II. Application of MONERIS within the Danube river basin

II.1 Characterization of catchment area

The Danube River Basin is a large sized river basin of more then 800000 km² that covers several countries in Central and South Eastern Europe (Map II.1). This chapter shortly presents the relevant input data for the application of MONERIS (see I.3.3). It follows the overall structure there.

II.1.1 Spatial input data

Large-scale national **river networks** of some countries[1] were merged with mid- to small-scale "Corine Land Cover" (in 2000 by EEA 2004) and "Digital Chart of the World" (ESRI 1993) datasets to elaborate a harmonized river network for the whole basin. Overlapping parts were removed and polygon segments were preferred to lines thus retaining area information. Although being projected uniformly, deviations were common and had to be manually considered for length and area statistics. In addition, a 3'' SRTM digital **elevation** model (USGS 2007) was used for elevation (Map II.2) and slope classification (Map II.3).

Based on this network, the basin was further sub-divided according to elevation, administrative areas and hydrological districts in close cooperation with national partners. The results had to be verified and aligned along the countries' boundaries. More than 900 **analytical units** (AU) could thus be separated. (Map II.4 and Chapter I.4.1.1.1)

Land cover classes were obtained by merging the "Corine Land Cover" (EEA 2004) and "Pan-European Land Use and Land Cover Monitoring" (PELCOM 2004) databases. The original classification was adapted to the MONERIS landuse classes (Map II.5, see also chapter I 5.2 and table I 5.7). Arable land was attached to slope classes.

The European **Soil Database** version 2 (EUROPEAN SOIL BUREAU NETWORK & THE EUROPEAN COMMISSION 2004) was suitable for discriminating soil properties. It already consisted of layers for several physico-chemical properties (see Map II.6 as an example). Furthermore, soil loss was estimated using slope, Corine Land Cover classes and agricultural statistics (Map II.7, see chapter I 4.2.2.4).

[1] Germany, Austria, Hungary, Serbia, Bulgaria, Romania, Slovenia, Slovakia and Switzerland

REGIONALE ZUSAMMENARBEIT DER DONAULÄNDER (1986) provided an **hydrogeological map** that was used to discriminate rock types according to consolidation and groundwater level (Map II.8).

Monthly means for several decades of **precipitation** were calculated by interpolating[2] global (GPCC 2002) and some national station data[3]. The results were aggregated to annual, summer and winter means. Map II.9 shows the long-term annual mean. Long-term **runoff** was based upon "Mean Annual Runoff in the Danube Basin" map (REGIONALE ZUSAMMENARBEIT DER DONAULÄNDER 1986, Map II.10).

Long-term **atmospheric deposition** rates of nitrogen oxides and ammonium were taken from the CO-OPERATIVE PROGRAMME FOR MONITORING AND EVALUATION OF THE LONG-RANGE TRANSMISSION OF AIR POLLUTANTS IN EUROPE (2002). Total nitrogen deposition was defined as the sum of both input data (Map II.11).

Spatial data on **municipality** (GFK MACON GMBH 1999) and city population (HELDERS 2006) was used to calculate population density and to distinguish between urban and rural population (Map II.12).

II.1.2 Data for calculating point source emissions

Point source emission data was taken from the INVENTORY OF INTERNATIONAL COMMISSION OF PROTECTION OF THE DANUBE RIVER (ICPDR 2000). As an example, the location of water treatment plants is shown in Map II.13.

II.1.3 Monitoring data for surface water

Monitoring station data from the TRANSNATIONAL MONITORING NETWORK (TNMN 2006) and national data from most countries were combined to build monitoring database (Map II.14). This database described water temperature and discharge as well as chemical parameters on water quality although the number of measured parameters and the temporal coverage differed very much.

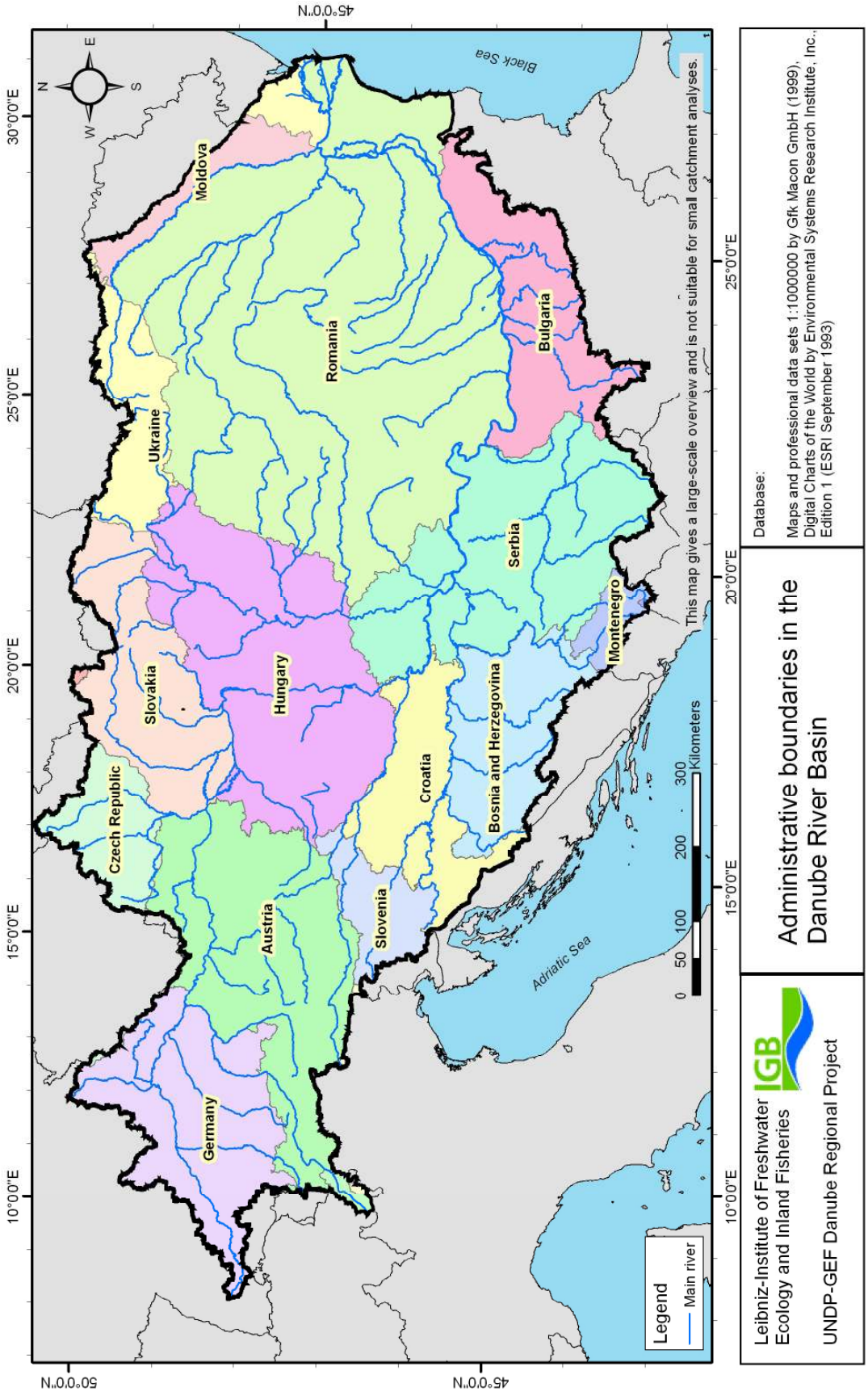
[2] using Inverse Distance Weighted (IDW) interpolator as implemented in the software ArcView 3.2 (ESRI 1999), parameters: neighbors = 8, power = 1

[3] Slovakia, Slovenia, Romania, Poland, Hungary, Germany and Austria

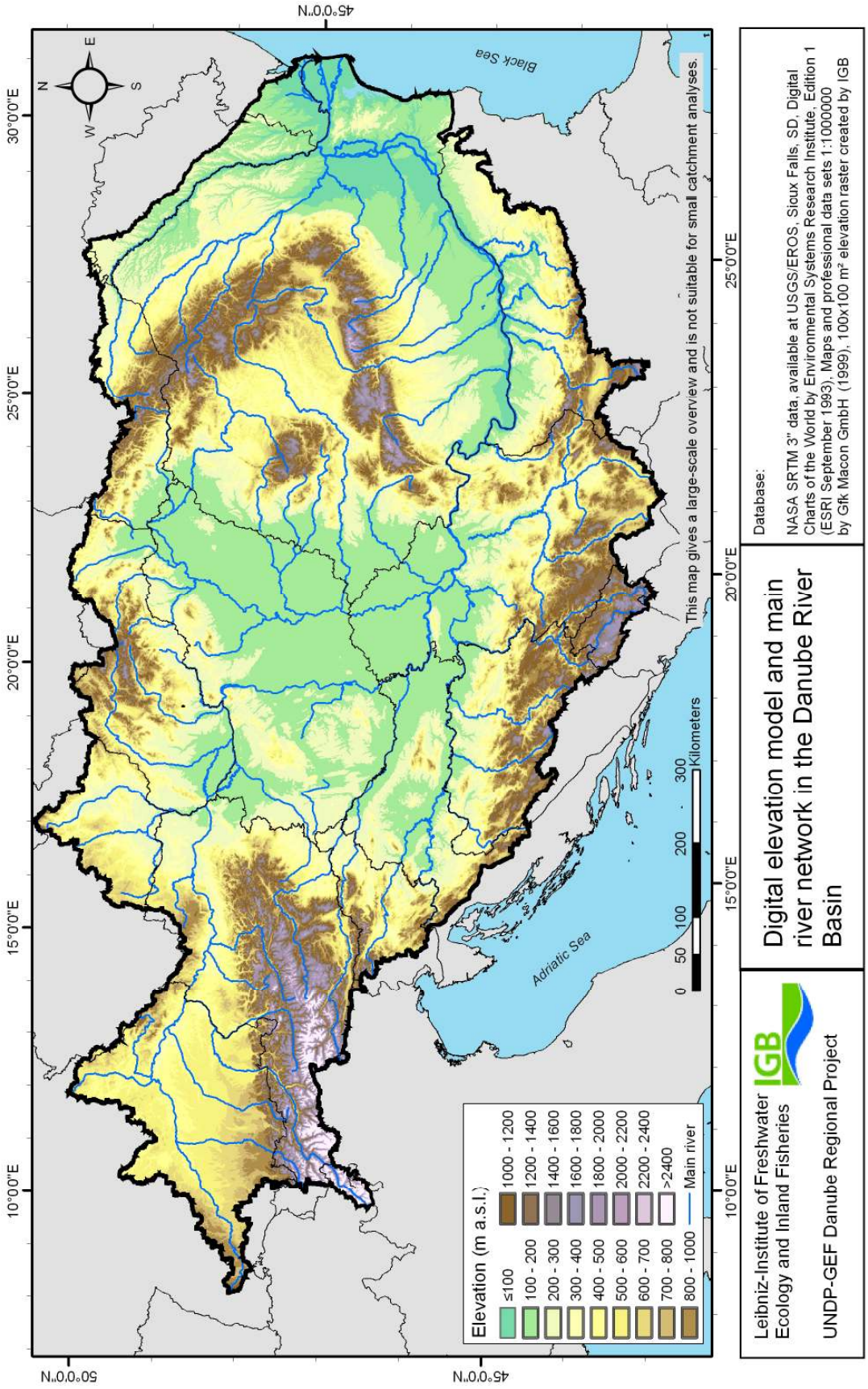
II.1.4 Administrative and agricultural data

FAOSTAT (FAO 2007) and national data was used for statistics of agriculture and land use over several decades. Pre-existing values for the former Soviet Union, Czechoslovakia and Yugoslavia had to be assigned to their succeeding countries by multiplying with the fraction in the first year of independence of the respective countries. Land use fractions were finally used to adjust the C factor of the soil loss equation.

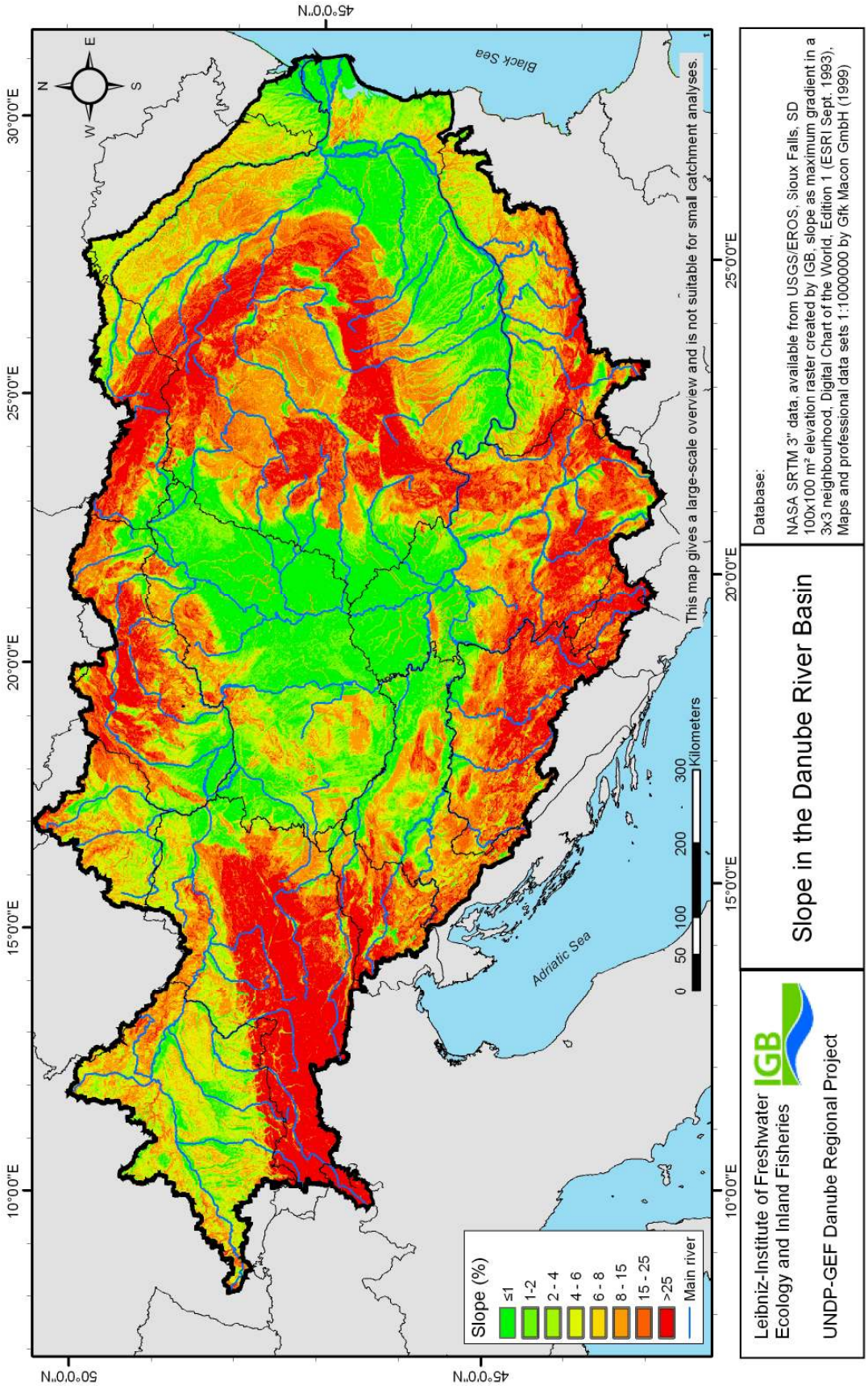
II.1.5 Maps



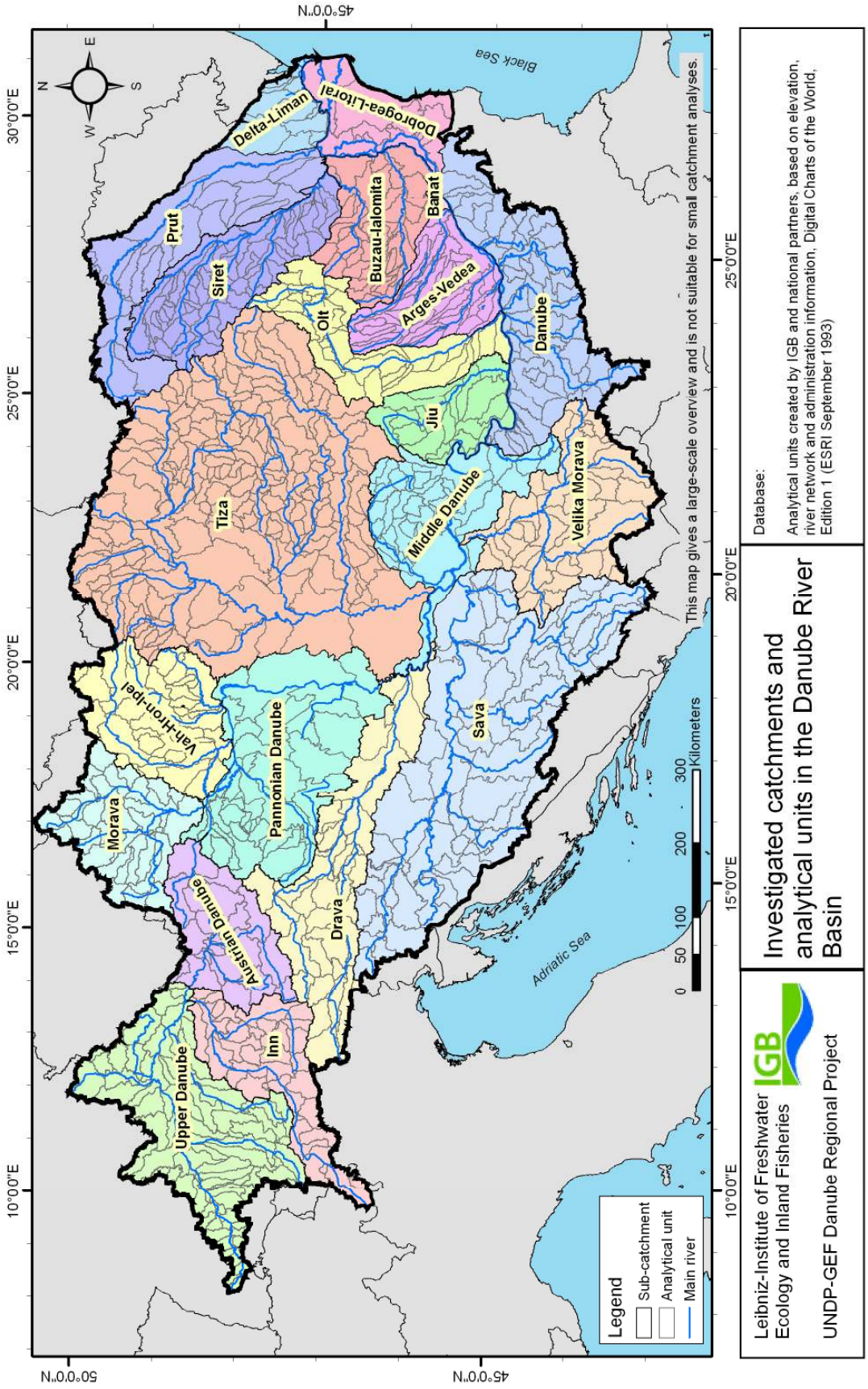
Map II.1: Administrative boundaries in the Danube River Basin



Map II.2: Elevation and main river network in the Danube River Basin

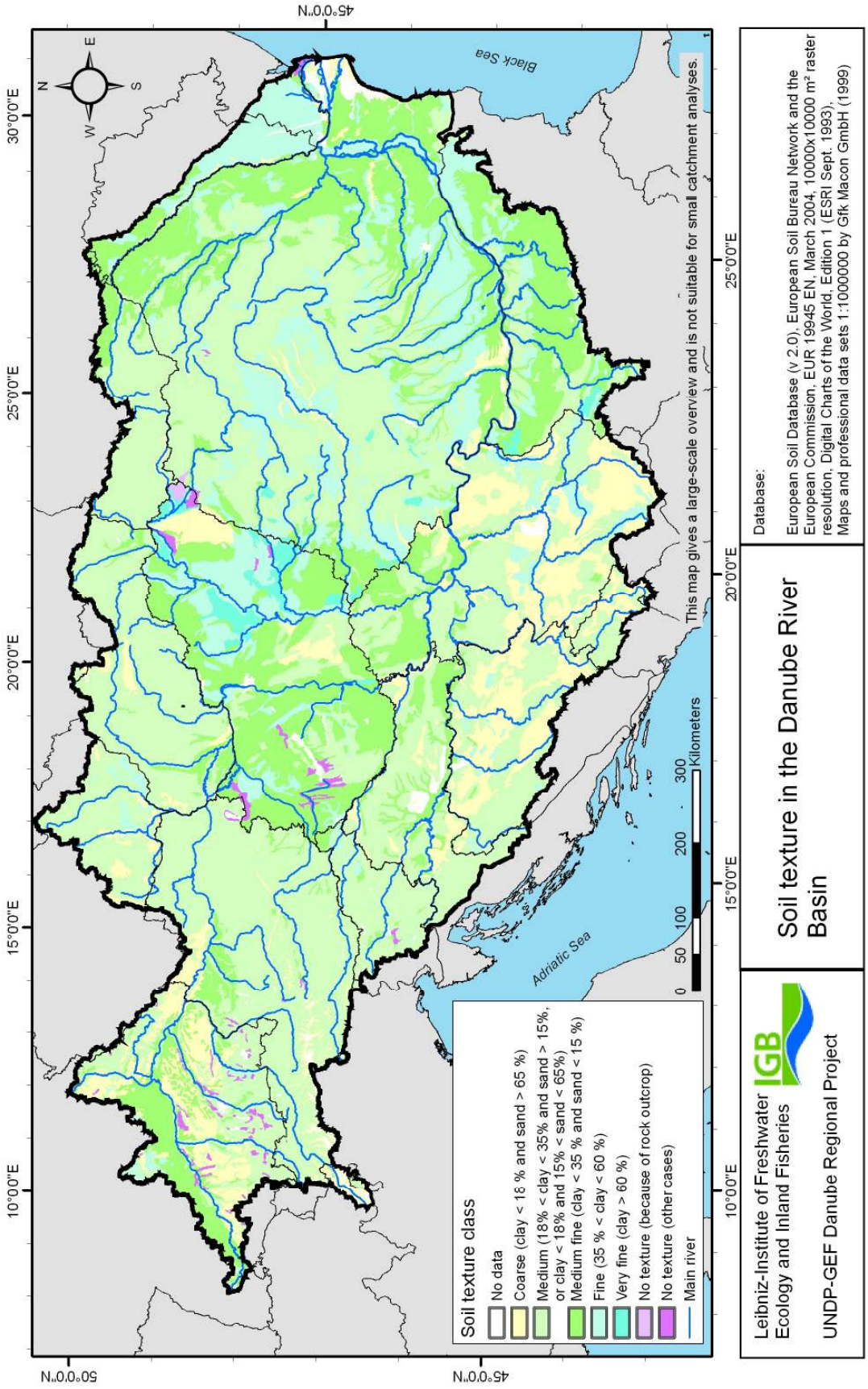


Map II.3: Slope in the Danube River Basin

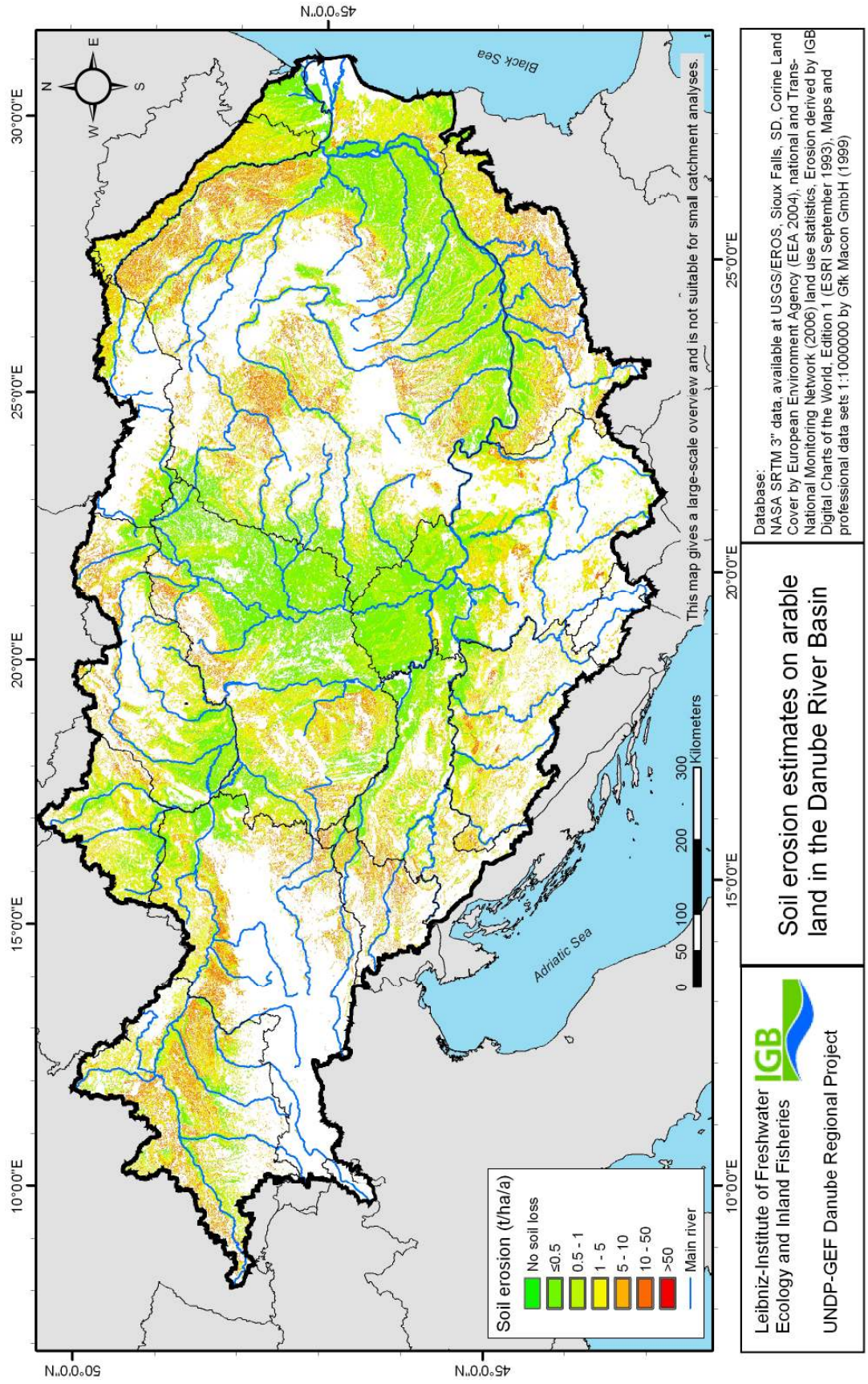


Map II.4: Catchments and analytical units in the Danube River Basin

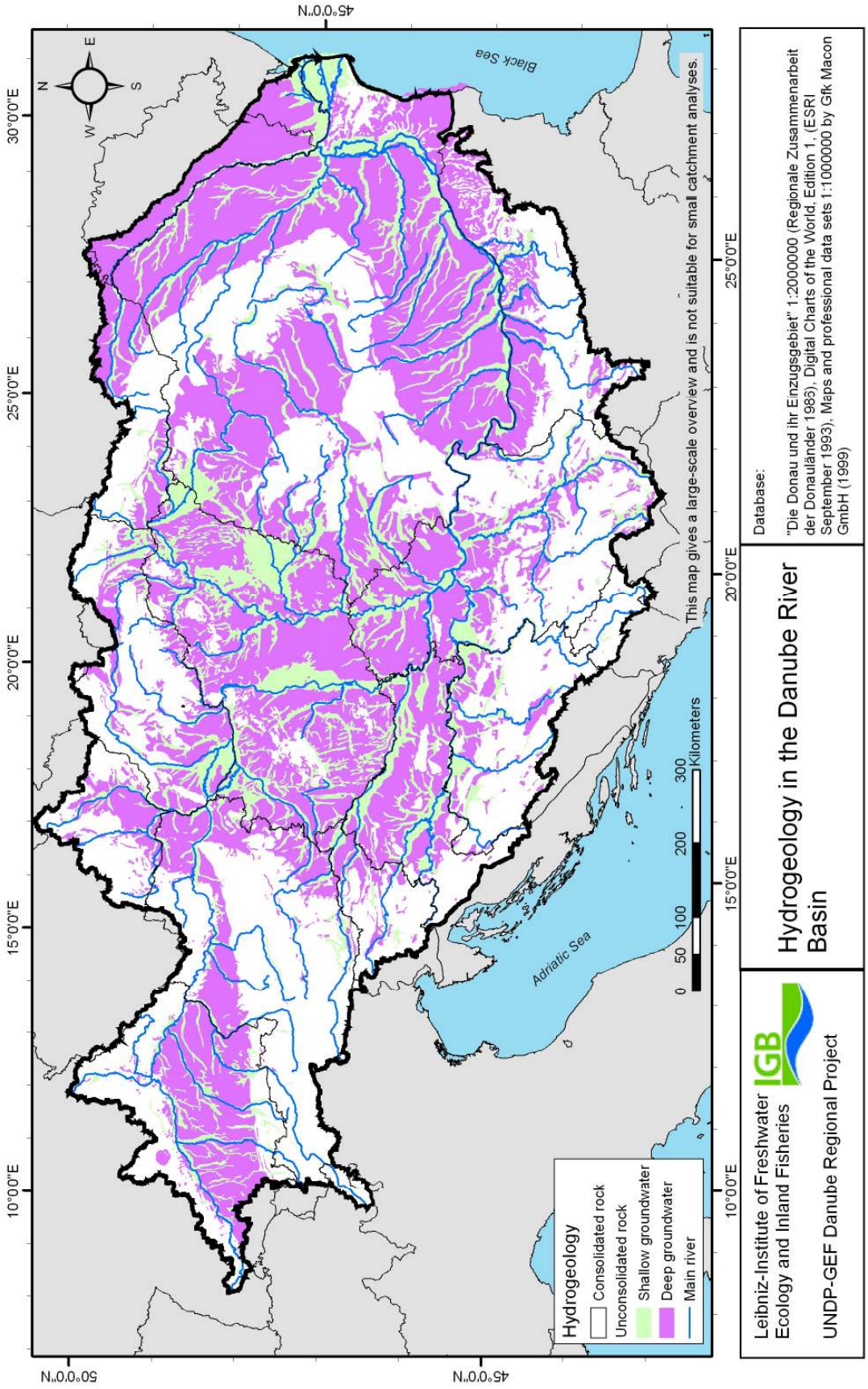
Map II.5: Land cover in 2000 within the Danube River Basin



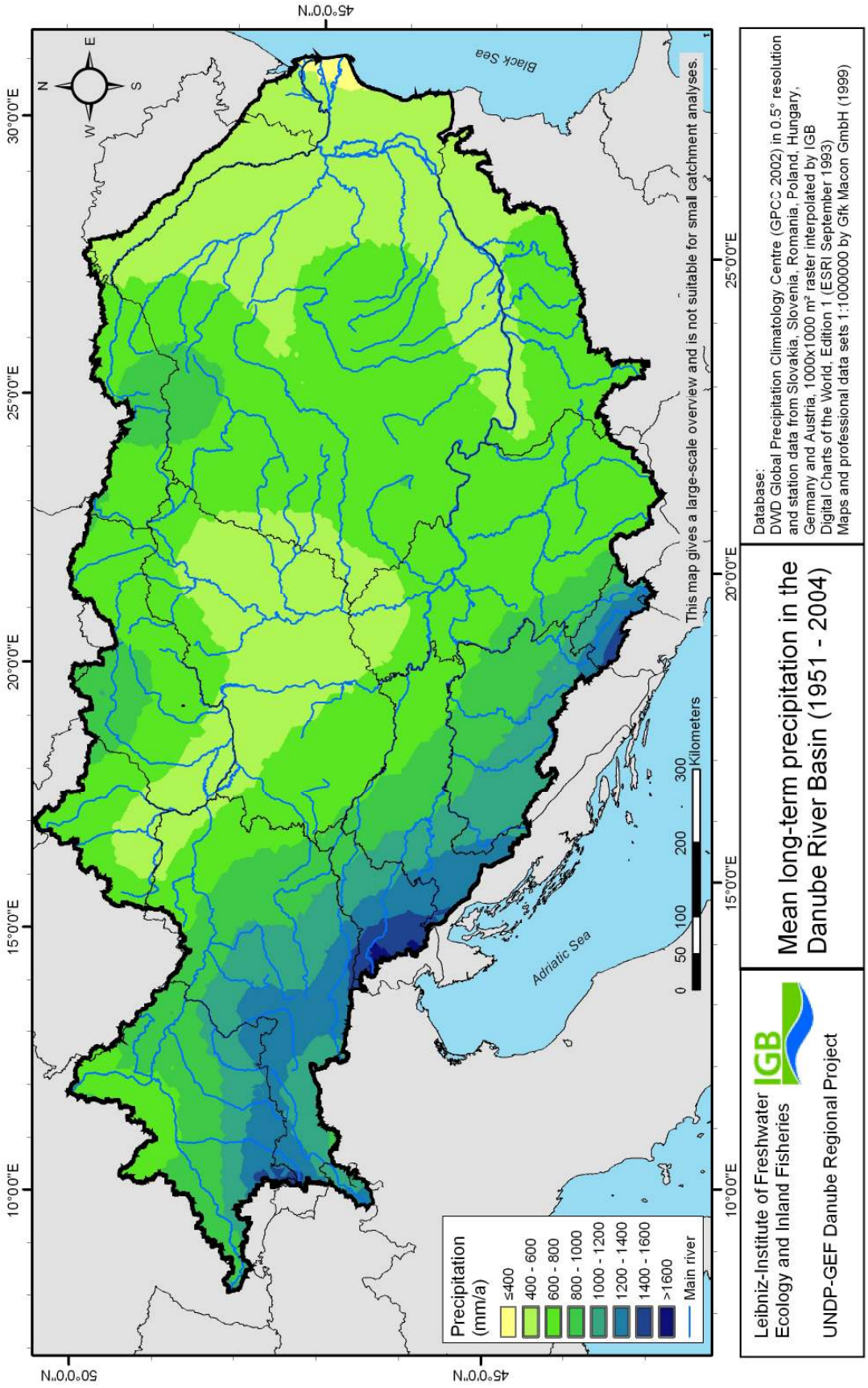
Map II.6: Soil texture in the Danube River Basin



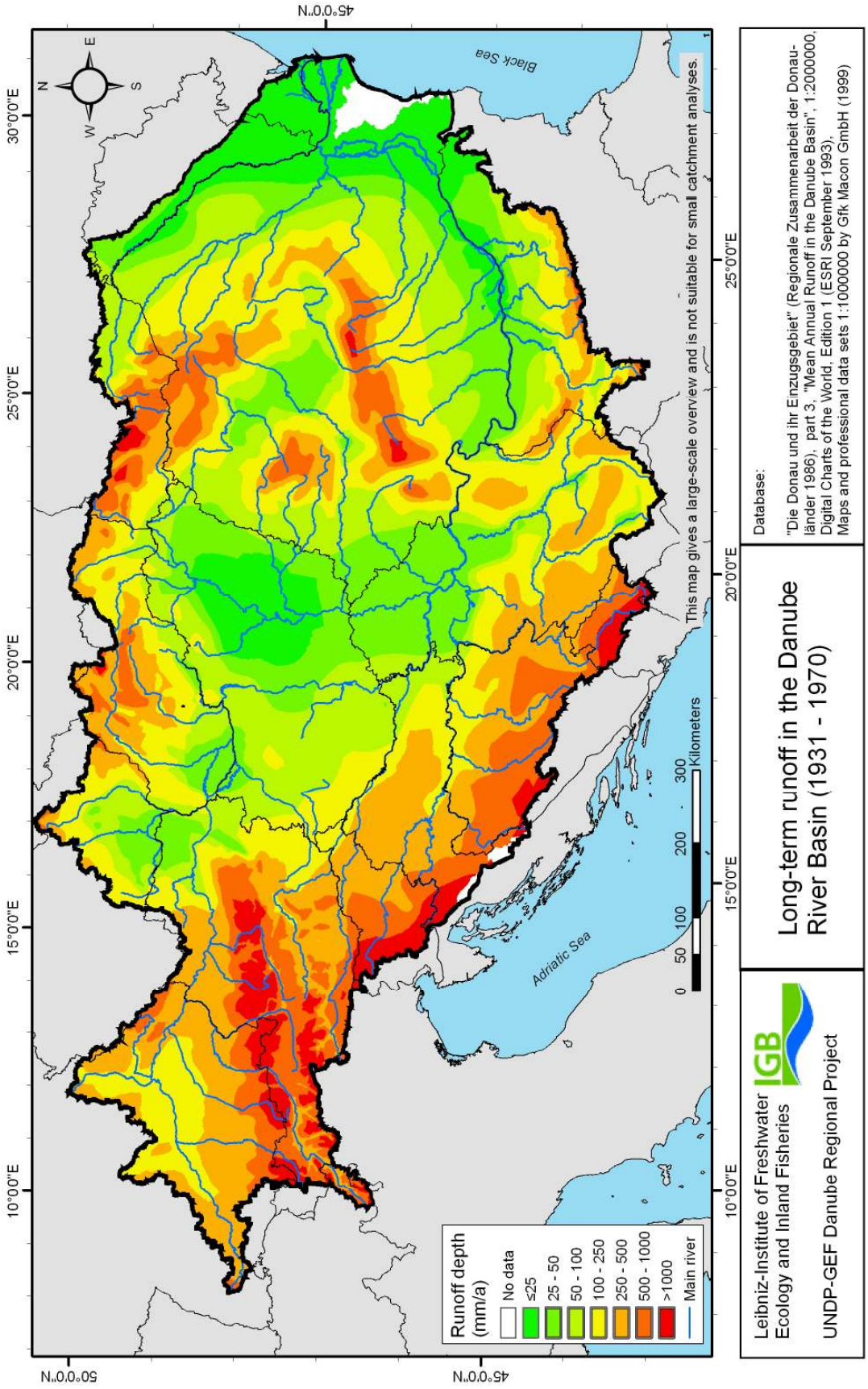
Map II.7: Soil erosion estimates on arable land in the Danube River Basin



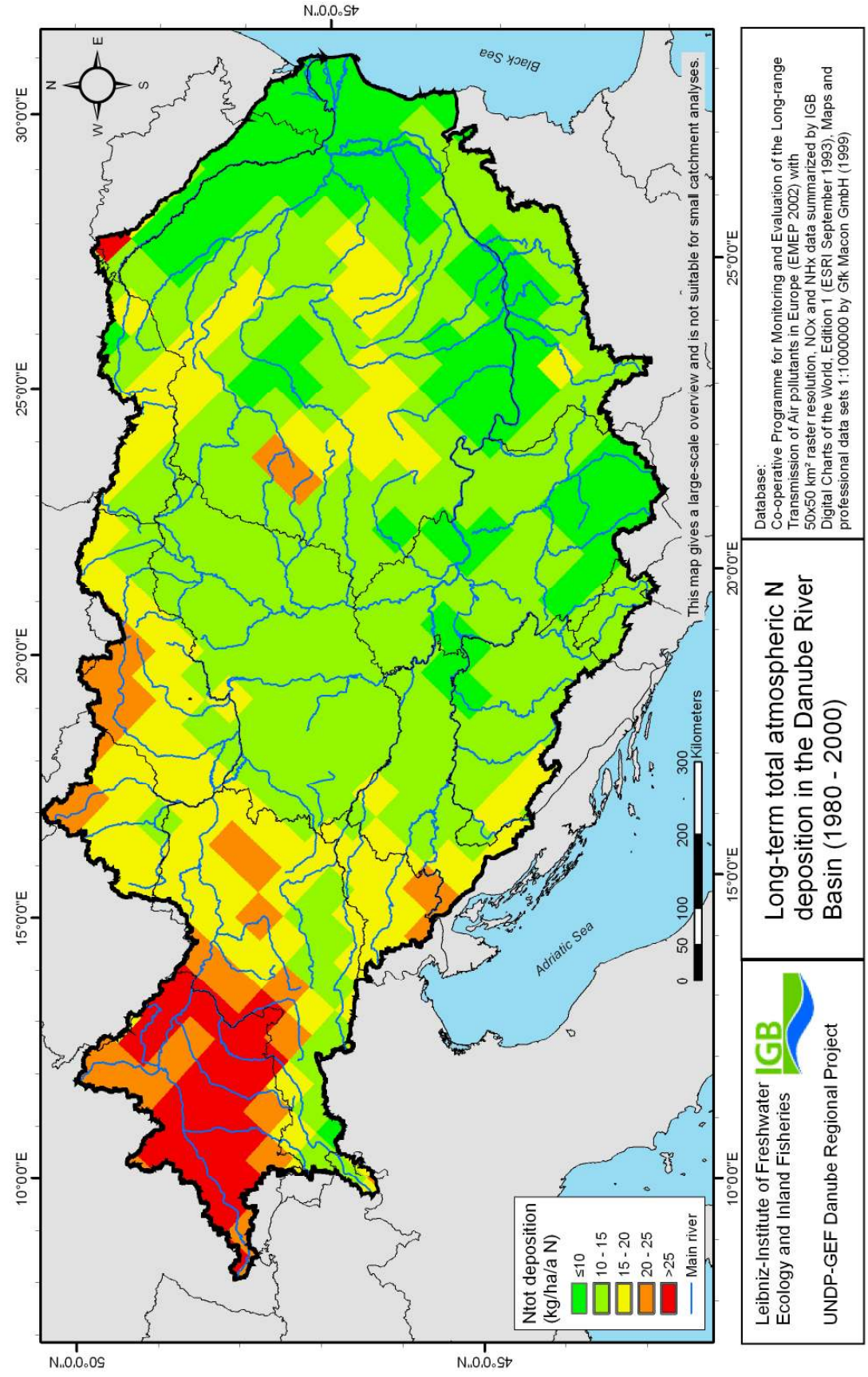
Map II.8: Hydrogeology in the Danube River Basin



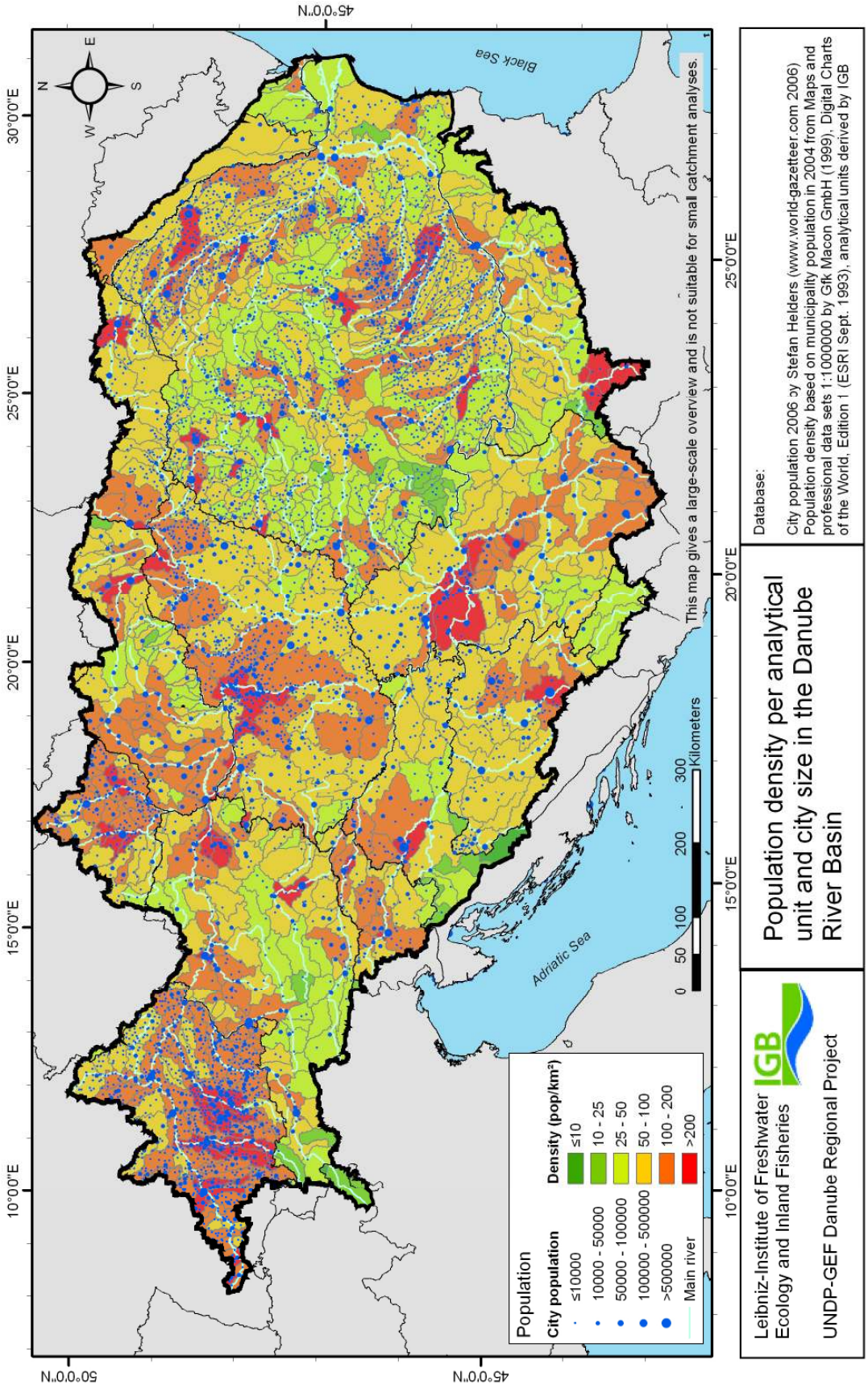
Map II.9: Long-term precipitation in the Danube River Basin (1951-2004)



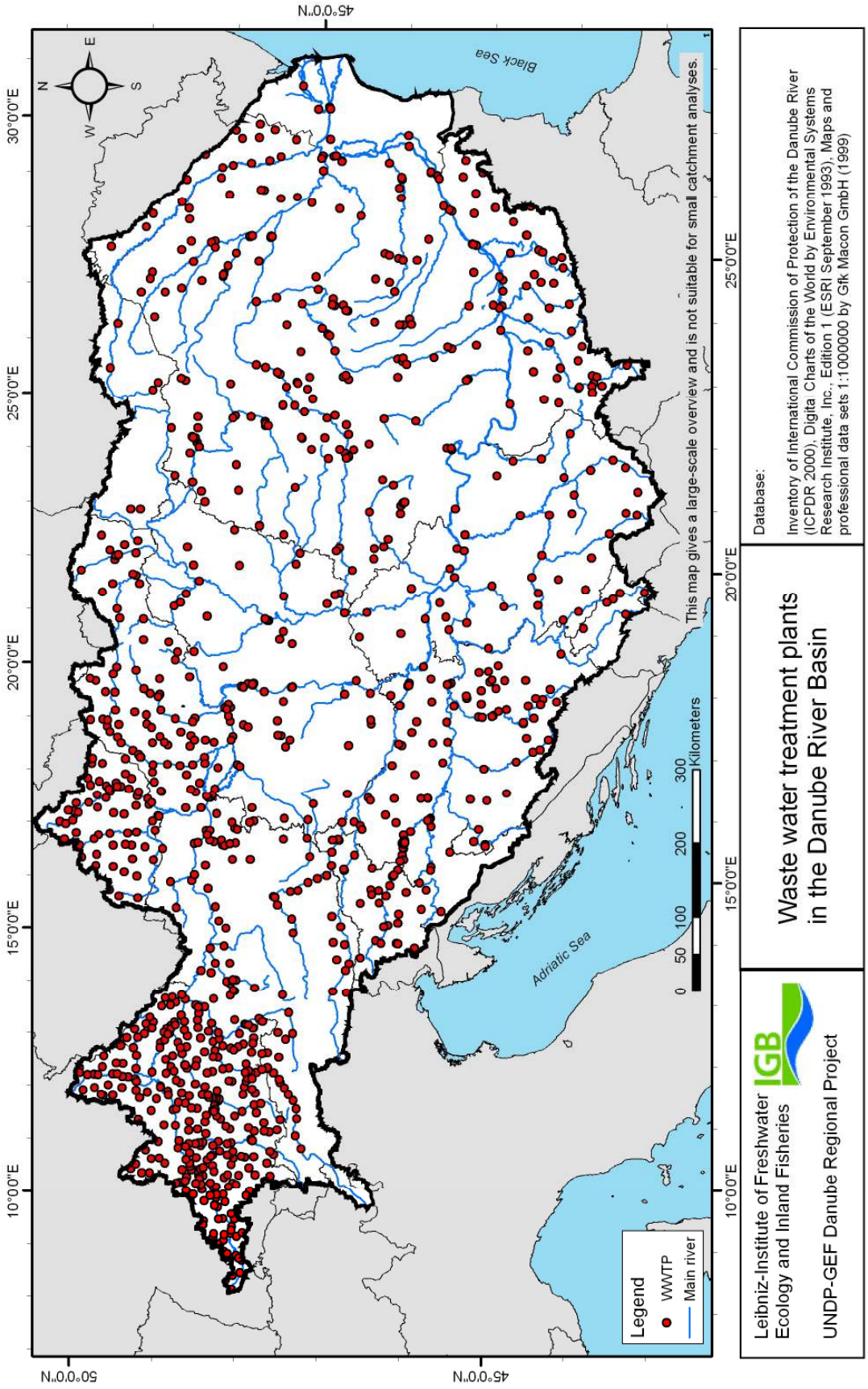
Map II.10: Long-term runoff in the Danube River Basin (1931-1970)



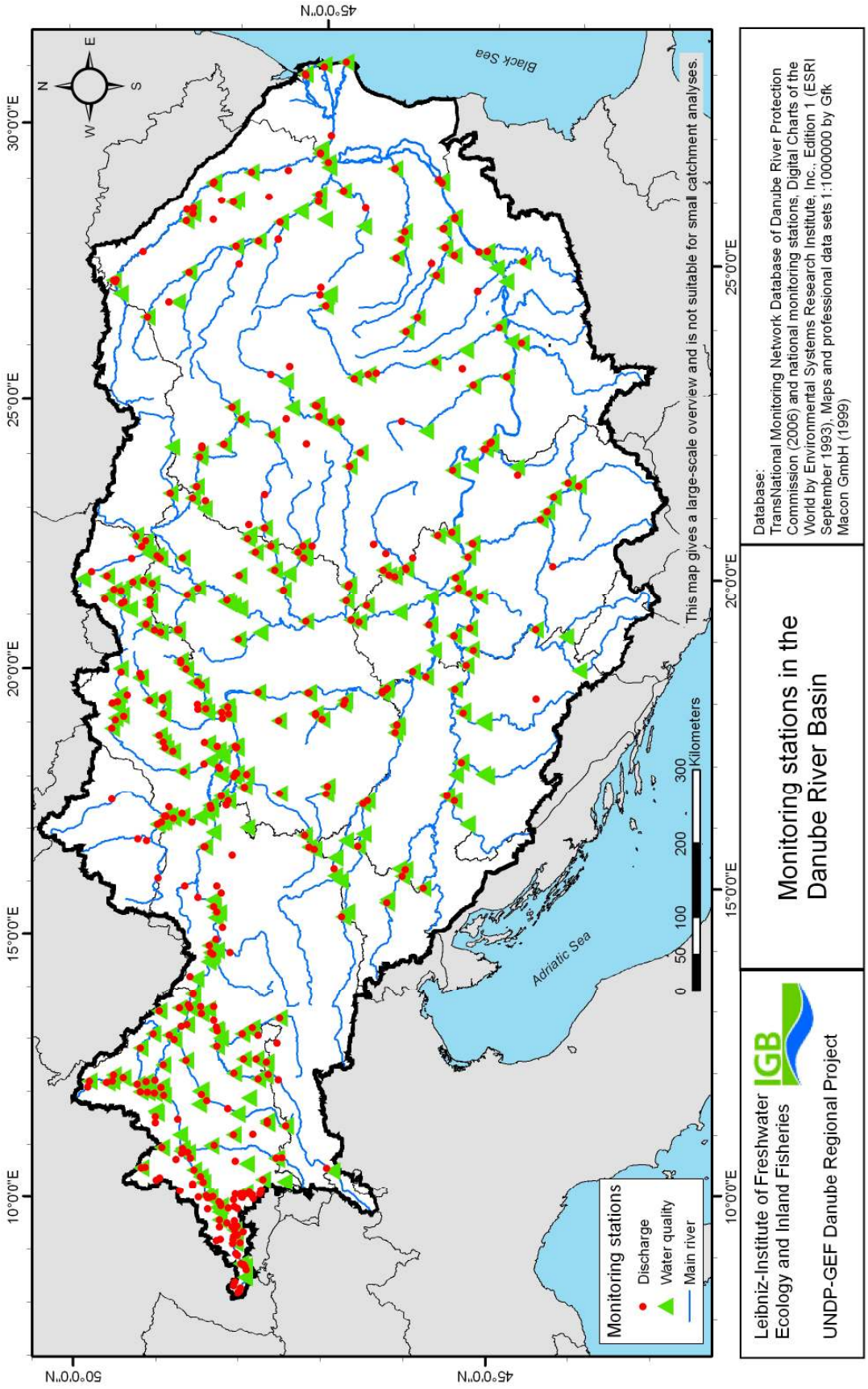
Map II.11: Long-term total atmospheric N deposition in the Danube River Basin (1980-2000)



Map II.12: Population density and city size in the Danube River Basin



Map II.13: Waste water treatment plants in the Danube River Basin



Map II.14: Monitoring stations in the Danube River Basin

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