May Land Use Change Reduce the Water Deficiency Problem Caused by Reduced Brown Coal Mining in the State of Brandenburg?

AGREC

Objectives

Surface mining alters the water regime not only locally, but also regionally. The reduced brown coal mining in the south-east of the state Brandenburg (Germany) leads to decreasing river discharge and consequently to a shortage in the water supply. Land use change is one possible option to counteract this development. In this simulation study, we explored the impact of temporary and permanent set-aside of arable land on Brandenburgís regional water balance.

Material and Methods

Temporary and permanent set-aside were considered as major measures towards deintensification of agriculture. Three basic rotation schemes for poor, intermediate and good soil were applied to the whole cropland area of the original land use map in order to represent the reference scenario A for land use on arable crop land (Fig.:1)

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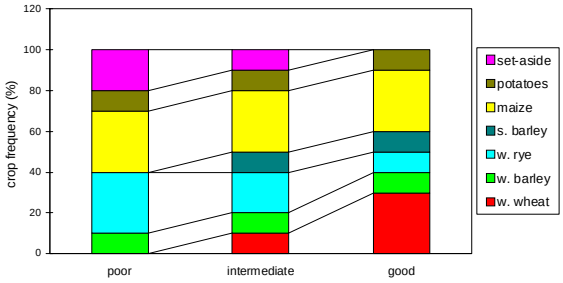

Fig. 1: Basic crop rotation schemes for the three Brandenburg soil groups poor (sandy soils), intermediate (sandy-loamy soils) and good (loamy)

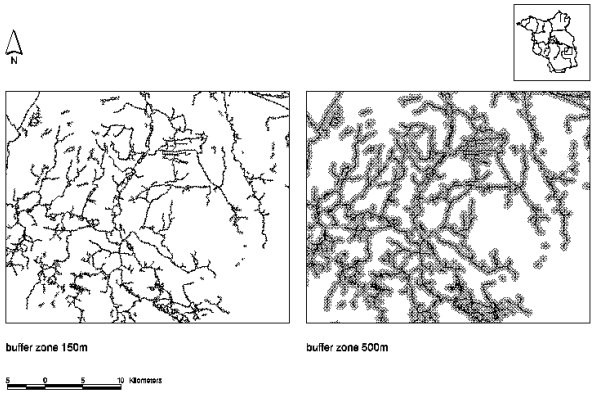

Fig. 2: River corridors of 150 and 500m width applied for a river network in Brandenburg

Land use change scenarios were created based on either

- modification of the basic rotation scheme by increasing the portion of temporary set-aside, and/or
- modification of the original land use map by introducing river corridors (Fig. 2) and converting cropland inside the river corridors to meadows.

Simulations were performed using the regional ecohydrological model SWIM, which integrates hydrological processes, vegetation growth, erosion and nutrient dynamics. The model was used to simulate the consequences of different land use change scenarios on main components of the regional water balance.

Results

Changes in the use of arable land altered significantly its water balance. The impact of these changes on the regional water balance for Brandenburg did not exceed ±10% for its single components. Opposite tendencies were established in the simulations by contrasting effects of temporary and permanent set-aside of arable cropland. While temporary set-aside increased runoff from the whole area up to 6.7% due to lower evapotranspiration and higher soil moisture in arable land, the conversion of agricultural land within river corridors to meadows had an opposite effect on regional runoff (6.9% decrease) due to higher water retention coefficients and higher evapotranspiration losses. Therefore, only temporary set-aside may compensate to some extent for the anticipated decrease in river discharge.

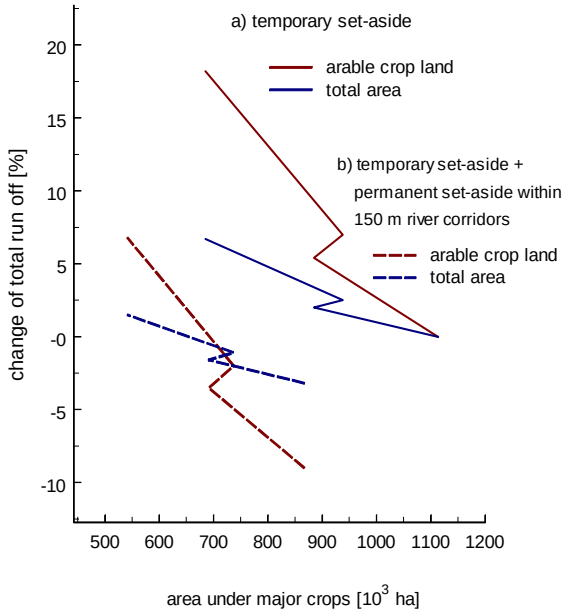

Fig. 3: Relative change in run off for Brandenburg with a) increasing of temporary set aside and b) combined increase of temporary and permanent set aside within river corridors

F. Wechsung, V. Krysanova, Michael Flechsig & Sibyll Schaphoff

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POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH • P.O. BOX 601203 • 14412 POTSDAM
Phone: (0331) 288 2500 • Fax: (0331) 288 2600 • Email: pik@pik-potsdam.de • Web: www.pik-potsdam.de