries. Gaseous losses of nitrogen will also be significantly affected by climate change throughout Europe. It is predicted that nitrate leaching will decrease in Europe.