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Effects of potential land use changes in transboundary river basins in the Central Eastern European Member States

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1. Introduction: European Integration and transboundary issues

After successfully growing to 25 members this year and first steps towards political cohesion, the European Union is now also asked to strengthen the environmental policy of the new member states (<http://europa.eu.int/comm/enlargement/arguments/index.htm>). As one of major challenges for an integrative European environmental development the integrated management of water resources in order to secure a sufficient availability of clean water has to be seen. Thus, methodical designs are necessary which refer to the complexity of the river basins to be managed and the difficulty to predict the factors or driving forces influencing them. Generally, water management must become more responsive to processes of land use change. Besides that, large European river basins are extending oftentimes over the national boundaries of several countries with different political status (Haase and Volk 2002). An efficient trans-national land use related water resources and river basin management according to the requirements of the EU Water Framework Directive and flood risk management (http://www.munichre.com/default_e.asp) therefore needs (i) a sound prognosis and reliable indicators for potential land use (distribution) changes based on different scenarios for transboundary river basins, (ii) a harmonisation of the existing databases and monitoring programmes to assess the environmental situation in relation to occurring land use changes and, finally, (iii) an analysis of the specific and nationally different competencies of the relevant environmental and planning authorities and institutions. These issues become especially obvious regarding the new member states of the EU and their Eastern neighbours (e.g. Ukraine, Belarus, Romania, Bulgaria), where a transboundary investigation of the environmental situation and deficits of spatial planning are of particular importance for Europe as well as a methodical and political challenge (Haase and Volk 2002, Mysiak et al. 2004).

2. Land use related impacts on water resources

In comparison to the Western and Central parts of the EU the new member states share partly different land use pattern with a high percentage of arable land and forested area. Whereas in Western Europe a proportion of arable land of about 30% goes along with a high degree of (sub-)urbanisation (>80-95%) within the Central Eastern and Eastern member states we find relatively large areas of arable and forest land (Table 1). Due to conventional farming and cultivation practices the high proportion of arable land use leads to considerable nutrient and pesticide inputs into surface and groundwater (Table 2). (Post-)socialist industrial complexes in the neighbourhood of urban areas as well as mining activities are the reasons for an enormous pollution (heavy metals, organic pollutants) of large transboundary river basins. Shortness of water often occurs, too. As another severe problem regular flood events in the plains resulting enormous financial losses of >10 Millions of Euro have to be considered. Increasing demands on land utilisation (settlements, trade) within the floodplains are the main reason therefore. An adequate example is the Tisza catchment. It is part of the Ukraine, Romania and Hungary, partial densely populated with high share of industry, trade, urban settlements, which mostly not dispose of adequate (waste) water treatment facilities. The major ecological problem of Tisza catchment in the Ukraine is the enormous industrial and communal pollution, the agricultural drainage as well as the large volume of waste water input.

Table 1: Land use pattern throughout Europe (in %)

| Country | arable land ¹ | forested area ² | urbanisation degree ³ |
|----------------|--------------------------|----------------------------|----------------------------------|
| France | 33.3 | 27.9 | 78.4 |
| Germany | 33.9 | 30.7 | 89.9 |
| Netherlands | 26.5 | 11.1 | 91.1 |
| United Kingdom | 26.4 | 11.6 | 90.8 |
| Poland | 45.8 | 29.7 | 66.5 |
| Estonia | 26.5 | 48.7 | 71.3 |
| Hungary | 52.2 | 19.9 | 69.4 |
| Czech Republic | 40.0 | 34.1 | 76.4 |
| European Union | 30.95 | 29.12 | 78.26 |

¹ CIA World Factbook 2003, ² estimated by FAO, ³ UN 2002. World Urbanization Prospects: The 2001 Revision.

Crossing the national borderline, there are two main issues of environmental interest in Hungary: the annually occurring floods and the serious water contamination coming from Romania and the Ukraine. The most serious issue was the cyanide (accident) pollution from Romania in February, 2000, which exterminated most of the higher animals in the river. The significant fluctuation of the water quantity is caused by deforestation in the Ukraine and Romania and deficient flood protection as well as water control works. Therefore new water management techniques and practices have to be developed. Such an initiative is the Vásárhelyi Plan which is based mainly upon temporary water stores created along the river sides. Besides natural hazards threatening this area, the Upper Tisza Region belongs to the economically declining parts of Hungary with high unemployment rates and serious social problems. Therefore, it is in the focus of both regional politics and the public.

Table 2: Eastern European transboundary river basins and land use related impacts on the environment

| Catchment | Size (km ²) | Countries | Environmental situation and impacts |
|-------------------|-------------------------|-----------------------------------|--|
| Western Bug River | 73,500 | Ukraine, Belarus, Poland | coal mining and chemical industry, water scarceness, extreme pollution of surface and groundwater, related illness of children |
| Dnister River | 72,100 | Poland, Ukraine, Moldova | hydro-technical engineering, extreme water use, timber purchasing, industry/transport in the floodplains, erosion processes, extreme floods events, destruction of settlements, communication networks, surface and ground water pollution |
| Morava River | 21,145 | Czech Republic, Austria, Slovakia | rural settlement, metallurgical and chemical plants, quality of drinking water, flood problems |
| Tisza River | 157,000 | Hungary, Ukraine, Romania | poor water quality due to heavy metal pollution, hazard accident 2000, regular floods |

3. Challenges for research and issues of presentation

As one of the spatial relevant consequences of the new EU membership of the former Candidate States in 2004 and as response of global socio-economic trends fundamental land use changes will occur. Moreover, European guidelines and framework directives enforce spatial planning in order to reduce land consumption, to improve the water quality, to maintain floodplains and to reduce point source as well as diffuse pollution related to the agrarian land use. The following scenarios will be relevant for the future land use shaping in the EU: the going-on of the status quo (industrial growth, intensification), the increase of organic farming (extensive development), the stagnation of urban sprawl due to a shrinking population and an extensive afforestation. In the lecture special attention will be paid to the evaluation of potential land use changes and related environmental processes in transboundary river basins in Central Eastern Europe. The methodical approach presented here is among others issue of an Integrated Project NEWATER).

4. Literature

- Haase, D. & M. Volk (2002): Transborder river basin management on the basis of the EU-Water-Framework-Directive, Expression of Interest. <http://www.cordis.lu/fp6/>.
- Mysiak, J., M. Rosenberg, U. Hirt, D. Haase, D. Petry, K. Frotscher (2004): Uncertainty in spatial data transformation for the implementation of the water framework directive, proceedings of the 10th EC-GI & GIS Workshop Warsaw 2004 (CD version)