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Agnieszka Latocha

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Geomorphic Evidence of Past Human Activity: Examples from Depopulated Villages in the Sudetes Mountains, SW Poland

Depopulation; soil erosion; human impact; land abandonment; anthropogenic landforms; Sudetes.

The aim of the research was to identify traces of former different land use (intense agriculture, more extensive settlement network) in the contemporary landscape of areas which are now depopulated and abandoned. The Sudetes Mountains have been subject to intense depopulation and land abandonment since the 1880's and the trend intensified after the Second World War.[1] However, remnants of past human activity can be still recognized in the landscape.[2] The study was based mainly on the geomorphic mapping of old anthropogenic landforms, including their morphometrical characteristics, and on sedimentological analyses (including laboratory analyses) of deluvial and alluvial sediments, which record the evidence of past agricultural land use. Additionally, old carthographic and historical materials were used for comparative studies. The detailed studies were conducted in the central part of the Sudetes—in the Stolowe Mountains, where 12 settlements have disappeared completely (19%) and 33 (54%) have been subject to intense depopulation.[3]

The legacy of past human occupancy and intense activity in the depopulated areas is still readable in the contemporary landscape as various types of anthropogenic landforms and features.[4] The main remains are ruins of buildings. Even though they are preserved in various conditions, the outlines of former farmsteads are clearly detectable in the relief, as they form artificial level surfaces (settlement terraces) within slopes and valley bottoms.

Landforms connected with former agricultural land use are the second group of anthropogenic features. They include the network of field-access roads, which form local road gullies. The morphometric parameters of the gullies vary in every catchment (they are from 20 to 720m long and from 0,4 to 4m deep, with the usual depth ranging between 0.8–1.5m). Road scarps, which are very frequent in the area, are more common than gullies. They are 0.5 to 4m high (usually 1–2.5m) and 50–940m long. Most of the roads are no longer in use and the road gullies are either partially filled up with mineral and organic matter or they are preserved as a result of being overgrown by dense grass and shrub cover (Fig. 1). The density of old unpaved roads was 7–10.2km/km^{2}in the 19/20th century whereas nowadays it is only 1.3–5km/km^2.Other anthropogenic scarps, which originated as agricultural terraces, are indicative of previous different land use. The

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1 Ciok 1995.
2 Latocha 2009.
3 Latocha and Roszczewska 2011.
4 Migoń et al. 2011.

Fig. 1 | Old, inactive road gully is well preserved in the landscape due to grass cover and tree roots (photo A. Latocha).

agricultural terraces are evidence of former ploughing while nowadays they occur within hay meadows and pastures. The average height of the terrace scarps is 0.5–1.5m. Other landforms connected with former agricultural land use are embankments and heaps of stones collected by farmers from arable grounds to facilitate ploughing. Nowadays they are usually overgrown by vegetation, mainly by xerophilous species, due to the high permeability of their loose, open-work structure. They are a common landscape feature and vary in density and size. The height of these landforms ranges between 0.5 and 3m (usual value is 1.2–2.5m) while the length of stone ramparts may reach up to 350m. Some of the ramparts used to have a form of regular stone walls. However, they have collapsed in many places and their previous structure has been obliterated.

The third group of anthropogenic features is connected with water management. They include various hydrotechnical constructions such as bridges (preserved or partly destroyed), subterranean water passages (culverts under the roads), stone- or concrete-cased riverbanks, flood-and-debris control dams. Subsequent to depopulation of the area, the dams were not cleaned and nowadays are filled with sediments. In spite of this, the stone constructions of the dams are still clearly visible. The channel lining (stone or concrete) was common for mountain streams within all inhabited areas in the Sudetes. However, due to the lack of maintenance, only fragmentary and local remnants of former lining have been preserved in most areas. In the Stołowe Mountains, the only exception is Pasterka, where the channel lining has been preserved on numerous stretches along the stream, which constitutes the main settlement axis of the village.

Contemporary land use, which is dominated by grassland (meadows and pastures), does not support surface wash. However, the wide extent of arable grounds in the past, which can be seen on 19/20th century topographic maps, resulted in efficient soil erosion from ploughed slopes. The evidence of this process is recorded in the contemporary environment as deluvial sediments of anthropogenic origin. The detailed investigations of slope covers were conducted along slope profiles in four areas of former agriculture. The fine-grained deluvial sediments, which are the results of surface wash from ploughing fields, are especially thick in the lower parts of slopes and in slope flattenings, both natural and anthropogenic, such as agricultural terraces or road scarps. However, the legibility of sedimentological evidence of human-induced soil erosion depends on the lithology. Within the granite bedrock, the natural and human-induced layers of slope material can be distinguished quite easily (Fig. 2), while within the sedimentary rocks (especially in marls and mudstones), the separation of these two main genetic layers is much more

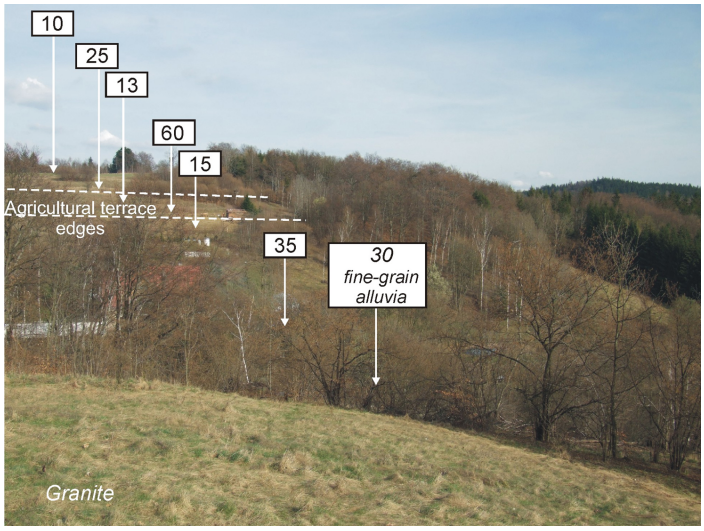

Fig. 2 | Thickness (in cm) of fine-grained human-induced slope and alluvial deposits on granite bedrock—former arable grounds (photo A. Latocha).

difficult due to a large amount of fine grains in the entire slope cover profile. In such cases, the occurrence of anthropogenic artefacts (charcoal, pieces of bricks) may help to estimate the thickness of deluvial layers connected with agriculture and soil erosion.

In the fluvial domain, the material washed down from arable slopes to stream channels was accumulated during floods, which led to a successive build-up of alluvial sediments on the valley floors. The human-induced alluvia can be as thick as 30–40cm in granitic areas (Fig. 2) and 50–60cm in the sedimentary bedrock.

Both slope and alluvial sediments can be treated as archives of past human activities, as nowadays such types of sediments only form very locally and are connected mainly with unpaved roads linking slopes and valley floors.

The results show that past human activities can have long-lasting effects on the landscape. They are recorded directly as anthropogenic landforms, and indirectly as human-induced slope and valley floor sediments developed under more intense human impact in the past. However, human impact on the landscape in the study area varies even in adjacent areas and the intensity and extent of the impact depend heavily on environmental conditions such as lithology and morphology.

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Agnieszka Latocha, University of Wroclaw, Institute of Geography and Regional Development, pl. Uniwersytecki 1, 50-137 Wroclaw, Poland, agnieszka.latocha@uni.wroc.pl