

Contemporary landscape of depopulated areas as a mosaic of relict and active landscape features (Stołowe Mts case study)

Agnieszka Latocha

University of Wrocław, Institute of Geography and Regional Development, pl. Uniwersytecki 1, 50-137 Wrocław
e-mail: agnieszka.latocha@uni.wroc.pl

Abstract: The study area (Stołowe Mountains) was subject to intense depopulation, which started at the end of the 19th century and was intensified in the 1950-60'. The aim of the study was to identify the landscape changes, which followed the abandonment of the region. The study was based on analysis of historical sources, including topographic maps from the 19th C), and on detailed field mapping and measuring of the anthropogenic landforms. The reduced human impact in the study area within the last century resulted in the following main landscape changes: (1) land use changes, especially the increase of grassland at the expense of arable grounds; (2) reduction of the settlement network (some of the villages disappeared completely); (3) dilapidation of other anthropogenic constructions; (4) reduction of the density of field roads. The spatial distribution of observed landscape changes is very uneven in the study area – the areas with substantial changes, such as total abandonment of settlements and increase of forest stands are adjacent to places, where the general landscape features stayed intact for centuries (e.g. central part of the Stołowe Mts with the highest elevation and rocky slopes). Most of the landscape changes are connected directly or indirectly with anthropogenic factors. They include both the tendency towards decreasing human impact (depopulation, withdrawal of agriculture, legal nature protection after the establishment of the Stołowe Mts National Park), the human efforts to maintain the present state of the environment (e.g. repairing of roads and tourist paths, maintenance of old orchards) and also the restoration of former landscape features (e.g. renovation of old flood-control dams). Therefore, the resulting contemporary landscape forms a very diverse landscape mosaic, with incorporated relict features of the old landscapes, which can still influence the present environmental processes and habitat changes.

Key words: landscape change, depopulation, anthropogenic landforms, relict landscape, Stołowe Mountains

Introduction

Landscape has the ability to store the history of the region – various elements of the landscape structure may represent different stages from the environmental history of the area, reflecting also the subsequent phases of socio-economical changes within the region (Richling, Solon 2002). In this way the landscape structure and composition is the landscape 'memory' (Antrop 2005). It is especially well visible in the depopulated areas, where traces of former more intense human activity are still preserved in the landscape as anthropogenic landforms and features or human-induced changes of habitats and morphological processes (e.g. Wolski 2007, 2009). In this way these old, direct and indirect results of human impact on the environment become remnants of the former, different land use. The relict features become incorporated into the present landscape. In some cases these old anthropogenic landforms can still influence contemporary environmental processes and thus influence further transformation of the landscape and of the anthropogenic features themselves. Therefore

the contemporary landscape of abandoned areas can be described as a mosaic of relict and active landscape features. That phenomena is known from many European regions, especially in mountains and uplands, which were subject to depopulation during the last century or last decades (Baldock et al. 1996).

The article presents the problem of landscape transformation due to the land abandonment on the example of the Stołowe Mountains National Park but it can be representative to some extent for the entire Sudetes Mts (SW Poland). The region was subject to the intense depopulation, which started at the end of the 19th century and was intensified in the 1950-60' (Miszevska 1989, Ciok 1994, 1995). The socio-economical transformations were reflected in the changes of the main elements of the landscape structure, which included the reduction of the density of settlement and field road networks, and changes of land use, including the development of secondary vegetation succession on abandoned arable grounds (Chachaj 1978, Plewniak 1978, Salwicka 1983, Latocha 2007, 2009 a). A new trend of the landscape transformation can be observed in the Sudetes since the late 1990's, namely the increase of number of single family houses, which again influences the spatial distribution of settlement network (Latocha 2009 b). Furthermore, new trend in the land use changes can be observed in the Sudetes since 2004, when Poland has joined the European Union (Mastalska-Cetera 2006, 2008). The access to various environmental funds and agri-environmental schemes and development projects results in the reduction of areas of spontaneous secondary vegetation succession. However, the above mentioned new trends, which are typical for most of the areas in the Sudetes, do not occur (or only at a very minor scale) within the study area. The establishment of the national park in 1993 effectively limited the negative results of excessive human impact on the landscape, which can be observed in other Sudetic regions in recent years. Therefore the study area is very suitable for tracing the persistence of old landscape features, which are still preserved in the contemporary landscape. The research questions addressed in the study were as follows: (1) What are the landscape changes in the depopulated areas, what is their scale and spatial distribution?, (2) Which old anthropogenic features are still developing (active landforms), which are vanishing and which are preserved (relict landforms)? (3) What is the role of human impact on the present state of the depopulated areas?

Materials and methods

The study was based both on historical analysis and on field mapping. The first one included analysis of archival historical data and cartographic materials (topographic maps Messtischblatt 1:25 000, sheets: Bad Reinerz 1884/1928 and Lewin 1883/1919), which were compared with the contemporary maps and statistical data. The field investigation included mapping of anthropogenic landforms and features, their morphometrical characteristics as well as an assessment of their state of preservation/ degradation and the trend of alternation. The collected archival and field data were further analyzed using the GIS software and methods. The study was conducted within 5 catchments in the central part of the Stołowe Mountains National Park, which were areas of former settlements and agriculture (fig.1)

Results

Land use changes

The type of the land use and land cover is one of the main landscape features. It is also very vulnerable to changes. The comparison of the land cover presented on the topographic maps from the 19th century and the present airborne photographs reveals, that the basic land use change in the study areas refers to the arable grounds, which have been entirely turned into the hay meadows and pastures, which dominate in the contemporary landscape. Surprisingly, the increase of forest stands has not been so spectacular as it can be observed in other parts of the Sudetes (Staffa 1990, Zimny 1996, Latocha 2007) and it has been calculated for around 4 sq. km (8%) for the entire area of the central part of the Stołowe Mountains National Park. Such a minor increase of the forested areas can be explained by the natural environmental conditions, as the vast areas are occupied by the highest mountain massifs in the Stołowe Mountains, such as Szczeliniec Wielki, Szczeliniec

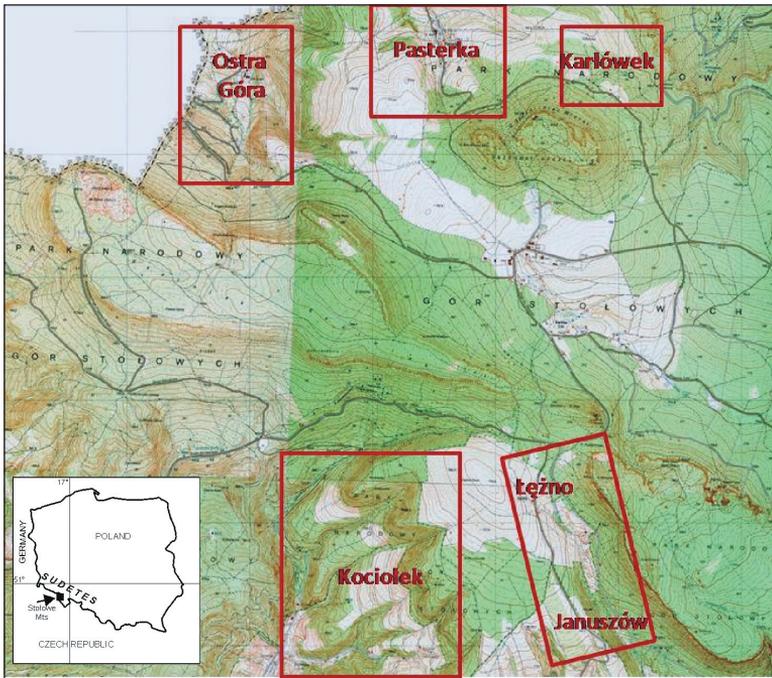


Fig. 1. The study areas with the names of the settlements (existing and vanished)

Mały and Skalniak. They form isolated plateaus with rocky cliffs, numerous bedrock outcrops and steep slopes covered with rocky debris. As a result, these areas were never suitable for agriculture, therefore the increase of forests due to the secondary vegetation succession on abandoned grounds is relatively of minor importance than in other regions. The increase of forest stands is limited mainly to the areas of former settlements. Another typical landscape feature in the study areas is the occurrence of the isolated areas of fruit trees, which are found nowadays often within small forest clearings, in the vicinity of former settlements. They are another example of the land use change and can be classified as the remnants of the old landscape.

Reduction of the settlement network

In the period of the maximum population, which is dated for the turn of the 19/20th century, there were 62 settlements within the entire region of the Stołowe Mountains. By the present day 12 settlements (19%) disappeared completely and in 33 settlements (54%) the process of depopulation was observed at various scales (own calculation based on Staffa 1992). In the study areas the only village, which maintained its status as an independent administrative unit, is Pasterka, even though the number of its inhabitants was reduced from 572 in 1910 to only 18 in 2010. Two other settlements, Karlówek and Januszów, disappeared completely, while in 1910 there were 49 and 104 inhabitants adequately. Three remaining settlements (Ostra Góra, Łężno and Kociolek) were intensively depopulated and remained only in a vestigial form (several farmsteads). Nowadays they are incorporated administratively into the nearby bigger villages.

In the contemporary landscape the traces of all the former villages can be detected, mainly as the ruins of houses and other farmsteads' buildings (fig. 2). Many ruins are located now in the forests or within the small forest clearings. The exception is Pasterka, where ruins of former farmsteads are located next to the inhabited buildings within the vast open areas of agricultural grounds. In contrast to villages, which disappeared completely, the settlement structure in Pasterka was only thinned out.

The ruins of old buildings are preserved in various conditions with general tendency to become less and less discernible in the landscape. In some cases the remnants of farmsteads, especially in places where only underpinning is left, the location of former human occupation can be traced only on the basis of a vegetation type, which is different than in the adjacent areas. However, even though the construction of former buildings may be not well preserved, the slope flattenings (the settlement's terraces) are still well recognizable in the

relief. In general the remains of former farmsteads and their present landscape expression can be classified as the relict landscape features (fig. 3).

Dilapidation of other anthropogenic constructions

Besides the remains of the buildings, other anthropogenic constructions are also preserved in various state in the landscape of the depopulated areas. The first group includes various hydrotechnical constructions, such as bridges, subterrain water passages (culverts under the roads), stone- or concrete-cased river banks and flood-control dams. These constructions are usually only locally well preserved, while in the most places they are either preserved fragmentary or the constructions have collapsed but they can be still discernible in the landscape. The second group of the anthropogenic constructions, forming new landforms in the relief, is connected with the former agricultural land use. Numerous stone ramparts and piles of various extent and size are spread in all the study areas (fig. 4). They are evidence for former arable grounds, as they are built of stones collected by farmers from the fields in order to facilitate ploughing. Some of the rampart used to have a form of a regular stone wall, however, they collapsed in many places and their previous structure was obliterated. Most of the stone ramparts and piles are nowadays overgrown by vegetation - trees, shrubs and various xerophilous species, as they are dry habitats due to the high permeability of their loose open-work structure.

Another example of anthropogenic landforms connected with former agricultural land use are the agricultural terraces. These landforms are also indicative for former ploughing, however, nowadays they occur (mainly in the vicinity of Pasterka village) within the hay meadows and pastures. They are still discernible in the landscape as the slope breaks and scarps, even though in many places the scarps are overgrown by dense shrub and tree cover and the general tendency of the terrace's scarp development is to lower down and to obliterate the slope break due to various slope processes, mainly creeping.

The third group of anthropogenic constructions is connected with the network of old roads – within some of the roads old stone pavement is preserved. It can be found in many places although in most areas only short and isolated stretches of the pavement are preserved. In general, all the above mentioned anthropogenic constructions can be classified as the relict landscape features, as they are preserved mainly fragmentary and

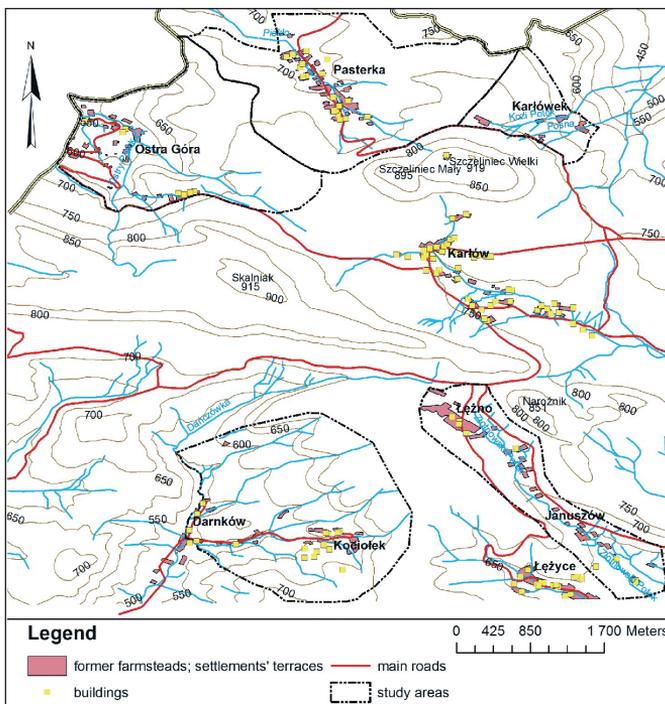


Fig. 2. The present settlement network in the context of the extent of former farmsteads and built up areas (at the end of the 19th century)

they all show tendency to decline and to become obliterated in the landscape. However, these relict features can also induce the present landscape changes. Firstly, some of the constructions can contribute to the changes of the morphological processes. It refers mainly to the hydrotechnical constructions, where the collapsed bridges and culverts or the uncleared dams and culverts change the spatial distribution and intensity of erosion and accumulation (fig. 5). Also the preservation of the pavement contributes effectively to reduce or inhibit erosion along the roads. Secondly, the relict anthropogenic constructions induce the development of the new types of habitats within them or in their vicinity, as they modify the local ground properties and topoclimatic conditions.

Reduction of the field road network

The typical landscape change in the depopulated areas is the reduction of the field road network. Most of the roads in the study areas, which are presented on the topographic maps from the 19/20th century, can be classified as the relict landscape features, as they are slowly vanishing from the relief or they are preserved as 'fossilized' landforms. The disappearance of the road incisions and the constant obliteration of road gullies are the results of three main processes: overgrowing by vegetation, filling up with mineral and organic material or incision of road surface by water erosion during the episodes of intermittent flows. All these processes lead to a similar landscape effect, which is an obliteration of road incisions and gullies as landforms readable in the relief. In contrary, the preservation of road gullies, often with distinct slope breaks and steep scarps, is mainly due to overgrowing by a dense grass cover or to a reinforcement by tree roots overgrowing the gullies' scarps



Fig. 3. The ruins of an old farmstead in Ostra Góra. The slope flattening (the settlement's terrace) is well preserved in the landscape (phot. by A. Latocha 2010)



Fig. 4. Ramparts and piles of stones collected from arable grounds are nowadays usually overgrown by vegetation and become a new type of a habitat (phot. by A. Latocha 2010)



Fig. 5. Accumulation of the fine grain material and organic matter on the anthropogenic obstacle (collapsed bridge) contributes to the development of a new habitat (phot. by A. Latocha 2010)



Fig. 6. The relict, 'fossilized' road gully near Pasterka (phot. by A. Latocha 2010)

(fig. 6). In some places the steep scarps are preserved due to the construction of the stone embankments along the roads, which are now entirely overgrown by vegetation and their inner stone structure, which reinforces the gully's scarps, can be visible only locally.

Some of the old roads are still active (developing) landscape features, which is best visible in the road gullies. Within the active gullies the retreat of their scarps can be observed, as well as the incision of gully's bottom by the episodic water flow. However, the present development of gullies due to the active morphological processes is limited only to such old roads, which are still in use. It refers to the short stretches of roads within the contemporary villages, leading to the nearby slopes with grassland, and to the old roads, which are now used as tourist tracks. Nevertheless, such active gullies within old roads are of minor importance, as the general trend is to reduce the visibility of the old roads in the landscape. However, it should be stressed, that the old roads disappear mainly as landforms, while the location of relict roads can be still well recognizable in the landscape due to the change of the habitat and the vegetation cover within and along the roads. In this way, the traces of former roads are long-lasting in the landscape in form of the belts of vegetation different from the adjacent areas. The lines of trees or shrubs become often the only present landscape indicator of the old roads pattern (fig. 7).

Contemporary human impact on the relict landscape features

The natural environmental trends of the landscape changes in the depopulated areas can be locally modified by the contemporary human activity. On one hand human impact can enhance the tendency to eliminate the relict anthropogenic features from the landscape, on the other hand, some activities can lead to the opposite effects and the relict features become incorporated into the present human activity and they may become active again. The first trend is strongly connected with the legal nature protection of the study areas as a national park. Most of the activities are prohibited or limited within the national park boundaries, which results, among others, in the lack of removal of the fallen trees and woody debris from the forests. The accumulation of the uncleared organic debris contributes highly to increase the rate of disappearance of the unused roads. This process is especially well visible in the forested slopes in Kociolek (fig. 8). Also the general rule in the national park not to use other roads and paths than the selected tourist trails favors the trend of disappearance of the abandoned roads, which are not in use.

However, the opposite effects of the present human activity can be also observed in the study areas. There are examples of some old roads, which used to be relict, disappearing landscape features, as they were already entirely overgrown by forest. Nowadays, the establishing of the tourist routes along these roads 'returned' them to usage. The trees were cut down and the former relict features became active paths again. Similar activity was undertaken in order to restore the old flood-control dams near Pasterka, which were renovated



Fig. 7. The tree or shrub lines are often the only indicators of the traces of old roads in the present landscape (phot. by A. Latocha 2010)

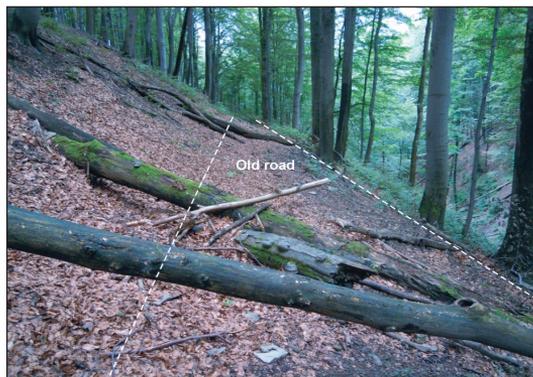


Fig. 8. The limitation of human activity in the national park (a lack of cleaning of woody debris) contributes to a faster disappearance of the unused roads (phot. by A. Latocha 2010)



Fig. 9. The maintenance and restoration program of the old orchard (Ostra Góra) (phot. by A. Latocha 2010)

according to the old building techniques. In this way these relict constructions were restored and became active landscape features once more, effectively modifying the present fluvial processes. The human activity can also slow down the rate of the natural landscape changes. For example the old roads, which are still in use (either by local inhabitants or by tourists, or by park managers), are repaired as soon as they are destroyed (dissected) by erosion. If it was not for the human action, these landscape features would have evolved in a different way. In this case human activity can be described as an effort to maintain the present state of the environment. Another example of such activity is the restoration and maintenance of the old orchard in Ostra Góra, where old species of fruit

trees are under special scientific restoration program (fig. 9).

Conclusions

The spatial distribution of the observed landscape changes is very uneven in the study area – the areas with substantial changes, such as the total abandonment of the settlements and the increase of forest stands are adjacent to the places, where the general landscape features stayed intact for centuries (e.g. the central part of the Stołowe Mts with the highest elevation and rocky slopes). Most of the landscape changes are connected directly or indirectly with the anthropogenic factors. They include both the tendency towards decreasing human impact (depopulation, withdrawal of agriculture, legal nature protection after the establishment of the Stołowe Mts National Park), the human efforts to maintain the present state of the environment (e.g. repairing of roads and tourist paths, maintenance of old orchards) and also the restoration of the former landscape features (e.g. renovation of old flood-control dams). Therefore, the resulting contemporary landscape forms a very diverse landscape mosaic, with the incorporated relict features of the old landscapes, which can still influence the present environmental processes and habitat changes (fig. 10).

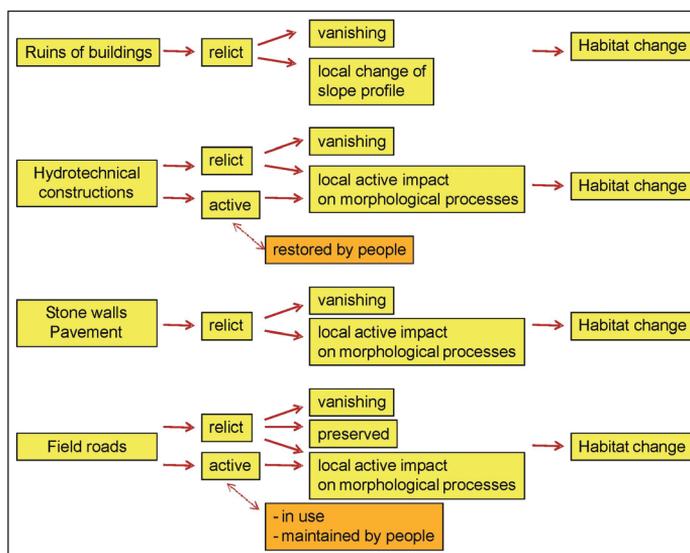


Fig. 10. The impact of old landscape features on the present environmental processes

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