Resources and Roman Land-use in Southeast Noricum: a GIS case study

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Introduction

Southeast Noricum counts as one of the best researched archaeological landscapes in Austria. It is especially important to draw attention to the specific topographic position between the resource-rich Alps and the Amber road (fig. 1). Besides the municipium Flavia Solva/Wagna 31 Roman settlements in the plains of Graz and Leibnitz (Grazer, Leibnitzer Feld) as well as in the river valleys of Laßnitz and lower Mur are documented. Due to excavations and geophysical prospections six of them can be clearly defined as villae (rural estates), five as settlements with commercial and trading function (often referred as vici).

![Fig. 1. Southeast Noricum, main research area in the plains of Graz and Leibnitz (Grazer, Leibnitzer Feld) and the river valleys of Laßnitz and lower Mur. Red squares: central places. Red dots: selected settlements. Blue squares: villae (© ÖAW/ÖAI, GIS Steiermark).](image)

The high-resolution Geodata available for this region (including 1 × 1 m Digital Elevation Models, the Austrian soil map 1:10 000\(^1\) or the Franziscan Cadastre from 1820–1825 as WMS-Service\(^2\)) offer a rare opportunity to analyse the ratio behind the Roman utilization of resources and territory in detail.\(^3\) The main research question can be summarized as follows: why are villae and settlements situated where they were documented? E. g. do villae and settlements continue using prehistoric sites? Or are villae preferably located in areas with good soil, settlements at traffic junctions regardless of former land-use?


\(^{3}\) The works are carried out as a Master thesis at the University of Salzburg (UNIGIS MSc, supervisor Dr. Christian Neuwirth).
Methodology

Spatial techniques mainly used to answer research questions concerning resources and territories can be summarized as least-cost analyses. For this study site catchments and least-cost paths were calculated with different parameters (Wheatley and Gillings, 2002, pp. 157-163).

Both analyses are based on raster surfaces representing costs of moving through each cell (cost surface). The resolution of cost surfaces used in the majority of recent works range from a minimum of 5 × 5 m to a maximum of 90 × 90 m, assuming that raster grids with a coarser resolution provide better representations of the paleogeography (Herzog, 2014, p. 224 tab. 1). While rougher surfaces blur out modern features such as streets, buildings and regulated rivers, they also neglect changes in the terrain like small hills or ridges that could be important for the results of the analysis. This case study generated a 1 × 1 m cost surface based on the 1 × 1 m Digital Elevation Model derived from LiDAR-Data (GIS Steiermark) as well as rivers and wetlands mapped in the Franziscan Cadastre (1820–1825). Utilizing land-use data modern features such as streets, buildings and regulated rivers were filtered from the Digital Elevation model (fig. 2).\(^4\)

In the following step different cost surfaces were generated; two representing the time it takes for a human and oxen to cross the landscape based on Tobler’s hiking function for the site catchments\(^5\), another one containing postulated friction costs for the construction of a Roman road for the least-cost paths.\(^6\) Site-catchments as well as least-cost paths were then calculated using the Tools implemented in the Spatial-Analyst-Extension in ArcGIS.

Combined with the high-resolution Geodata the availability and quality of arable and pasture land as well as other resources like water, timber, ore and clay deposits or quarries were examined in the area of one hour walking distance for a human and one to two hours walking distance for oxen. Furthermore it is possible to evaluate the walking distance to other find spots (fig. 3).

In a final step traces of Roman land surveying should be validated and analysed with geostatistics.\(^7\) The good stage of research in South-East-Styria allows asking sophisticated questions, e. g. for the relation between the orientations of parcels mapped in the Franziscan cadastre (1820–1825) to the municipium Flavia Solva/Wagna as well as the different settlement sites with known layouts.

The presentation gives an overview over the used data, methods and first results, focusing on the surprising new insights into Roman territorial systems derived from high-resolution geo-information.

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\(^4\) For the same approach providing very good results cf. Schmidt et. al., 2018.

\(^5\) Tobler, 1993. The values of a human being were divided through 2/5 to estimate the walking time of oxen.

\(^6\) It is assumed for example that a straight layout is more important than small variations in slope.

\(^7\) Cf. the GIS-based case study concerning the limiatio in the hinterland of Carnuntum: Gugl, 2005, p. 109.

References


