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Database of extinct historical objects in the Vltava river valley

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Summary: The Vltava River used to be an important trade and transport route in the past, with its beautiful landscape favoured by many and permanent hydropower essential for the regional economy. Nowadays, it is the river on which the largest dam reservoir system in the Czech Republic was built, with water management, hydropower and recreational use. Landscape along the Vltava river changed intensively, the life in the area as well as many important objects related to the river vanished, they were demolished or just flooded. The main objective of the project supported by the Ministry of Culture of the Czech Republic is to create a comprehensive information system about the Vltava River aggregating and incorporating various historical and modern documents and data. The integral part of this system is a database of cultural, hydrological and other objects related to the river, which disappeared or, on the contrary, were built during the construction of the dam reservoir system. Within the project the database is filled using existing data sources (e.g. specialized database of water mills) or new data are added on the basis of combination of object position on old maps, textual or graphic information in other documents (books, archive material, building plans, photographs, post-cards, iconography) and terrain research. The information system uses old and current 2D maps as the elementary positional interface. Moreover, 3D models of the landscape or detailed 3D models of selected objects are being created and will be linked with the database and easily accessible through the system. Last but not least, geolocated couples of old and present photographs (taken during low water level) are a great complement of the database entries.

Introduction

The database is being created within the project supported by the Ministry of Culture of the Czech Republic. This project is focused on the historic Vltava River valley, especially from the 18th to 20th century (Janata and Cajthaml, 2018). The aim of the project is to collect as much archive material as possible including maps, plans, photographs and others. The comprehensive information system about the historic valley is intended to be the main output (Krejci and Cajthaml, 2019). Alongside the information system we are working on the modelling of historic DTM (Pacina and Havlicek, 2015). This model will result in the virtual environment as well as physical models in the areas flooded by water reservoirs built in the second half of 20th century.

In the area of the Vltava River valley, we are interested in objects from many areas of interest. There are hydrotechnical structures like dams, weirs, mill races there. Water crossings like bridges, ferries, fords are in the scope as well. Other structures like embankments, roads, important buildings (mills, guesthouses) are important too. As a part of the final information system, the database of these points of interest is being created. The database itself is not very complicated, but in the beginning, we are facing a harmonizing of all the sources, connecting data together and creating a robust database schema. The current state of the issue in this field includes many local databases focused on

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the specific topic (like water mills) or on the other hand there are no databases for other features (like ferries or weirs). We would like to gather all existing data, create new vector data based on the old maps and present them through the information system to the broad public. The data can be used in the history research and can serve as a landscape memory.



Figure 1: Historical photograph of extinct Moran settlement

Data sources

There are large volumes of miscellaneous historical and modern data sources dealing with the Vltava river which are being used in the project. Extensive research of various public and institutional archives is currently still being carried out. Some resources such as old photographs and postcards are found also in private collections.

First of all, there are various works from old cadastral maps, old river maps with cross sections, longitudinal profiles of the river, old site plans and interesting building plans, State Derived Map and aerial photographs from 1950s, site and constructional plans of dams to the up-to-date cadastral map, orthophotos and DTM. These cartographic works were already processed (scanned, georeferenced, vectorized) and employed in the project, therefore were well prepared for data extraction.

The Imperial Imprints of the Stable Cadastre (scale 1:2880) from the years 1826–1843 rank among the most valuable and very useful. Due to their geometric precision and visual attractiveness, these maps are the most suitable for object (bridges, ferries) vectorization. We georeferenced them into a seamless mosaic that shows root mean square error (RMSE) about 3 meters.

Three Military Mapping Surveys of the Habsburg Empire are important sources about the landscape during the 18th and 19th century. They are created in middle-scale 1:28 800 (for 1st and 2nd mappings) and 1:25000 respectively (for 3rd mapping). Many important objects from the military point of view like bridges are depicted, some small ferries are missing. The 1st Military Mapping

(1764-68) has no geodetic basis and therefore its georeferencing shows RMSE about several hundred meters. Its image is more or less informative (Cajthaml and Janata, 2016). On the other hand, the 2nd (1836-52) and 3rd (1876-80) Military Mappings were based on the previous cadastral mapping and are very precise (RMSE about 20 meters).

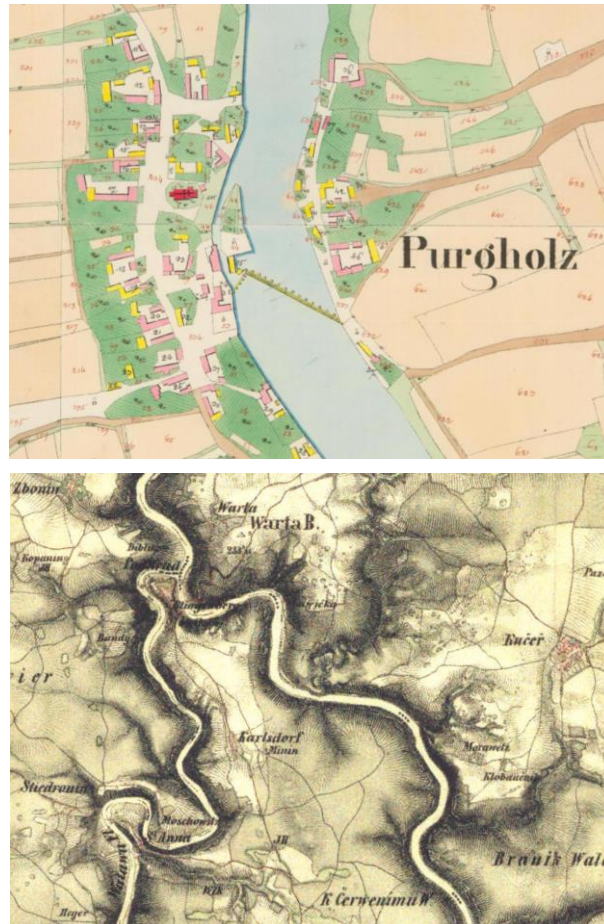


Figure 2: Depiction of maps of Stable cadastre (left) and 2nd Military Mappings

There are many different site plans and building plans of the Vltava River related buildings and structures both historical and modern. Plans can supplement map layers for higher detail and position accuracy and can be also used for 3D modelling of extinct important buildings (e.g. churches, mills, bridges). Old river maps are very variable. They are dating back from mid-18th to mid-20th century, some are handmade, and other printed, covering the whole stream or just part of the river. The maps also differ somewhat in the level of graphic processing, but also in the degree of accuracy and completeness of the state of things.

Valuable source of information was also the longitudinal profile of the Vltava River from 1940. The covered area is displayed very precisely, with all height marks (not even on the river banks), flood marks, hydrotechnical or other important objects, confluences with other rivers and streams etc. with their distance to the confluence with the Labe River. The profile contains information about river banks heights and the most damaging historic floods as well. Another source is Canoeing and river descending map from 1938 with a schematic depiction of weirs and their crossings.

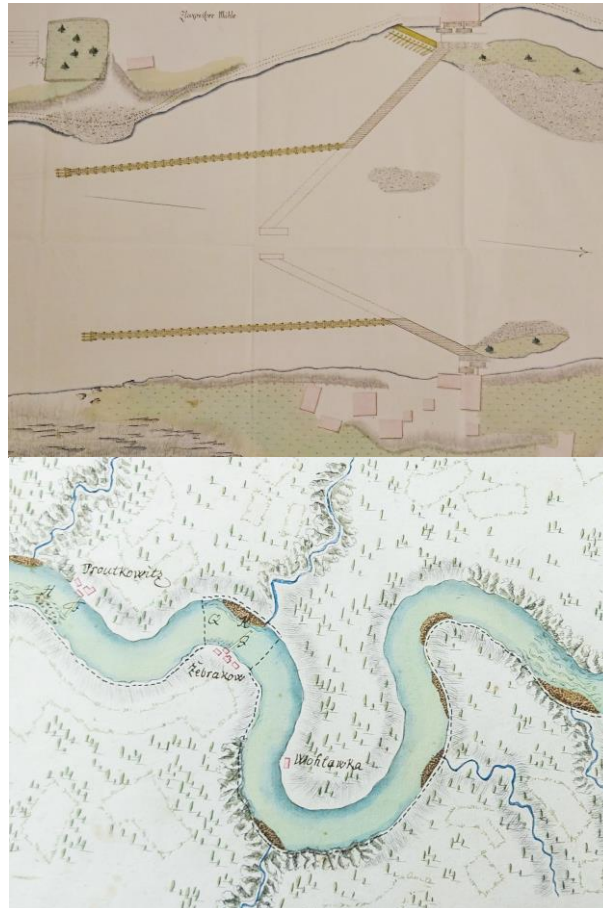


Figure 3: Example of site plan (left) and old river map

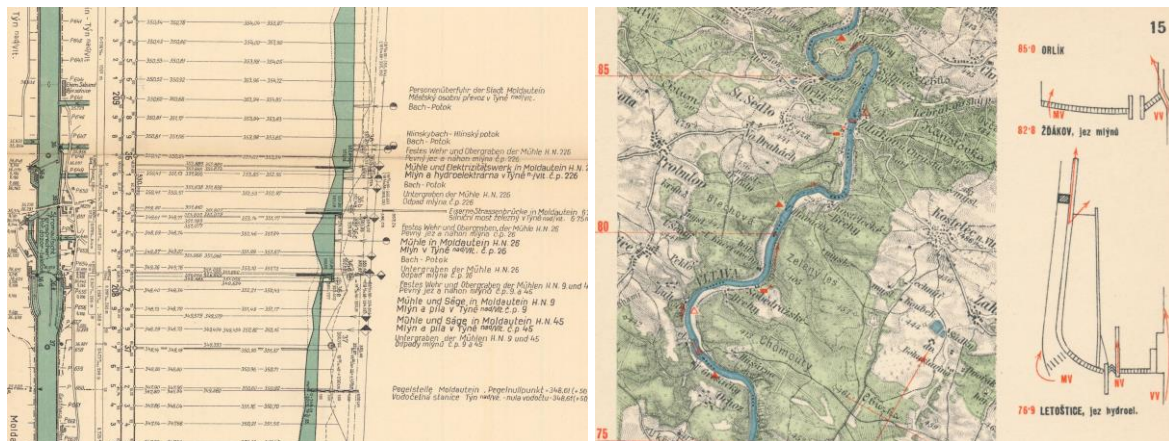


Figure 4: Depiction of longitudinal profile (left) and Canoeing and river descending map

Apart from the old maps it was necessary to search existing data sources about our points of interest. These local databases are usually under management of physical persons or interest associations. Unfortunately, many of them are focused on the modern history of the 20th century. We contacted two most important and suitable web pages that are in the scope of our project.

The web <http://www.stara-vltava.cz/> is gallery of old photographs from the Vltava River surroundings. It contains thousands of photographs, but their geolocation is made only as a connection with nearby villages or homesteads. In the project the author of the web page Vojtěch Pavelčík was invited and is an invaluable member of the project team. His job is to geolocate selected photographs

so that they could be visualized on the map. He is also responsible for other sources of old photographs to search and obtain.

The web <http://vodnimlyny.cz/> is database of all water mills in the area of Czechia. It contains thousands of entries with much information about each mill. In our project, we are interested only in mills on the Vltava River. We established cooperation with Rudolf Šimek the author of the web page and database administrator. We obtained a basic database table with general information about each object and link to the database of mills. Thus, our information system will be connected with existing one. This is the way we would like to go with other information systems.

The combination of previously described sources leads us to collect the data about the Vltava River points of interest into the database model, which is being filled. Database is connected to the web mapping application; thus, records can be presented over various map layers.

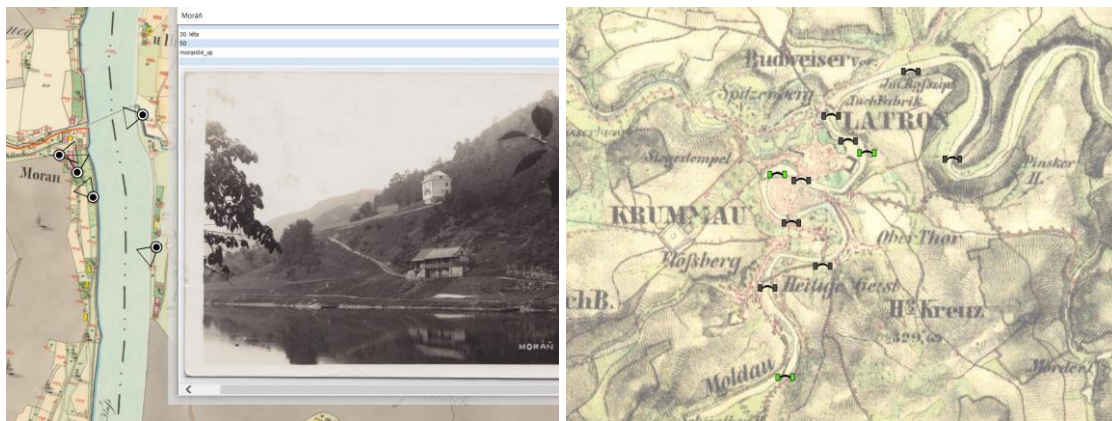


Figure 5: Depiction of localised photograph on background of the Stable cadastre map (left) and on background of the 2nd Military Mappings

Database

The data obtained from various sources has to be stored in a harmonized way into the database keeping their relations. Therefore, a robust database schema was designed. It is based on three main tables for storing the important attributes of objects, photographs and related documents (maps, situation and floor plans, archival documents, etc.). Although any of these tables has its own importance in the project and may serve separately, they are connected via the table of Objects. Only records in tables of Objects and Photographs also have geographical information. There are several additional tables designed for frequent or mutual characteristics. Each table is designed with a wide range of attributes covering all the necessities of the evolving information system. Tables were designed to allow store information about various kinds of heterogeneous objects, documents and photographs in a unified way. Such a database model is being filled while it is creating a harmonized and easy to visualize data model of historical extinct objects accessible via web mapping application. All the objects and photographs keep comprehensive information about themselves (e.g. related documents with its descriptions) enabling subsequent historical research or just interest of the general public. Filtering of data by attributes or full text search will be enabled to serve this purpose.

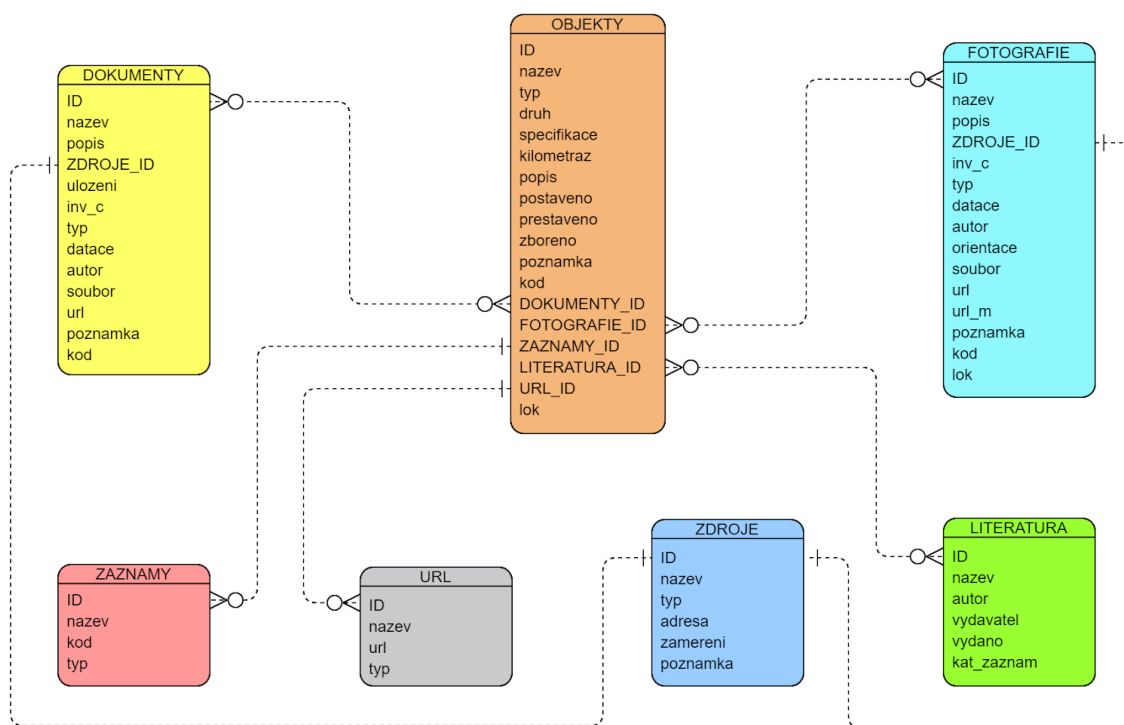


Figure 6: Database schema

Results

The mission of the project is, in particular, to document information on the changes of the Vltava riverine landscape within the last three centuries in the context of various events, as well as to make it subsequently available to the general public. Established Database of extinct historical objects is the one of the outcomes which is fulfilling that point using modern cartographic and online mapping methods. The project accessible on <http://www.vltava.onmaps.cz> is actually still in the process, the activities proceed continuously and the database is being filled.

Acknowledgements

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