LANDSCAPE TRANSFORMATION IN THE AREA OF THE HRIŇOVÁ RESERVOIR DURING 1764–1971

Adam Čaplák, Henrich Grežo
Department of Ecology and Environmental Sciences, Faculty of Natural Sciences, Constantine the Philosopher University in Nitra, 949 74 Nitra, Slovakia

https://doi.org/10.11118/978-80-7701-087-0-0238

Abstract
This study focuses on the analysis of landscape changes in the area of the present Hriňová Water Reservoir from 1764 to the present, using historical maps and GIS tools. By evaluating historical road networks, watercourses, railways, bridges, and culverts, we identified significant changes in land use, particularly during the period before and during the construction of the reservoir (1952–1971). The most notable changes were observed in the lengths of roads, watercourses, and the number of bridges: before the reservoir was built, 13 bridges were recorded in the area, whereas after its construction there were none. The results highlight the substantial human impact on the landscape due to the implementation of the water structure, which today serves as a source of drinking water and represents an important feature within the boundary of the Poľana Biosphere Reserve.

Key words: water tank, historical map, change

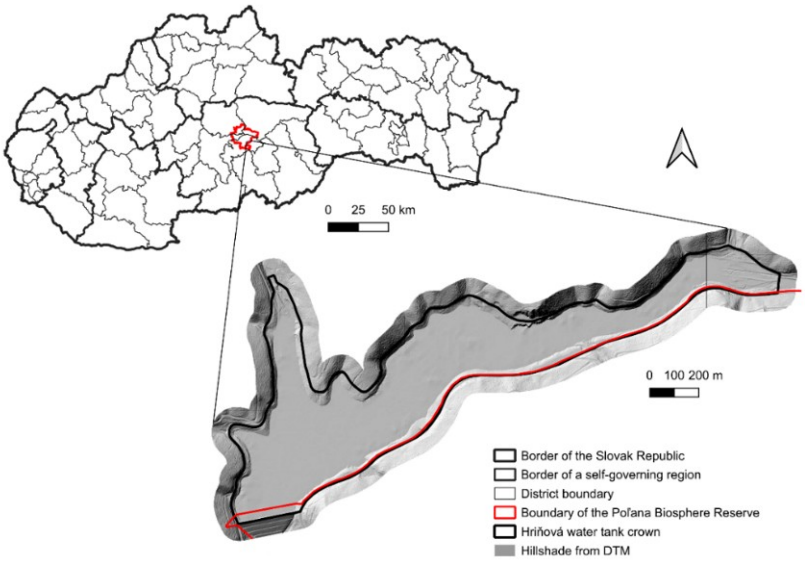
Introduction
Reservoirs are vital for water supply, flood protection, and recreation (Verdhan, 2025). Above the town of Hriňová, the Hriňová water reservoir has been in place since 1964, serving as a high-capacity source of drinking water (ESDPM, 2020). Failure to maintain proper work discipline during construction—particularly in some important details such as filter placement—caused operational problems for the water structure. These issues appeared immediately after the reservoir began to be filled. Local seepage accompanied by landslides and subsequent remediation recurred for more than 20 years. Only extensive rehabilitation of the dam carried out between 1988 and 1992 finally resolved the long-standing problems of the water facility (SNCLD, 2025).
Because the reservoir serves as a source of drinking water, recreational use is not permitted (ESDPMH, 2020). The area is popular with tourists due to its location in the Poľana Protected Landscape Area (Trenčiansky et al., 2025). The Hriňová reservoir is a traditional destination for hikers, cyclists, photographers, and mushroom pickers (SBTZ, 2025).
Our aim was to assess changes in the territory based on historical maps dating back to 1764 in the area now affected by the Hriňová reservoir.

Area of interest
The Hriňová water reservoir is located in the Banská Bystrica Region, in the Detva District, within the cadastral territory of Hriňová, forming the southeastern boundary of the Poľana Biosphere Reserve, with a total area of 67.52 hectares (Map 1).
The dam crest elevation is 567.60 m a.s.l.; the crest width is 5.50 m; the dam height above the valley floor is 41.50 m; the permanent storage volume is 226,64 m³; the total reservoir volume is 7,379,77 m³; and the inundated area at the maximum allowable water level is 555,00 m² (SWMC, 2025).

Methods
The basis of the methodology was the approach of Dostál and Havlíček (2025). In their research, the authors used GIS (ArcGIS 10.6) founded on the interpretation of historical map documents. To define the historical road network, they used a set of state and district maps issued by the Ministry of Technology of Czechoslovakia in 1947, as well as historical orthophotos from the early 1950s. The authors Švoňová et al., 2024 focused on the state and changes in landscape structure based on the analysis of remote sensing data (1949, 2003 and 2018), as well as field research and a review of archival photographs.
Prochádzka and Pišút (2015), in their study on the regulation of the channel of a lowland meandering watercourse during the period 1782–1900 (using the example of the Váh River in the Sereď–Komárno section), used a map from the Second Military Survey as their main reference. Based on this map, they performed vectorization and supplemented the base with additional features such as cut-off meanders, identified using more recent maps that captured changes occurring after the creation of the historical map.

We adapted and adjusted the authors' methodologies to suit our study area, focusing on landscape changes within the Hriňová water reservoir and its immediate surroundings. We monitored changes in the length of roads, field roads, railways, intermittent streams and permanent watercourses, as well as changes in the number of bridges and culverts.

Map 1:Area of Interest – Hriňová Water Reservoir



Source: PABR, 2025; ALS, 2024

We used maps from the First Military Survey, Second Military Survey, and Third Military Survey, as well as military topographic mapping from 1952–1957, military topographic mapping from 1957–1971, and contemporary mapping. For each analysed period, we created vector and point layers of landscape elements, specifically roads, field roads, watercourses, intermittent watercourses, railways, bridges, and culverts. Subsequently, in the QGIS software, we calculated lengths in meters using the attribute table and its field calculator with the function "$length / 10.000".

Result

Between 1764 and 1787, we recorded total changes in length of 1.56 km; between 1810 and 1869, 6.12 km; between 1875 and 1884, 6.03 km; between 1952 and 1957, as much as 11.57 km; and between 1957 and 1971, 3.17 km. Regarding changes in bridges and culverts, we recorded a total of 2 bridges in the period 1810–1869, 2 bridges in 1875–1884, as many as 13 bridges in 1952–1957, and only one culvert in 1957–1971 (Table 1).

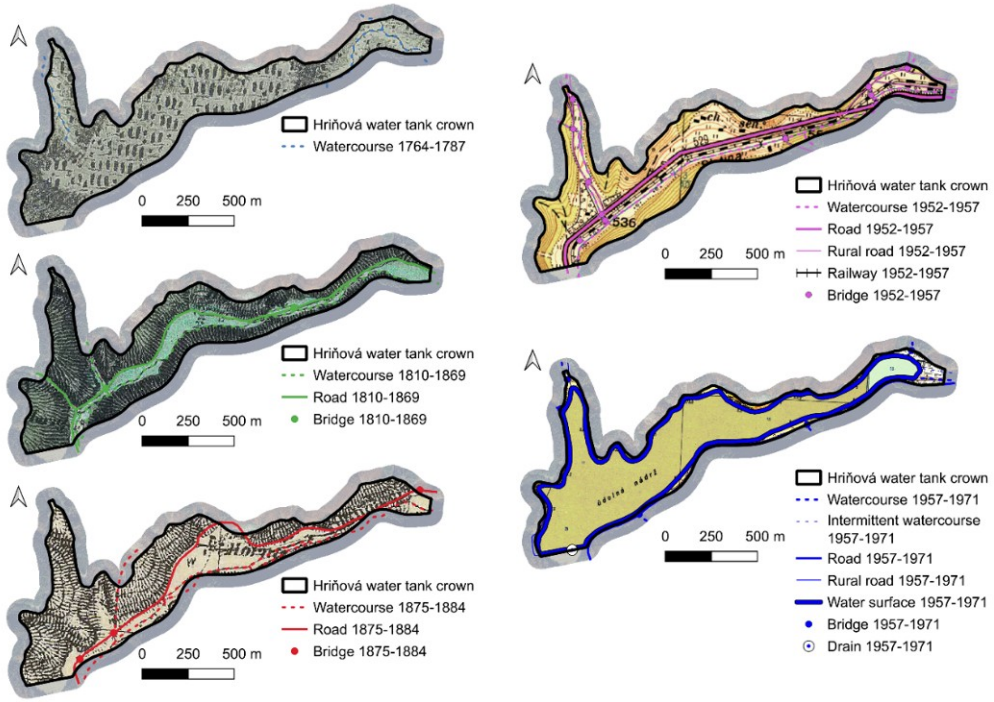
Tab. 1: Changes in the length of linear elements

Year	Road (km)	Rural road (km)	Railway (km)	Intermittent watercourse (km)	Bridge	Drain	Watercourse (km)
1764-1787	-	-	-	-	-	-	1,56
1810-1869	2,83	-	-	-	2	-	3,29
1875-1884	2,55	-	-	-	2	-	3,48
1952-1957	2,47	2,43	2,50	-	13	-	4,17
1957-1971	2,36	-	-	0,18	-	1	0,63

Source: ALS, 2024; 1MM, 2022; 2MM, 2021; 3MM, 2022; TM1, 2022; TM, 2022

Specifically, in the years 1764–1787 there were 1.56 km of watercourses; in 1810–1869 there were 2.83 km of roads and 3.29 km of watercourses; in 1875–1884, 2.55 km of roads and 3.48 km of watercourses; in 1952–1957, 2.47 km of roads, 2.43 km of field roads, 2.50 km of railways, and 4.17 km of watercourses; and in 1957–1971, 2.36 km of roads, 0.18 km of intermittent watercourses, and 0.63 km of watercourses (Map 2).

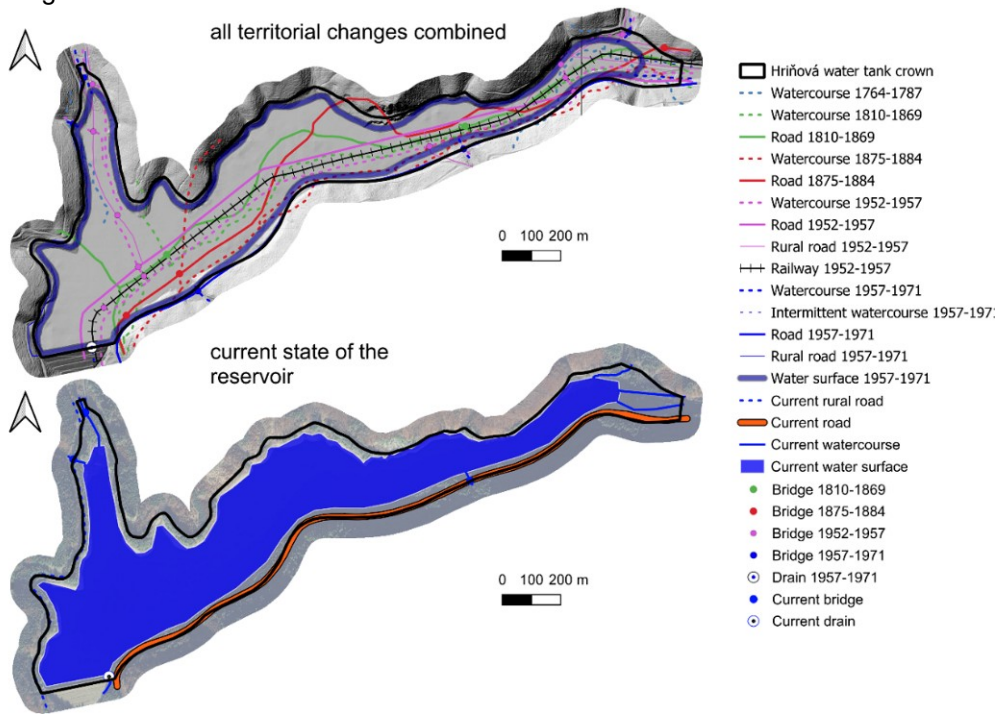
Map 2: Change Across Individual Periods



Source: ALS, 2024; 1MM, 2022; 2MM, 2021; 3MM, 2022; TM1, 2022; TM, 2022

In Map. 3, we observe the overall changes across all monitored periods within the Hriňová Water Reservoir area from 1764 to the present.

Map 3: Change Across All Periods in the Water Reservoir Area



Source: ALS, 2024; 1MM, 2022; 2MM, 2021; 3MM, 2022; TM1, 2022; TM, 2022

Conclusion

The greatest changes are observed between 1952 and 1971. This period reflects the years before the reservoir was built compared with the years during the construction and completion of the Hriňová Water Reservoir. During this time, we see a significant change particularly in the number of bridges: between 1952 and 1957 there were 13 bridges in the area of the present reservoir, while between 1957 and 1971 there were none. We also observe the most substantial changes during these years in

the lengths of roads, field roads, railways, and watercourses. Today, the reservoir serves as a source of drinking water.

References:

1ST MILITARY MAPPING (1764-1787) – 1MM (2022). Processor: 1st Military Mapping (1764-1787) Ministry of the Environment of the Slovak republic. Available: https://rpi.gov.sk/metadata/9c837b0f-393b-44f0-9a1e-c0dfe1b06cc8

2ND MILITARY MAPPING (1810-1869) – 2MM (2021). Processor: 2nd Military Mapping (1810-1869) Ministry of the Environemnt of the Slovak republic. Available: https://geoportal.gov.sk/gallery/datasets/detail/f6a9ae10-9b22-489c-bbfe-e6751700a6ae

3RD MILITARY MAPPING (1875-1884) – 3MM (2022). Processor: 3rd Military Mapping (1875-1884) Ministry of the Environment of the Slovak republic. Available: https://geoportal.gov.sk/gallery/datasets/detail/8e66952f-b2b1-4ff4-8dc0-f8a33f062348

DIGITAL TERRAIN MODEL 5.0 – ALS (2024). Processor: Aerial laser scanning. Available: https://www.geoportal.sk/sk/zbgis/lls/

Dostal, I., Havlíček, M (2025). Decommisioned road – an opportunity for active modes ? Public recreation and landscape protection – with environment hand in hand (**13**)1, 69-75, ISSN 2336-632X

ECONOMIC AND SOCIAL DEVELOPMENT PROGRAM OF THE MUNICIPALITY OF HRIŇOVÁ 2020-2025 – ESDPMH (2020). Processor: Econimic and Social Development Program of the Municipality of Hriňová 2020-2025 Water. Available: https://www.hrinova.sk/e_download.php?file=data/editor/63sk_1.pdf&original=Program%20hospod%C3%A1rskeho%

Prochádzka, J., Pišút, P (2015). Regulácia koryta nížinného meandrujúceho vodného toku v období r. 1782-1900 (na príklade rieky Vás v úseku Sereď-Komárno). Geograpgia Cssoviensis (**1**)9, 44-55, ISSN 2454-0005

PROTECTED AREAS – BIOSPHERE RESERVES UNESCO - PABR (2025). Processor: Area of the UNESCO biosphere. Available: https://rpi.gov.sk/metadata/94350707-4651-4a37-8312-9867f6f3c916

SLOVAK BUS TRANSPORT ZVOLEN – SBTZ (2025). Processor: Hriňová Dam – a traditional tourist destination – Slovak Bus Transport Zvolen. Available: https://sadzv.sk/tipy-na-vylet/hrinovska-priehrada-tradicny-ciel-turistov-cykloturistov-fotografov-aj-hubarov/

SLOVAK WATER MANAGEMENT COMPANY – SWMC (2025). Processor: Major hydraulic structures – Slovak water management company. Available: https://www.svp.sk/sk/uvodna-stranka/odstepne-zavody/oz-banska-bystrica/vyznamne-vodne-stavby/

SLOVAKIA NATIONAL COMITTEE ON LARGE DAMS – SNCLD (2025). Processor: Hriňová basin on Hron – Slovak National Comittee on Large Dams. Available: https://t3.skcold.sk/?id=38

Švoňová, K., et al. (2024). A detailed assessment of the land cover development in a territory with dispersed settlement area (case study Hriňová – Snohy, Slovakia). Nature Conservation (**1**)55, 41-54, ISSN 1617-1381

TOPOGRAPGIC MAPPING 1:25 000 (1952-1957) 1ST EDITION – TM1 (2022). Processor: Topographic Mapping 1:25 000 (1952-1957) 1st Edition Ministry of the Environment of the Slovak republic. Available: https://geoportal.gov.sk/gallery/datasets/detail/f6d9cfe7-afcc-4617-8fd1-8220e45b49a4

TOPOGRAPHIC MAPPING 1:10 000 (1957-1971) – TM (2022). Proccesor: Topographic Mapping 1:10 000 (1957-1971) Ministry of the Environment of the Slovak republic. Available: https://geoportal.gov.sk/gallery/datasets/detail/16334c58-c447-4a3b-96a7-a3d8dc8dd70b

Trenčiansky, M., et al. (2025). Current Issues and Challenges in Slovak Water Reservoir Management 15(1), 1-21, ISSN 2073-4441

Verdhan, T. (2025). Short-Term Forecasting of Reservoir Water Levels for Recreation Management: A Case Study from Taiwan **1**(1) 1-12, ISSN 2693-5015

Acknowledgement

This research was supported by The Slovak Research and Development Agency (SRDA) Under project N. : APVV-24-0101 Biosphere reserves as living laboratories.

Souhrn

Práce analyzuje změny krajiny v oblasti Vodní nádrže Hriňová od roku 1764 do současnosti pomocí historických map a GIS. Hodnotili jsme historické silniční sítě, vodní toky, železnice, mosty a propustky, přičemž nejvýraznější změny nastaly v období před a během výstavby nádrže (1952–1971). V tomto období došlo k významným změnám v délce komunikací, vodních toků a počtu mostů – před výstavbou bylo v území 13 mostů, po jejím dokončení již žádný. Výsledky ukazují výrazný

lidský zásah do krajiny v důsledku realizace vodního díla, které dnes slouží jako zdroj pitné vody a je významným prvkem na hranici Biosférické rezervace Poľana. Práce zdůrazňuje důležitost historických map a GIS při monitorování a hodnocení změn krajiny v čase.

Contact:
Mgr. Adam Čaplák
E-mail: adam.caplak@ukf.sk