APPENDIX 3

Decline in Ecological, Economic and Social Sectors of the HTRB

Summary: The current disadvantage of life in the Tisza region is clearly evident in the contrast in economic and social indicators between counties bracketing the Tisza river and the rest of Hungary. Finding data to demonstrate historical trends leading up to this situation is difficult, even looking back only 17 years to the transition from socialism to democracy (Anna Vari, pers. comm.). Similar conclusions apply to biodiversity data. The paucity of baseline data made it extremely difficult to assess the ecological impacts of a cyanide spill on riverine fauna of the Tisza in 2000 (Geza Jolankai, pers. comm.). Extending historical analysis back to the pre-industrial era of the 18th century relies on but a few observations or estimates from that era, such as the number of registered varieties of fruit or the regional export of fish. Regarding the productivity and diversity of fruit orchards or fisheries, the gross difference between the current and previous centuries underlies the common assumption of decline shared by many residents and researchers in the region. Below we provide evidence from data and expert opinion that gives more detail on decline in all three sectors.

Economic and social indicators of regional decline

Economic and social stagnation or decline is evident (Table A3-1**)** in comparing leading indicators of post-socialist "modernization" or "development" at the county level with national averages. HTRB counties have five times the national concentration of employment in relatively low-paying employment such as agriculture, a little more than half the national average in terms of car ownership, and a 50 percent higher out-migration rate than counties in other regions of Hungary. In addition to declining levels of services (education, access to suitable drinking water and heating), the relatively high concentration of employment in agriculture suggests the region is being left behind in a nation where agricultural contribution to GDP sank from 12.5% to 3.7% between 1990 and 2000 (MoEW 2005).

Agricultural productivity is frequently suppressed by water stagnation in many areas of the HTRB, sometimes disrupting production on as much as 500 000 ha (Nagy et al., in review and see Figure A1). Dike construction and enhanced canal drainage has disrupted the water cycle by impeding the ebb and flow of water in creeks and across the floodplain, leading to water stagnation that stifles or kills biological activity in the soil and can postpone agriculture practices for extended periods. Land degradation and the disrupted water cycle have contributed to declining agricultural productivity, trends evident since the 1970s (MoEW 2005). Collapse of former Eastern Europe markets, where Hungary was a prominent figure prior to 1989, has not been compensated by demand from elsewhere. Therefore, regional unemployment and land abandonment have risen with declining demand for Hungarian agricultural products.

Table A3.1. Select economic and social indicators of a sub-set of counties in the HTRB in 2005 (source: MoEW 2005 p.21)

County in the HTRB	Contribution of agriculture to GDP in the county (%)	Percentage unemployed	No. of cars/100 habitants	Migration from the region(%)
National Average	*3.7*	*7.2**	*23*	*1.4*
Szabolcs Szatmár	15.30	15.40	13.60	2.27
Hajdu Bihar	11.60	13.20	12.40	1.90
Bács-Kiskun	21.30	6.50	19.20	1.85
Békés	23.40	12.70	11.90	2.10

* - source: EUROSTAT 2005 data

Agricultural productivity is suppressed by drought, causing impacts at similar geographic and economic scales to those resulting from excess surface waters and flooding (MoEW 2007). Aridity maps (PAI index) shows drought exposure is most likely in areas within the Great Hungarian Plain, which contains the HTRB (Nagy et al. in review). Extreme drought events are common, occurring five times (1990, 1992, 1993, 1994, and 2003 in the last 15-year period (Pálfai 2006). Analysis of longer time series indicated increasing arid trends (Szász 1997). The multi-annual damage cost counted in 2005 price-level is expected to approximately 40 Billion Ft (Pálfai 2006).

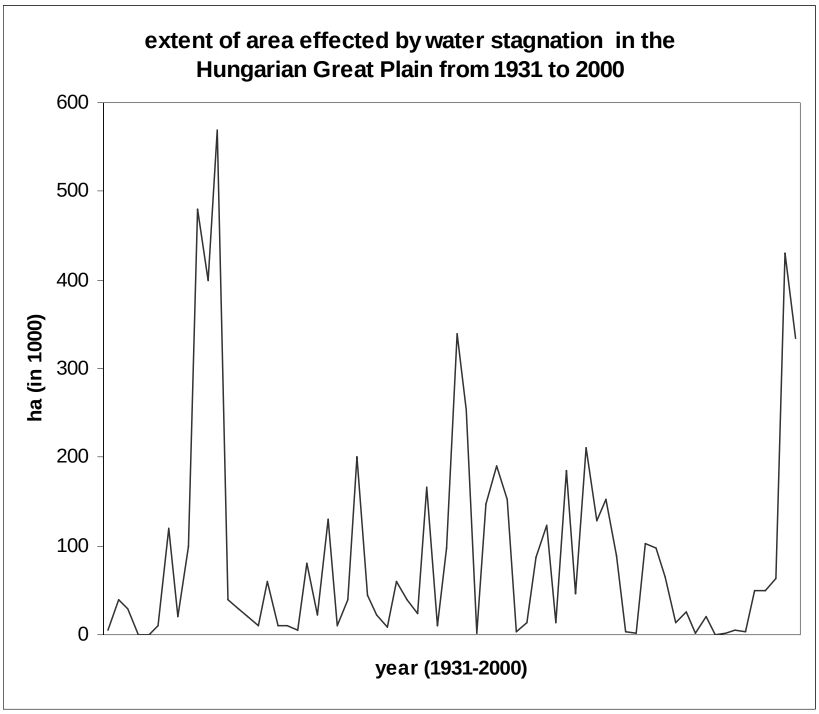

Figure A3.1: Excess surface water on the Hungarian Great Plain during the period of 1931-2000 (sources: Nagy et al. in review, Barta et al. 2000)

Environmental indicators of regional decline

The common impression (Molnar 2003, 2005, VATI 2006, Sendzimir and Flachner 2007) of regional environmental decline in the HTRB gains most of its scientific documentation from observations since the Second World War, especially in the last two decades (see, for example, Jolankai and Pataki 2005). Far less evidence is available to rigorously document declines in biological productivity and biodiversity over the centuries since river engineering began. However, such declines can be inferred from several regional changes at coarse scales. First, river channelization and diking have severely cut or eliminated hydrological connectivity and reduced the active floodplain area by 90 percent. In some regions of the HTRB, such as the Bodrogköz, wetlands have declined as a fraction of land cover from 80 to 25 percent (Gal et al. 2007). The resultant loss of waves of flood pulses over most of the floodplain have reduced the spatial diversity of the landscape mosaic, cut off fish migrations to and from nursery habitats, and allowed accumulation of stagnant water that has reduced biological productivity in the remaining soils and aquatic habitats. Second, HTRB fisheries have declined from an industry that exported nationally before the 20th century to one that currently provides mostly for local consumption and at best supports part-time employment for a tiny minority along the river. Third, loss of habitat and hydrological connectivity coincides with a vast loss of regional agro-biodiversity as the number of fruit varieties adapted to local flooding dynamics declined from hundreds to dozens (Dr. Dezső Surány, pers. Comm.). Fourth, construction of dikes, maintenance of drainage canal margins and channels, and the introduction of tree plantations (Török et al. 2003) at large scales have created artificial corridors that allowed rapid penetration of invasive species. The invasion rate can increase due to disturbance of vegetation and soil (poor agricultural practices) or when arriving species are *transformers,* e.g. those invasive plants that "change the character, condition, form, or nature of ecosystems." (Török et al. 2003). In the latter case, tree plantations have replaced patchworks of diverse habitats with silvicultural mono-cultures that have further eroded the spatial diversity of the landscape mosaic. The habitats most prone to invasion are "semi-natural managed forests and wet habitats (gallery forests, disturbed bogs, and marshes), forest plantations…and ruderal, severely disturbed areas" (Török et al. 2003).

Even if little data exists to document trends over centuries, data over the past three decades are very valuable as evidence for the impacts of significant increases in the extent and intensity of agricultural practices and land use change. According to Figeczky (2003):

> "The quality of these habitats and the quality network of wetlands has deteriorated significantly in the past decades due to drying out, eutrophication, construction, reservoirs, dyke systems to prevent floods, etc."

Bird, reptile and plant biodiversity has declined as a result of drainage of land to increase arable land for intensive, dryland, cultivation practices and the decline of riparian habitats due to canalization, riverbank clearance and dam building (Figeczky 2003). Avian biodiversity has declined in Western Europe as a result of “intensification and industrialization of agriculture” (Verhulst et al. 2004) and such processes are following similar trends as Central European nations such as Hungary modernize and intensify production practices. Fish species diversity also suffers when habitat diversity declines (Erös and Grossman 2003, Erös 2005, 2007). Erös concludes

> Water flows in the highlands were, however, mainly locally affected by small-scale canalisation, reservoir construction and, in the past, industrial activities. Submontane streams (SMS) remained relatively unimpacted (Erös & Grossman, 2003, 2005), although some of them are now exposed to local influences, such as intensive tourism, forestry and organic pollution from villages. Consequently, the landscape is largely affected by human perturbations, which may have contributed to the successful establishment and recent proliferation of non-native fishes and the decline of native fish populations in this region (see Erös, 2005 for the species pool of native and non-native fishes).

In summary, over the past two centuries two fundamental factors that support biodiversity have been drastically reduced by industrialization of the HTRB: total area of wetland habitat and the active floodplain as well as the diversity of the habitats in the landscape mosaic. Combined with displacement or reduction of endogenous species by invasive species, these factors have contributed to an overall decline in biodiversity. These factors have also reduced the processes supporting agro-biodiversity, which has suffered as well from expansion of cereal and forest plantation monocultures and from commoditization of fruit and nut varieties to a tiny fraction of the diversity of varieties endemic to the HTRB that existed prior to the 20th century. Gal et al. (2007) convey this depauperate condition by describing the present Tisza river valley as an “agrarian desert.”