Radosław Janicki

Specific features of the landscape succession processes in Przemyskie Foothills

Key words: anthropopression, renaturalization, landscape succession.

1. Preface

The Przemyskie Foothills Landscape Park was chosen as the subject of research for landscape succession because of the long-observed trend of decline in anthropopression that was observed in this area as far back as the end of World War II. This phenomenon was caused by the depopulation occurring in the area as a result of the last war and the ensuing military action code name "Wisła". Processes of renaturalization have started to take place here for about 60 years already and are clearly visible in landscape. The results of this research will be useful in the prognosis of similar phenomena in other parts of Poland (and other countries with a similar environment) that have been abandoned as a result of political, social and economic changes that took place in the more recent past.

2. Characteristics of the Case Study Environment

Przemyskie Foothills Landscape Park covers almost 62 thousands hectares of hilly area in southeast Poland, close to the Slovak and Ukrainian borders. The Park was established in 1991. This Park almost covers the entire geographical region of the Przemyskie Foothills, which is part of the Middle Beskid Mountains Foothills, the farthest in Poland located region of the Outer Western Carpathian Mountains (Kondracki 2000).

The bedrock of the Przemyskie Foothills is made up of Carpathian Flysch covered by Pleistocene rocks. Wide hills, as high as 350 – 550 m a.s.l., create the relief of this region. These hills are cut by network of river valleys as deep as 150 – 200 meters. The pattern of river network is distinguished by the occurrence of rocks that are less-resistant to erosion and by tectonic dislocations. It has the character of ridge-and-valley hills (Klimaszewski 1972).

The most dominant type of soil is brown and luvisol (lessive) soils developed on silky or loamy material. They are rather rich soils, fertile enough to plant wheat and rye there (Mapa Gleb…). Water conditions as well as climate allow the production of a variety of crops, therefore people preferred to settle down in this area in the early ages.

3. Research Method

The research is complex and requires analysis of statistical data, archival and present day maps, aerial photographs as well as field investigations. The study of Budzyński (1993) was a very useful source of demographic data for this research. He collected early data of Austrian military censuses and church statistics for each village of Polish – Ukrainians borderland. The Dictionary of Polish Kingdom (Słownik geograficzny… 1881-95) was also very valuable. Other statistical data that was used to analyze the development of population come from guide books from XIX century and published results of the National Population Censuses of 1921 and 1931. The most recent data comes from statistical yearbooks published by the Polish Central Statistical Office. Statistical data were mainly concerned with demography; however, there is also information about land use in XIX century. Better source of information on land use during past centuries are archival maps.

Between 1772 and 1918, this terrain belonged to occupants from the Austro – Hungarian Empire, which they named "Galizien" or "Galicja" (in Polish). The first maps were done by them. Austrian and Polish maps from the years 1824 – 1990 were also used. Present land use was investigated using aerial photographs and field research to confirm. The oldest map that was used was Austrian "Koenigreich Galizien und Lodomerien" from the year 1824. It is the second edition of a map from 1790. The scale is 1:288000 so that while the map was generally useful, its results are imprecise and creates difficulty in defining areas due to inaccuracy. Second map that was used is from circa 1912 and also far from perfection. This Austrian map however has better scale for landscape research – 1:75000. Inexactness of this map comes from the fact that borders of forested areas are hard to define. The map that can be considered as modern is a Polish one, from 1936-39 printed in 1:100000 scale. It was published by Military Geographic Institute (WIG). Polish State Cartographic Publisher (PPWK) issued maps in scale 1:50000 that depicted the environment in the years 1964-74. The most recent map of the area is a digitally-based map in the scale 1:100000 made for the order of Polish National Inspection of Environment (PIŚ).

To investigate landscape changes more closely, two villages were selected – Łomna and Łętownia. Comparisons were made on the land uses in both villages between the years 1852 and 2002.

The cadastral maps from 1852 were prepared by Austrians occupants for military and taxation purposes. Measurements were undertaken in 1844-54 (Konias 2000). They are colourful and show all elements of land use in very precise manner, due to map's scale - 1:2880. However the recent land use

situation was presented in black and white aerial photographs in scale 1:13000. Field verification was necessary to use these pictures due to their lack of colour.

All cartographic materials were scanned with resolution 300 dpi (dots per inch) in full colour. The next step was rectification that is, giving scanned maps cartographic coordinates. Rectification allows comparison of different maps and aerial photographs since they will be representing the same projection and scale. In this case cartographic materials correspond with present day maps in the system of coordinates 1965. Last operation was to digitise all possible layers of maps. The following layers were created: fields, meadows, pastures, orchards, forests and barrens as well as big rivers and old river-beds that were representing polygonal type; linear were roads and small rivers; and point type was settlement. Even though houses are rather polygonal in that scale, they were digitised as points, because they are not too important in landscape research. As a result of that work, maps and statistic data presented in this paper were achieved. Computer-aided spatial data analysis and modelling, through the use of Geographical Information Systems (GIS) software, such as ArcView version 3.2 were conduct. To rectify maps ArcInfo was used in few cases.

4. History of the Settlement

At the end of upper Palaeolith, the first people appeared in the case study area. Przemyśl region was one of most densely populated places in Poland ever since the country's founding in the year 996 (Kunysz 1981). Settlement leads to deforestation. Anthropopression grew along with the increase of population. Research of geomorphologists shows that in XI – XII century erosion of soils were triggered and accumulation of alluvia took place in rivers and creeks valleys of Przemyskie Foothills (Klimek, Łanczont, Nogaj-Chachaj 2003). However short periods of regression caused by wars or diseases occurred several times, general trend of an increase in the population is noticeable. Archived statistical data allowed estimations about the increase of population that took place in the area up until World War II. Villages of the area were overpopulated at the end of XIX and beginning of XX century. While people migrated to North and South America in those days, the Przemyskie Foothills was still overpopulated. Despite the fact that censuses were seldom done and we suffer form the lack of data, we still can estimate that the land was most populated in the thirties of XX century. Population density was a lot higher than 100 people per 1 km^2.

World War II and the following military action „Wisła" however, caused a rapid decrease in population. Mass shooting and arresting of people happened even during the first days of war. Germans ordered the resettlement of over 27 thousand of people from Przemyśl County to become free labour in Germany (Konieczny 1975, Kryciński 1997). This comprised 12,5% of all people in the region. The Germans were forced by the Russians to leave this land in summer 1944. New border between Poland and Ukrainian Republic of Soviet Union was founded in the eastern vicinity of Przemyskie Foothills. The governments then decided to resettle Ukrainians from Przemyskie Foothills to the east and replace them with Poles resettled from USSR. However Ukrainians did not want to abandon their land, where they lived for generations. Authorities faced resistance from local populations, and used military power to relocate them. This triggered a regional civil war that caused many casualties on both sides. Military action under cryptonym "Wisła" has been start by Polish government in 1947. As a result, Ukrainians were resettled either to the USSR or northern and western Poland. Some Poles came here, but they could not compensate the decline in Ukrainians, so the density of population dramatically decreased. In SE Poland where "Wisła" action was executed as much as 7000 Ukrainians and 2200 Poles lost their lives. 63 854 people were resettled from Przemyśl county (Misiło 1996). Many villages were burned to the ground and never were rebuilt.

An estimate of the density of population changes is found in Table 1. The estimate is based on data collected in Budzyński's study (1993), Dictionary of Polish Kingdom (Słownik geograficzny… 1881-95) and GUS yearbooks (1939-98). It shows a small increase of density of population in fifties of XX century caused by a wave of Polish repatriates from the USSR. However pre-war level of population was never regained. Ever since the 1950s, the rate of population growth in this terrain is slow or practically, zero. Considering the trends of Polish demography, one does not expect significant increases in future. The opposite is more likely. Those dramatic changes in population levels have strong influence on the landscape.

Year	1785	1880	1931	1946	1950	1960	1970	1980	1985	1990	1997
people/1km^2	52	82	150	30	51	52	53	53	54	55	57

Table 1: Estimated population density of Przemyskie Foothills.

5. Results

Initially, the cutting down of forests for cultivation was the major change that took place in the natural landscape. The landscape – from the valleys along the slopes up to the tops of hills were inhabited by people. In the beginning, only the best soils were cultivated, but with the growth of settlements, cultivation extended to less favourable areas. Those processes were the early naissance of agricultural activity, which grew in intensity proportional to number of inhabitants. It seems that first event that could stop or slow down clearing the land from the forest, was the annulment of villein service in Galicia in 1848. However this

is hard to confirm because of lack of cartographic materials. Nevertheless, it appears that the loss of cheap labour that the peasants provided forced landowners to improve efficiency in crop production. This situation made it unprofitable to expand to new territory, which were characterized by poor soil quality, steeper slopes and terrains that were hard to cultivate. It was more cost-effective to make the production of good farm lands more efficient. On the other hand, large areas of Przemyskie Hills used to belong to poor peasants and these lands have been constantly partitioned. Due to overpopulation, people were still trying to clear the forest to cultivate new land where it was possible. Available maps show that the lowest forest cover in the history of Przemyskie Hills took place when population was highest, which is in thirties of XX century (fig 1).

Year	**1824**	**1912**	**1936**	**1969**	**1990**
Scale of original map	1:288000	1:75000	1:100000	1:50000	1:100000
Forested area [ha]	25849,02	27713,52	25018,98	36569,06	37198,70
Count of forested patches	63	143	289	391	100
Mean area of forested patch [m^2]	410,3	19,38	87,48	93,53	371,98
Maximal area of forested patch [m^2]	5960,2	5663,39	4470,04	7975,53	8395,68
Minimal area of forested patch [m^2]	3,3	0,56	0,005	0,01	0,002
Range	5956,9	5662,75	4470,0	7975,5	8395,7
Forestation [%]	42,33	45,39	40,98	59,89	60,92

Table 2: Statistical data of forested areas of Przemyskie Foothills Landscape Park based on maps analysis.

Therefore there is strong relation between density of population and forestation. Maps do not only show the different forestation rates but also of the different levels of fragmentation of forested patches that grew with outflow of time. Table 2 shows data yielded by measurements on digitized maps. Due to the small scale of the oldest map, the smallest patches of forest were apparently omitted. This is why only 63 such patches were monitored and the smallest patch appears to have a relatively large surface, but represent only small forestation. One should note that the forestation of the case study area could have been higher in reality and reach up to 46 to 48%. Next map, from 1912 is not too reliable either, because of its inaccuracy when it comes to the range of forests. The newest digital map, although made using a different technique than the previous ones discussed, is likewise only partly reliable. Even thought digital map is precise, the problem is that degree of generalization made is not explicit.

Despite problems with the collection of comparable materials, one can observe indisputable trends in the changes of landscape. Along with outflow of time, anthropopression increased, manifested in the expansion of arable fields and pastures. Surfaces of semi natural landscapes (forests and meadows) grew smaller. Swelling anthropopression was accompanied by a high degree of fragmentation of the landscape. Single patches of homogeneous landscape (which could be called landscape units) in the face of high anthropopression were smaller in size. Expansion of human settlements reached higher along slopes and harder to access terrains of worse conditions was applied to farming production.

Events that took place in forties of XX century stopped clearing of land. Depopulation and consequent decrease of anthropopression triggered a process of renaturalization, helped nowadays by foresters. Abandoned fields and pastures became overgrown with high grass, then bush and eventually, single young trees. Composition of vegetable formations is also subject to change, but those problems were not investigated, as one that has secondary meaning for landscape research.

Term "renaturalization", in Polish articles, is usually understood as bringing water conditions of particular area to the natural state. It is worth to highlight the active role of humans in this process. Some Polish authors also apply this term to conditions other than water. In this article "renaturalization" is used to describe the natural process of landscape succession. Natural landscapes were primarily changed by man, this way they became cultural. However decline in this change factor, results in the spontaneous return to its more natural state. It is hard to find a more adequate term for name this process than "renaturalization" of landscape.

Łomna case study

One of the examples of landscape succession is Łomna village. It distinctly shows the renaturalization of the cultural landscape. Before World War II, Łomna was a big village, inhabited by 703 farmers in 1943 (Amtliches… 1943) and covering area of 10,5 km^2. Throughout fights that affected this region just after the war, the whole population of the village was killed. In this sudden way, all of the land of village was abandoned. Although after the war there were attempts of introducing PGR (National Farms) and sheep were bred here in seventies, it never rebuilt the village. There is no mark of its old buildings today. A few buildings that one can find in village are heritage of PGR. Nowadays, the village is playing recreational role, as camps for youngsters from orphanages are organized here in the summer. They live in military tents set

up on meadows. Landscape changes that took place here are shown on map (fig 2). First of all, diversity of its landscape decreased in drastic way. One hundred and fifty years ago, when this land was cultivated, fields, meadows, pastures, orchards and forests were creating highly complex mosaic, due to the fact that single patches of landscape units were really small. Arable land and pastures had the shape of very narrow and long stripes as they were partitioned several times by farmers (traditionally each son of a farmer got an equal part of his father's land both in quality and quantity). Some orchards or pastures were as small as 80 sq. m. and fields as small as 100 sq m. Nowadays those orchards can be considered as forests from the point of view of a landscape researcher. The smallest of them covers 3410 sq m. Also Łomna's landscape used to be highly fragmented. This is proven not only by the surface of smallest patches of land, but also the number of their divisions. In 1852, there were 489 fields, 285 meadows, 303 pastures, 62 orchards and 94 forests parcels. The biggest homogenous units of land were three patches of forest in the marginal part of village – on the north, east and south. Forestation in those days was at 31%. Today, landscape is composed of only two dominant forms: forests (33 patches, forestation – 74%) and meadows (7 patches, covers 26% of village area). There is no arable land, pastures or orchards in the village. Consequently, the mean and maximum surface of a patch is smaller than compared with today's sizes. For example, the mean surface of meadow is now over 100 times bigger than 150 years ago! The mean forest surface is almost 7 times bigger. The biggest parcel of meadow in 1852 was only 8,8 ha and today it is 132 ha, corresponding numbers for forests are 121 and 767 ha. The main element of today's landscape is forest between 80 – 20 years old. It is an expansive component. Forest boundary shows distinct tendency to descend along slopes to valleys. This is why oldest trees grow on the top of the hills and the lower the trees grow, the younger they are. Glades vanished and forest created, in principle, one big patch, slightly segmented in central part, where the valley is. Arable lands and pastures were displaced by forests and meadows. Nowadays, meadows take the place of old pastures and fields localized in the valleys. The meadows today also create compact areas. Everywhere where anthropopression is insignificant, even meadows are replaced by forests. Single trees appear within meadows of high grass.

It is interesting to note that the total length and density of roads increased in spite of general depopulation. Today it is almost 27,5 km. One suspects that most of those roads already existed since 1982, but were not marked on cadastral maps that were used in this research.

Other totally depopulated villages of Pogórze Przemyskie Landscape Park are: Kopyśno, Krajna, Łodzinka Dolna, Paportno, Polchowa and Sopotnik. They are theatres of similar landscape successions. A majority of the Park's 86 villages saw a decrease in population and abandonment of arable land; however processes of landscape succession towards renaturalization are not as drastic as in case of Łomna or other deserted villages.

Łętownia case study

The process of landscape renaturalization did not dominate the whole area of the Park. Near the San River valley between Dynów town and Przemyśl, one can find results of an opposite processes. This northern vicinity of the Park has been continuously used for farming purposes and anthropopression is slowly increasing here. An example is Łętownia, a small village located about 6 km to NW from Przemyśl. The village covers only 5,65 km^2. In the year 1880 there were 217 inhabitants; ten years later 273. It was poor and overpopulated village, there were 5,5 persons per one house an average. In 1926 village had 88 hectares of arable land and 55 households with farms. Therefore average farm was only 1,6 ha. In 1931 land of the village was consolidated. As a result of that average farmer owned about 4 ha of land. Just before the World War II village had over 400 inhabitants with 133 farms on 165 hectares, which means that land was parcelled again due to the high natural increase of population. Average farm had only 1,24 ha. Due to the war village depopulated. In the year 1943 there were only 387 people living there. After "Wisła" action during which 30 Ukrainians families were resettled, that number decreased to only 317. Five Polish families came here from USSR, therefore in 1950 there were 338 people in village and in 1960 – 373 (Konieczny 1994). Today Łętownia has 525 inhabitants (data from 2002).

Increasing anthropopression manifests in an increase in road lengths. Roads of Łętownia in 1852 were 8,9 km, nowadays 11,4 km (increase of 22%). Between 1852 and 2002, fragmentation of forest patches increased, and today there are 34 of them, compared to only 9 one and half century. Today, the smallest forest patch covers only 193 m^2, while in 1852 it was 744 m^2. The surface of biggest forest patch grew smaller as well as the overall average surface. The mean one used to be 0,416 km^2 and now only 0,089 km^2. Forestation of village decreased from 35,6% to 28,9%. It is caused largely by the expansion of farming into rather big and compact patch of forest that used to exist on SE periphery of village. On the other hand, some fragments of fields found in higher parts of the valley, which is main axis of the village, have been abandoned. This area is harder to access and cultivate, and as a result, this terrain is becoming forested. Small dells of meadows and arable lands in the forest have vanished. It seems that farming is taking place on the land most predisposed to the activity – located on lower, flatter areas with richer soils. Fields of worse soils on steeper slopes has been abandoned. There are just a few villages in the Przemyskie Foothills

Ladscape Park like Łętownia, where only insignificant decrease or increase of population has been noticed. Such villages are: Bachów, Dąbrówkę Starzeńską, Huwniki i Reczpol.

6. Summary

In conclusion, lands brought into cultivation here, followed along natural communication tracks, which are valleys, similar to other hilly or mountain areas in Poland. Here soils are the richest; it is also easy to get water for drinking and other purposes. Even if transportation did not take place immediately on the river, roads were built along these lines as they were the easiest and cheapest localization for this aim. Therefore settlement has started here, in San and Wiar Rivers valleys. Then smaller valleys were colonized. Up to the present, one of the most important communication artery here, is the San River valley, which leads along north border of the Park. However, increase in population caused "land hunger", and resulted in the clearing up of slopes. The same took place on top of the hills afterwards. As demands grew, farmers were gradually reaching into lands that were harder to cultivate; land that was not initially found to be attractive enough. Initially, cultural landscapes were expanding at the costs of natural landscapes. This situation continues to prevail up to now only on some small areas of the Park (mainly on the north, close to Przemyśl). However on the whole, as a result of rapid depopulation, large areas of arable lands were deserted. Terrains with poor soils and difficult agricultural conditions were abandoned. These terrains were taken into cultivation last and neglected first when anthropopression intensity decreased. Here, cultural landscapes are disappearing in the present day.

Human activity used to lead to significant fragmentation of landscapes of mountains and hilly areas. As these happen, areas of natural landscapes decreased and were replaced by plantations. However, as a consequence of diminishing anthropopression, more natural (semi-natural) elements such as forests and meadows started to dominate the landscape. This results in the decrease of mosaics in the landscape, because small surfaces of homogenous landscape are disappearing. Borders between landscape units are consequently shorter; areas of ecotones are decreasing. The process of renaturalization of the landscape is taking place, understood to mean the return from cultural, farmland landscape to a natural one.

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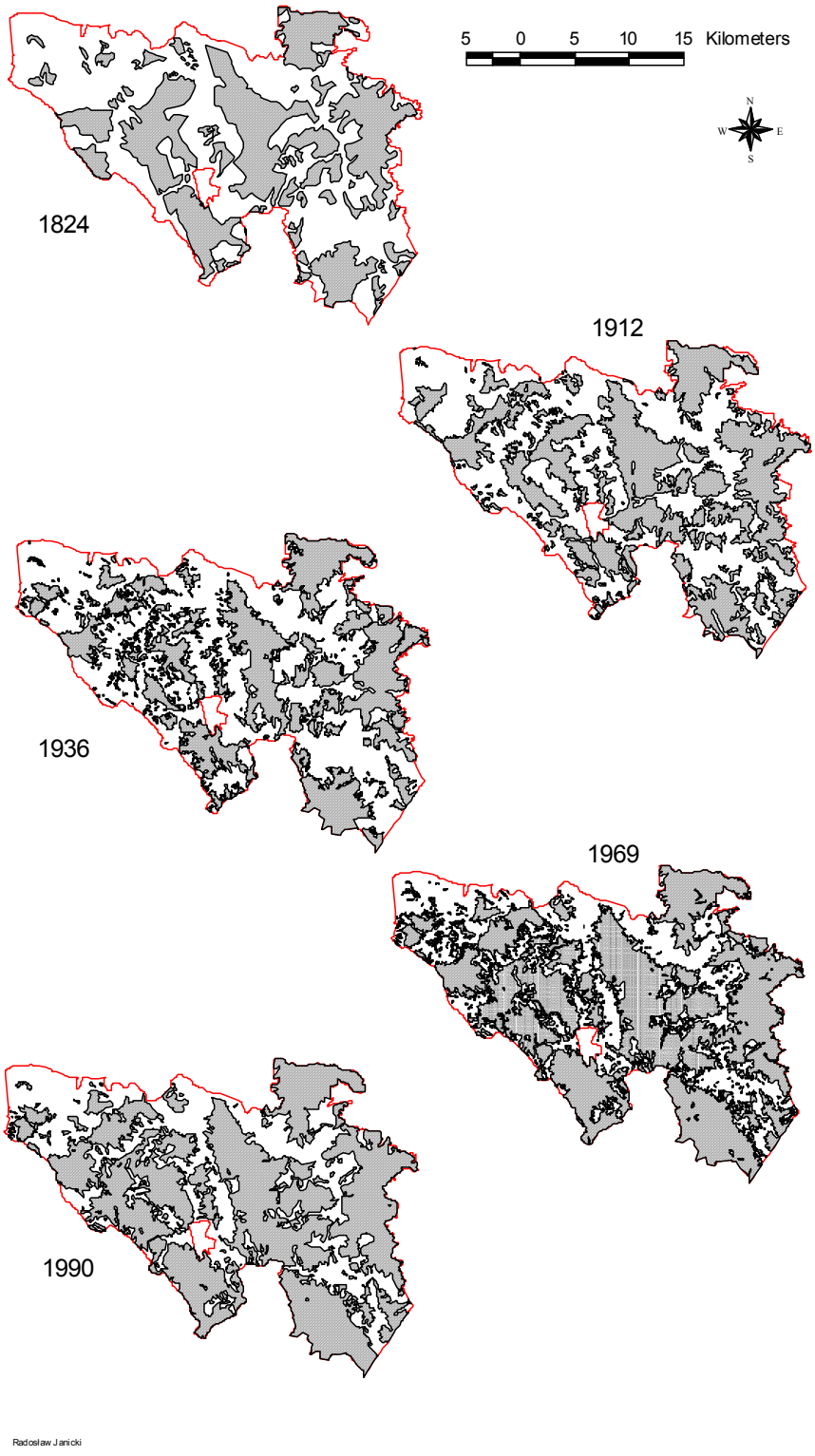

Fig. 1: Changes of forests of Przemyskie Foothills Landscape Park

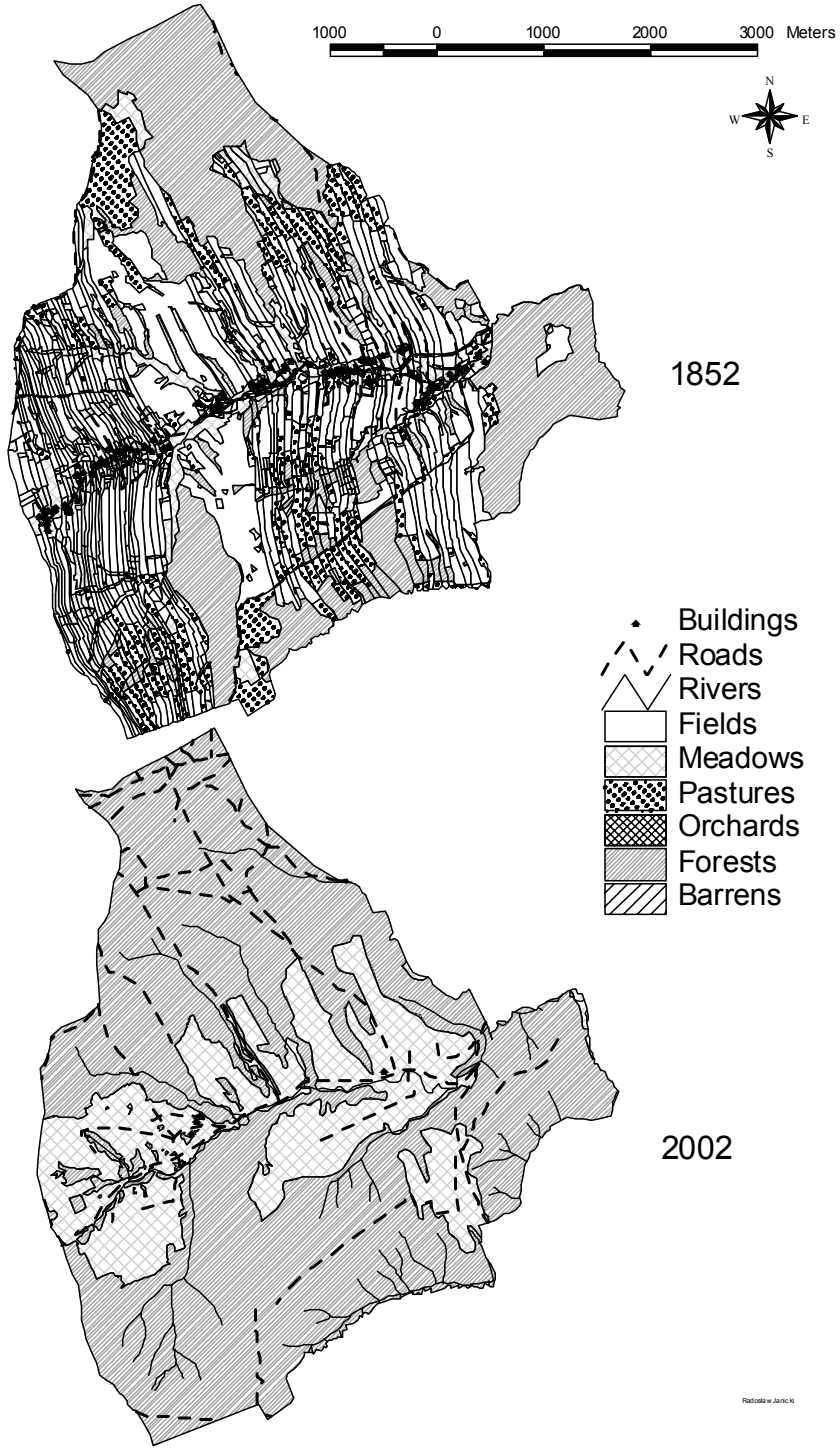

Fig. 2: Changes of Łomna village landscape within the years 1852 – 2002

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