IMPACT OF LANDUSE CHANGES ON WATER DYNAMICS IN TEMPERATED MESO- AND MACROSCALE RIVER BASINS

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The study illustrates a methodology for impact studies of land use changes on the water balance in macroscale river basins. Problems of impact studies in large river basins result from (i) huge heterogeneity inside, (ii) the relative rough input data base, (iii) the differences between river basin boundaries and administrative units, and (iiii) difficulties to assume realistic landuse change scenarios for the whole area. Simple approaches are needed to set up possible landuse changes on the basis of easily available spatial data. The investigations are carried out for the river basins of the Saale (24.000 km²) and the Havel (19.000 km²), two main tributaries of the Elbe river. Taking the European trend of both reducing agricultural areas and increasing urbanisation into account, the following scenarios are postulated, spatially disaggregated on the basis of digital soil, land use, and elevation information:

1) reduction of arable areas by conversion of former arable areas with relatively poor soils (soil number ≤ 40) or a slope greater then 4 % into pasture,
2) like 1), but conversion of these areas into mixed forest,
3) backtransformation of drained valley floors into natural wetlands,
4) increase of the sealed portion for urban areas by 50 % (without changing the urban area portion),
5) like 4), but with increase of the urban area portion by 10 %.

Based on the analysis of the present hydrological conditions for the periode 1981-94 (reference scenario), impact studies for these 5 land use scenarios were carried out using the distributed hydrological model ARC/EGMO. The resulting changes in evapotranspiration, groundwater recharge, land suface runoff, and discharge were analysed. According to the spatial heterogeneity and the different annual weather conditions in the river basins under study, substantial spatial and temporal variability was found in response to the scenarios for all observed variables. Significant impacts could be observed for scenarios 2 and 3 especially for the Havel river basin. Both scenarios lead to an increase in evapotranspiration coupled with a decrease in ground water recharge and a reduction of smaller flood peaks. The impact on extrem flood peaks is much smaller.