COMMENTS

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on the sections with issues on forests and forestry:

A. of the Counter Memorial (CM) of the Slovak Republic of 5 Dec 1994

I. Pages 190-192

7.92 "It is accepted that declining groundwater levels may have an impact on the soil regime." The fact is that groundwater levels do have impacts on the soil regime. Water is a major factor affecting - among others - soil processes in a floodplain region, therefore, in lack of this water, soil processes change significantly.

7.93 "It is correct that if the water table remains in the underlying gravel layers, it is not brought up to the surface by capillary action. But this was the case prior to the damming of the Danube in large parts of ... Szigetköz". This is not true, since the water table level was high enough prior to the damming of the Danube to almost always reach the soil layer in the largest parts of Szigetköz.

7.97 the Bechtel report, as cited by the Slovak CM, states that the "Project will provide several benefits to agricultural and forestry production ...", which is by no means the same what the Slovak CM states, namely that "the impact of the Project on agriculture and forestry would clearly be beneficical overall". It must be stated that for the forests to dwell, (1) enough water should reach the Szigetköz area; (2) trees and other plants should have access to this water, either so that the water from the main riverbed and the sidearms can reach the water table, or by floods; (3) this water should have approppriate quality, e.g., it should be rich in oxigen and nutrients, required by the plants. No "construction of underwater weirs" and similar measures would substitute the effect of regular, longer floods (lasting for 1 week or longer). In the pre-dam era, the Szigetköz was characterized by such floods, and forests were accustomed to them.

7.98 "the cultivated forest ... " had by no means "... adversely affected for several decades by the sinking riverbed". This sinking was a slow process that did not have any observable effect on these forests yet, and would not have been effected them for a long time, either. This could easily be proved by the yield of these forests in the last decades, the growth data collected by the Forest Research Institute in the region since 1986, the size of the present stands, and, by the easiest way, the width of annual rings of the still living trees.

II. Page 222-223

8.31-8.32 "Prior to the damming, the nutrient input into the floodplain had been dramatically reduced due to the isolation of the Danube main channel from the side armes". This is simply not true. The adverse effect of the isolation process - which was slow - is not comparable to the beneficial effects of inundations that took place usually each year, providing the plant communities with abundant nutrients. In addition to the floods, the side arms used to have regular and direct contact with the main Danube channel. The inundations cannot be simulated or substituted by channeling 40-50 m3/s water into the side arms, as the Slovak counter memorial suggests. Floods would always be required. - As shown elsewhere, “conditions for forestry have” not “improved in Slovakia due solely to the impact of Slovakia’s recharge program”.

8.33 "... the dying back of trees on Hungarian territory pre-dates the damming of the Danube by at least ten years and has been caused by the sinking water level of the Danube." It is true that some trees died already prior to the damming. Such die-backs do, however, occur in every forested area to a certain extent, and all die-backs are brought about by (known or unknown) specific causes. In case of Szigetköz, one of the major causes of these small-scale die-backs was that necessary thinnings were not carried out, thus self-thinning ensued. No large-scale die-backs occured in the Szigetköz earlier even in the most arid years.

Slovakia claims that "in areas where water recharge is implemented ..., an increase in annual timber growth has been recorded". Examples of this increase are given in footnote 59: "This increase has been: 0.3 mm for Populus Alba ... and Salix alba ..., and 0.2 mm for Fraxinus Angustifolia". This can easily be disproved. First, it is not clear whether these data relate to increase in diameter or in annual ring (increase in diameter doubles that in annual ring). Second, even in case of considering the larger increase, it is insignificant compared to the wide annual rings or diameter growth that are produced in an alluvial forest. Under optimal conditons - which used to be the case in Zitny Ostrov and Szigetköz prior to damming -, trees grow very fast, and diameter growth of Populus hybrids amounts to, on the average, about 20 mm a year, and can reach 30 mm. Third, if the amount of water is optimal for trees (as it was the case prior to the damming), no excess water (i.e., no recharge system) can increase growth. Four, only two years have elapsed since implementing of the recharge system in Slovakia, which is a rather short period of time to conclude that the estimated growth increase was due to the beneficial effect of the recharge program. Five, this small increase is, in all probability, smaller than the error of estimation. Thus, the Slovakian argument of growth increase cannot be regarded as scientific evidence, therefore, cannot be accepted.

As for the sustainability of forests, evidence and measurements support that the recharge in the side arms does not provide enough water to mitigate damages. By the end of year 1994, as a possible result of colmatation, the water in the side armes did not reach the ground water body. Whereas the water level in the side arms at that time was at around 100 cm below ground level, the ground water level in wells close to 10-20 m from the side arm reached only around 200 cm below ground level. This means that no direct contact existed between the water body of the side arms and the ground water, the level of which is regulated only by the water level of the main Danube channel. Similarly, the recharge program on the Slovak side did function well only untill the autumn of 1994 when colmatation started to take effect there, too. This can be proved by the data of wells on the Slovak side.

8.34 The Slovaks themselves admit later that "deterioration of the alluvial forests ... is a direct effect of Variant C's operation": "adverse impacts... have indeed been recorded on the Slovak side of the Danube" (Reply, Volume I, p. 331, section 13.14).

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8.60 Inconsistency of expert opinions - in both Slovakia and Hungary - is a result of (1) inadequate monitoring programs, (2) research has not, by far, been complete, and (3) time has been short to fully show actual trends on either sides. This only underlines Hunagry's claim of ecological necessity.

B. of the Reply of the Slovak Republic of 20 June 1995

I. Volume I, pages 323-331

13.01 "... the Project as it developed did not have adverse impacts ont agriculture and forestry production": see, e.g., comments on Vol. III. Ch. 4., p. 87.

13.11 Slovakia claims that "monitoring of reduced tree circumference increment is not a reliable tool for measuring short term impacts", but "more reliable measures are the leaf area index ... and the growth season leaf loss". Because tree growth can be measured much more accurately than either leaf area index or growth season leaf loss, it is a more reliable tool. See comment on Volume II, remark 5, p. 83.

13.12 "thickness and height have changed only (very slightly) in harmony with the growth laws of the respective forest ecosystems. On one permanent monitoring plot a more intensive growth pressure was recorded as a result of the ecosystem revival." Cf. footnote 59 for 8.33 on p. 222 of the Slovak Counter Memorial, which includes firm statements of the "beneficial" effects of the recharge system on tree growth. The Slovaks disprove themselves.

13.13 The four monitoring plots observed in Slovakia are obviously not there where the drainage effects of diverting the Danube can clearly be seen: close to the main riverbend, where dying of willows is a pure fact both on the Slovak and the Hungarian side of the river, which is also stated in the very next paragraph (13.14): "adverse impacts... have indeed been recorded on the Slovak side of the Danube".

13.14. The adverse impacts are due to specifically Project conditions, because a significant drop of the water level in the main riverbed is a direct consequence of the building of the bypas canal.

II. Slovakia's rebuttal of Volume 2 of the Hungarian Counter-Memorial (Volume II, pages 73-83)

P. 74, remark (5), paragraph one: "The G/N Project is a ... very well researched intervention." This statement is clearly not true, and has been shown by the history of the entire Project, and the scientific level of the Data and Monitoring Reports of the Slovak Republic. (Nor is satisfactory the Hungarian monitoring enough.)

P. 74, remark (5), last 5 items in the list of paragraph two: the statements are exaggerated. The basis of these statements is questionable, because the objectives and methods of earlier studies (see Vol. III., p. 73-74) were not adequate for monitoring purposes: "All changes of the floodplain ecosystem's biota in the Slovak side of the Danube lowland have been carefully monitored since 1991 (Vol. III., p. 74, paragraph 2).

P. 80, remark (3), paragraph one: the term "semi-" means 'partially'. Although Hungary's "floodplain forests" mainly "consist of one" "unnatural" "species", hybrid poplar, the other parts of the forests are partially still in a natural state. Therefore, the floodplain forests of the Szigetköz may be considered as "semi-natural".

Paragraph two: it is by no means "significant" that Hungary fails to mention "the poor conditions for certain trees in the 'semi-natural' state". No major problems were encountered in the floodplain forests before 1992.

P. 81, remark (6): the Hungarian comment was by no means "irrelevant". The Alps in Switzerland are not to be moved, but the Danube was diverted and there is a great danger that some parts of the Szigetköz may become a "wooded steppe".

P. 81, remark (7): 64 % is (much) less than 100 % so the word "partly" was correctly used.

P. 81, remark (8): the Slovaks state here (as on p. 82, remark (2), p. 83, remark (3) and (8) and elsewhere) that the "economic evaluation of the worth of the floodplain forest can have no relevance to Hungary's legal claims". The economic value in itself is substantial, if not for the whole country, but the local people. However, the benefits of the forests other than timber (e.g., reserving biodiversity, cleaning water, preventing floods etc.) are even economically much more valuable than timber. Moreover, the economic value of the timber production is strongly bounded with the other values of the forests: if forests as environment are in risk, so is the timber production capacity in risk and vice versa. Thus, the economic value of the timber production capacity can be used as an indicator of the state of the environment.

P. 82, remark (3), paragraph one: because it is easy to measure correctly, the "reduction of circumference increment" is "a reliable tool for measuring short-term impacts" of changes in the environment of the trees. "Reliable" means relatively: growth is an aggregate characteristics of the trees' physiological processes that reacts relatively quickly to environmental changes. Leaf area index and growth season leaf loss could also be used as indicators of environmental changes, but their measurement is much more difficult and subjective. Therefore, they are not as reliable tools as girth growth measurements.

P. 82, remark (4), paragraph one: "There is no evidence of damage occurring in the Slovak floodplain": lots of died trees can be seen even from the Hungarian side. Mostly willow trees have dried out so far. Damages on the Hungarian side are easier to demonstrate.

P. 83, remark (6): the cost is by no means self-inflicted. It was not Hungary that diverted the Danube.

P. 83, remark (7), paragraph one: the Hungarian statement is correct. Even if the ground water does not reach the soil in 30 % of the Szigetköz, it does reach it in all or almost all parts of the floodplain in case of floods. What is more, water fills the soil during the periods of inundations. It is the water - the water from the inundations - that the floodplain forests need: the inundations provide not only water, which is necessary for all life on Earth, but also nutrients.

P. 83, remark (7), paragraph two: The Slovaks have no proof that "the Szigetköz forests suffered from the sinking groundwater levels from 1950 onwards". On the contrary, no major deterioration was observable.

Page 83, remark (7), Note: the flow in the Mosoni Danube may have a little beneficial impact on the forests close to this river, but clearly no impact on the floodplain forests close to the main riverbed that represent the majority of the affected forests.

III. Data and Monitoring Reports, Volume III., Chapter 3. Section 3. Forests (p. 62-72.)

P. 63, at the bottom: The Slovaks admit here that, after 1992, "there have been indications" "in the so-called dry triangle" and "on the 50-100 m wide belt along the old riverbed which point as a possible result to the partial destruction of the forest". They also admit that their monitoring, the results of which are used to describe the situation in Zitny Ostrov before and after 1992, was started (only) in 1990. This is too short a period to prove things.

In their monitoring, the Slovaks have observed the structure of tree and shrub layer, the leaf area index (LAI), loss of leaves, biomass production and transpiration of water through the forest ecosystems. Generally, sample sizes are rather small, and the selection of the observation places may have a large effect on the results. (In the field of biology, things do not happen with a consistency that is common in physics. Biological phenomena are characterized by a high variance if one makes multiple observations of the same thing. Making only a few observations may mean that the result is much more influenced by the selection of the place or time of the observation than the driving force of the phenomenon under study.) The results published in this study may, in several cases, be interpreted in ways other than what the Slovaks did.

LAI, p. 64: the measuring method of LAI is not covered in the text. Measuring LAI is rather difficult, and the difference of LAI in two consecutive years may arise from using an inadequate method. On MB09, in a pole-stage young willow monoculture LAI dropped from 1992 to 1994. This is contrary that healthy young stands grow intensively and keep growing their leaf area. This can easily be seen on plot L19, where the young oak stands almost doubled their leaf area (Table 3.1., p. 65). It is, however, not to be explained by what the Slovaks assert, i.e., that this increase is attributable to the higher underground water level (p. 65, bottom, p. 66, up): this increase is mostly attributable to the young age of the stand. Of the 12 monitoring plots for these observations, only 6 have measurements for more than one year and the plots not analyzed above show practically no change whatsoever.

Loss of leaves, p. 66: of the 23 permanent plots for leaf loss observations, leaf loss is small on 9 plots, substantial on 4 plots and decreasing on 10 plots. However, it is conspicuous that leaf loss was unusually high in 1992. (This also points to the methodological problems of these types of observations, too.) Disregarding the observations of this year, trends are not as promising as the Slovaks state. To see what has been happening, a longer period of time is necessary.

Biomass production, p. 67: the Slovaks state, correctly, that changes in this production "can not yet be exactly assessed". This is true, as it is stated above, for leaf loss, too. Girth growth, however, can already be assessed within a vegetation period if the growth is intensive, which is the case in the floodplain forests.

Transpiration, p. 67: sampling requirements are met to the least extent here. Five individuals on three plots have been observed. However correct and high-level the measurements of these individuals are, one cannot draw conclusions from them for a whole region.

Some graphs do not show at all what the conclusions suggest. The transpiration of the poplar tree at Královská lúka (Fig. 3.6, after p. 72) did not drop after August because of the drop of soil moisture, but, in all probability, because of the end of the vegetation period: decreasing temperature, shorter days etc. in early September, cloudy weather might have prevented the trees

from transpiring. What is more striking, however, is that in July and August 1992, the average daily transpiration was approximately 600 liter, whereas that in August 1993 amounted only to around 350 (Fig. 3.7). This does not, by any means, show the beneficial effect of the recharge system ("improved conditions in the middle of inundation area"). It is worth mentioning, too, that "the selected oak ... which is close to the reservoir, despite rising ground water levels in 1993 ... has not indicated a considerable improvement of its vitality so far". Obviously, the presented methods are not convincing enough to support the Slovak standpoint. Nor is it sufficient "for optimalizations of the Gabcikovo water management regime immediately". For this purpose, a much more extensive and constantly run monitoring system is required on both sides of the Danube.

IV. Volume III., Chapter 4. "Flora and vegetation of the Danube Lowland within the impact area of the Gabcikovo Project" (p. 73-90)

On pages 74-80, the study analyses the changes in the structure of the floodplain forest on the Slovak side of the Danube. It tries to suggest that "due to the decrease of water flows in the side arm system, ... the floodplain forests would eventually have disappeared" and that "the Gabcikovo Project and Variant C 'have' prevented this regression" (p. 87). This message involves that the processes cover the whole area affected by the Project, and that the time frame in which the floodplain forests would eventually have disappeared would be something like the near future. This is, however, by no means the case. The shown changes in the structure of the forests must have occurred on small areas, and they may have happened also due to the relatively little amount of precipitation of the last 10-15 years. "Similar consequences" did not "appear" "in the right-side, Hungarian part of floodplain forests ... on the whole Szigetköz" (p. 80), because we have not experienced anything like that.

This is also shown by the fact that, by 1992, "the extent of" the Euro-American clones of poplars (also called the Hybrid poplars) "was about 80 % of the total extent of floodplain forests in the inundation area" (p. 80). These are highly productive tree varieties (after 1939, "the silviculture became concentrated on monocultures of poplar clones with high wood production", p. 62) that require a considerable amount of water: they demand "good nutrient and moisture conditions" (p. 62). The main reason that original forests were replaced by plantations of Hybrid poplars is that the country's economy needed a lot of timber of good quality and these poplars produce much more timber and assortments of usually much better quality than the species of the original forests. (The same happened on the Hungarian side, for the same reason.) Therefore, it was <u>not</u> "the decrease of increment and loss of leaves ... of willow-poplar [poplar species other than Hybrid poplars] forests" that "forced forest management to expand plantation of cultivar poplar monocultures". On the contrary, the existence of these cultures proves that conditions for timber production were, in 1992, still good enough on the Slovakian side.

Some of the arguments of the Slovaks, based on which conclusions are drawn in this chapter, are scientifically weak: in the lack of any monitoring, the assessment of "decrease of circumference increment" and "loss of leaves of willows" cannot be regarded as sound and objective.

Even the Slovaks admit that there are areas (e.g., the so-called dry triangle in Slovakia) where the floodplain forest is drained due to the Project ("the decrease of ground water levels" have reached "almost 4 m under the surface") that "made the floodplain forest dependent on precipitation" (p. 82). The preliminary results of the dendrochronological study referred to here are only

preliminary, and the statements of the reply that "the process of increment decrease began long ago", and especially that this decrease "was the result of the sinking of the Danube's water level" (p. 83) are not to be taken seriously.

In connection with the effects of the artificial recharge system, the Slovaks admit that only one of seven monitoring sites "is suitable for the observation of impacts of the water supply in the branch system" (p. 84). Yet they sum up the "results of monitoring of reactions of flora to existing situation", which, consequently, are not reliable results. What is more, if the "preliminary results" of dendro-ecological measurements" on increment borings (taken with Pressler borers, p. 84) were true, an increase of tree growth should be expected that would show the beneficial effect of the recharge system. However, the Slovaks found that there have not been "any apparent changes " in tree growth. This also shows that the conditions for tree growth might not have been as bad as the Slovaks assert. However, and "undoubtedly", "longer term observations are needed" to demonstrate any effect of the recharge system. (This, naturally, holds true for the Hungarian monitoring system, as well.)

The Slovaks admit that the building of the Project required the removal of 3,267 ha of floodplain and other forest (p. 87). This is quite a large area where timber could have been produced, and a lush vegetation and a rich fauna could have lived on if the Project had not been built.