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APPLICATION OF ALS DATA IN THE VERIFICATION OF HISTORICAL MAPS

ALS DATA IN HISTORICAL GEOGRAPHY AND ARCHAEOLOGY

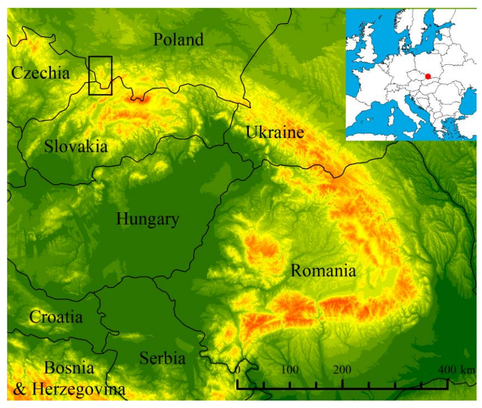
There has been a growing interest in using ALS (airborne lasser scanning; LiDAR) data in historical geography and archaeology research since the beginning of the 21st century. The application of ALS data enables to obtain of a very accurate Digital Terrain Model. **This model could be used to detect marks of long-term human activity**. Hence, apart from archival maps, it could be a source of information on historical land use.

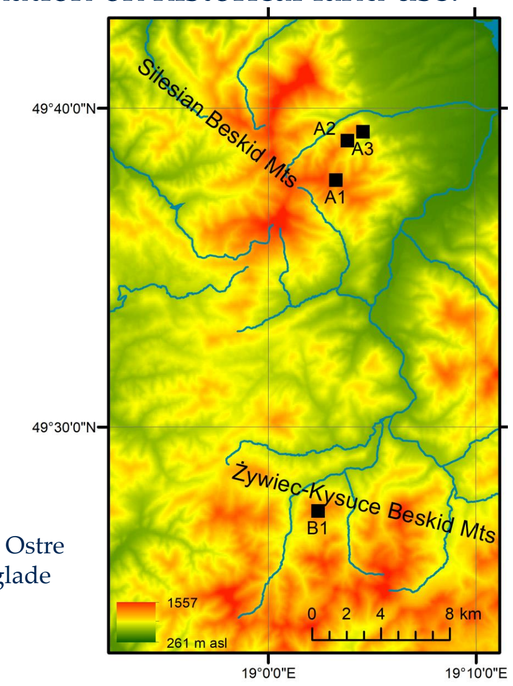
RESEARCH AIM

The research aims to **present the example of the use of ALS data in the reconstruction of historical land use** to assess former human impact on the environment.

1. The maximal range of deforestation in the Western Carpathians connected with agricultural activity fell in the mid-19th century (Kozak 2010).
2. At that time, arable fields were set at higher elevations and on sloping hills, although most sites were unsuitable for crops (Sobala et al. 2017).
3. Historical land use structure for this period is presented on Austrian cadastral maps from 1848.
4. The question is whether Austrian cadastral maps present the image of the most transformed environment in the Western Carpathians due to agricultural activity.

STUDY AREA



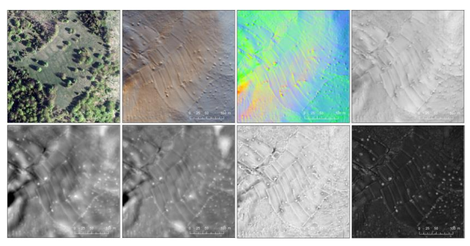


Western Carpathians (Poland)
4 test areas: A1 – Radziechowska glade, A2 – Ostre glade, A3 – Slopes of Ostre, B1 – Praszywka glade

MATERIALS AND METHODS

ANALOGUE HISTORICAL CADASTRAL MAP → scanning, rectyfication, digitazation, error correction → DIGITAL HISTORICAL CADASTRAL MAP → land use analyses

DIGITAL TERRAIN MODEL (DTM) → visualisation techniques → MHS, PCA, SCF, LRM, OPP, OPN → terrain forms detection

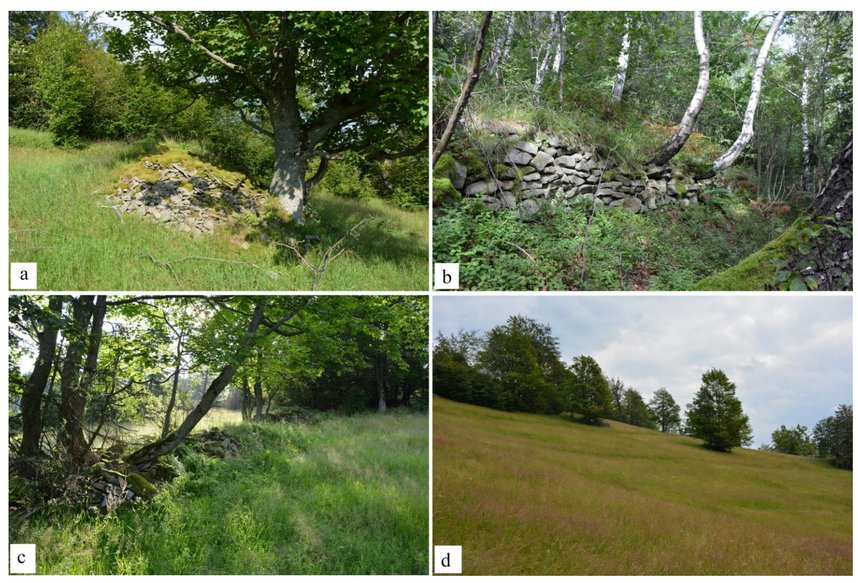


MHS – multiple hill shading, PCA – principal component analysis, SVF – sky-view factor, LRM – local relief model, OPP – opositive openness, OPN – negative openness

FIELD STUDIES → terrain forms detection using GPS receiver

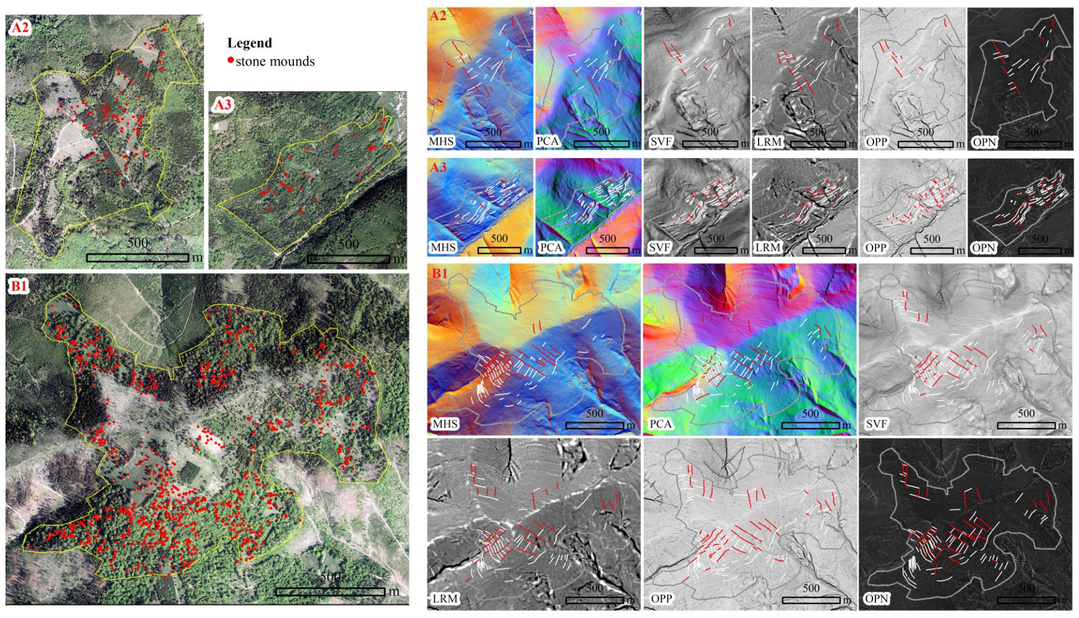
Terrain forms typical of arable fields:
a) stone mound, b) stone wall,
c) lynchet, d) terraces

Austrian cadastral map (1848)
- produced for the former Austrian Empire in 1817-1880s.
- covers at least partly the contemporary area of Czechia, Slovakia, Austria, Poland, Slovenia, Hungary, Ukraine, Croatia, Romania, Bosnia, and Serbia

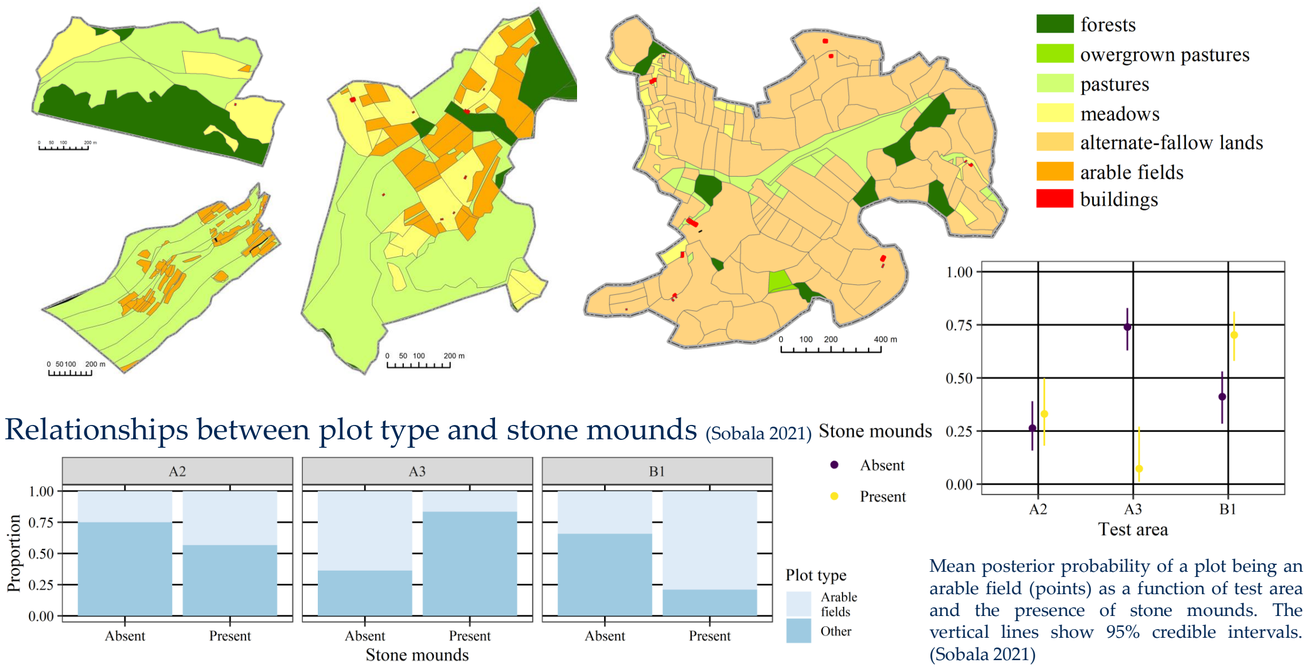


COMPARISON

Location of stone mounds (red dots), lynchets (red lines) and terraces or stone walls (white lines) (Sobala 2021)



Land use structure based on Austrian cadastral maps (1848)



Relationships between plot type and stone mounds (Sobala 2021)

Mean posterior probability of a plot being an arable field (points) as a function of test area and the presence of stone mounds. The vertical lines show 95% credible intervals. (Sobala 2021)

CONCLUSIONS

1. The historical land use analysis based on anthropogenic terrain forms using ALS allows historical maps to be verified.
2. The results of ALS analysis must be verified during field studies. Not all existing terrain forms can be clearly identified based on ALS and field studies. Hence, it is impossible to determine precisely the historical structure of land use.
3. Anthropogenic terrain form inventory can be used for land use assessment when historical maps have not been preserved or when available maps do not present land use in detail.
4. The degree of transformation of the environment connected with land cultivation in the Carpathians in the 19th century could be greater than the image visible on cadastral maps from 1848.

Acknowledgements
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References

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