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May cause environmental damage the diversion of the Danube in the Szigetköz area, Hungary?

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Summary
The floodplain area between the main channel of Danube and its branch river Mosoni-Duna is called the Szigetköz. This wetland area has special flora and fauna, and it is a natural protection area. Underneath of the Szigetköz, there are a thick (several hundreds meters) sedimentary sequence, the so called Kisalföld Quaternary Aquifer. This aquifer system is fed by the surface river system of Danube and supplies excellent quality drinking water for several hundred thousands of people in Hungary and Slovakia.

The Szigetköz Monitoring Network was established in 1991 to describe the environmental effects of the Bős-Nagymaros Dam System, which was partly built in 1992 on the Slovakian part of the Danube. The dam diverts three-quarter of the Danube runoff to a 40 km long artificial concrete channel north of the original river bed. The effect of this diversion is spectacular on the wetland area. Water level in the meandering channels have decreased significantly, part of the wetland area frequently becomes dry. The natural flow pattern has disappeared. As a consequence, the channel characteristics of the river network, therefore the flow pattern, the quantity and quality of surface and subsurface water on the upper region of the Danube have significantly changed.
The aim of our research is to describe the relationship between surface water and groundwater and considering the variable geology of the area, to describe trends in chemistry and to find the possible reasons for extreme values. Also to detect possible connection between the extreme values and the changes in flow pattern caused by the human intervention.

Water sample pairs from surface water and shallow and deeper ground water were taken in every season at 18 locations. To sample shallow ground-water 1,5 m long, screened metal probes were derived into the sediment at the possible nearest point to the surface water.
On the field pH, temperature, dissolved oxygen, specific conductivity, and in the wells redox potential were measured. Samples were taken for further laboratory analyses (major and trace components, nitrate.

The chemical parameters of surface and subsurface water show seasonal changes, due to the changes of temperature, of precipitation, of biological and microbiological activity.
At the monitoring points along the main channel the surface and subsurface water is closely related, and the velocity of groundwater can be calculated by the seasonal periodical dislocation.
At the monitoring points on the north-western part of the study area (point 1), subsurface water replenished by the rivers, and water level in the probes follow the surface water level changes with short shift. Practically water quality is the same in the probe as in the surface. It is the same on the south-eastern part of the study area, where the diverted channel rejoins to the original river channel (point 10).
The middle section (at points 4 and 5) of the study area, water level in the probes is higher than surface water level. Also concentrations of some chemical components are higher in the subsurface water here. These components are typically the results of water – sediment interaction. Based on these observations, the study area can be differentiated by the hydrochemical composition for losing and gaining sections.
At the monitoring points along the meandering sub-branch system, water in the probes is reductive, the connection between surface and subsurface water is week, furthermore at some point is non-existent.
At some points surface water has slow flow, or it is even stagnant. This means reductive environments, and high

concentrations of some components, especially at the monitoring points of 31 and 41. For example, concentrations of ammonium, sulphate, phosphate, magnesium, iron, manganese are extremely high in the shallow groundwater. Originally the Danube supplied fresh, oxygen-rich water to the area, while nowadays at these locations surface water and subsurface water almost has no connection, and these sections of river bed already turned muddy, and organic material accumulated in the sediment, which further increase the rate of reduction and decrease the flow rate. The extreme values, and values not following the trend in the time series of chemical parameters can be explained only by further detailed examination.

On the whole, it is unambiguously clear, since the diversion of Danube the water replenishment of the meandering sub-branch system is poorer, causing unfavourable changes in water chemistry both in surface and subsurface water.

Other research teams of the monitoring system, studying ecology, have found that the water regulation has major adverse effects on the biology as well. The typical floodplain vegetation is changing toward species tolerating dryness. In the water flora and fauna alters gradually as well, due to the changing chemical characteristic of water and the decreasing flow.

Considering that the abiotic environment react slower than the biotic to the anthropologic influence, we do not have a clear view how the water quality will deteriorate on the long run. Furthermore, the changes in flora and fauna have already caused changes in water chemistry, and these changes will persist causing a slow but continuous diversion from the original, natural values.

In Szigetköz area, the decreased flow and the deteriorating quality of surface water will endanger the important subsurface drinking water aquifer on the long-term.