

## **Rectification of historical topographic maps: a tool revealing the course changes and dynamics of Lower Gaula River, South Trondelag, Norway**

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The 1:50,000 and 1:100,000 scale historical sheets of the Norwegian topographic 'Rektangelkart' map series were georeferenced, in order to obtain the original hydrography of the Gaula River, at a ca 50 kilometer long section between Støren and the estuary to the Gulosen Bay. The 1:50,000 scale sheets are the earliest systematic topographic works of the area, surveyed in 1866-9, while the smaller scale sheets were surveyed forty years later, in 1906-8. Both series represent a river status before the extensive control works. Thus, together with the modern, present-day cartographic and GIS products, these two 'snapshots' from 100 and 150 years ago show not only the original, uncontrolled status of the river but also some elements of the natural changes of the course/thalweg.

To make the georeference, instead of using terrain points, the geodetic parameters of the Norwegian 'Rektangelkart' series were defined in GIS environment. The Cassini map projection was defined with a projection center in the fortress of Kongsvinger, Eastern Norway, some 350 kilometers from the study area. Knowing the sheet labeling system and the terrain position of the sheets in this Cassini projection, only their four corner points were defined in all sheets. The accuracy of the horizontal control of georeferenced was less than half map millimeter (25/50 meters).

The sheets show an interesting meander cutoff process between Ler and Kvål. In 1869, the meander curve is still active and fully operating. A cutoff channel is clearly mapped in 1906, together with the old one. Nowadays, almost no map signs show the old channel course, however in the field, it is still traceable. Another interesting map element shows the complete bar structure in the channel. These gravel bars showed a different pattern in the old maps, as there were more gravel sediments in the time before the building of upspring reservoirs. Gravel bars are important in some environmental processes, eg. as salmon habitats, This database shows their original status, providing an important input for environmental engineering.

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