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DEVELOPMENT OF SETTLEMENT AND FARMING FROM THE NEOLITHIC PERIOD TO DATE IN THE MARGINAL ZONE OF THE CARPATHIAN FOOTHILLS BETWEEN THE RABA AND USZWICA RIVERS

Abstract: Based on archaeological materials and historical documents an attempt was made to characterize the settlement and agriculture in the Carpathian Foothills. Three phases of intense activity were identified in the development of prehistoric settlement: early Neolithic, bronze/iron ages and the late Roman period. Starting from the early Middle Ages (10th century) to 1500 AD the Carpathian Foothills were entirely colonized. During that time a basic network of human settlement and transportation roads was formed along with the current arable land patterns. A relatively high density of population and the high percentage of arable land in the total land use structure over the entire historical period of exploration of this area indicates the adaptation of man to the existing environmental conditions and the local natural habitats' significant tolerance to human pressure.

1. Introduction

The geographical environment of the marginal zone of the Carpathian Foothills was shaped by natural evolution and the anthropogenic pressure initiated during the Neolithic period. One of the most fascinating problems of modern geography is the issue of mutual interaction between the natural environment and the social and economic organization patterns. A particularly significant issue is the influence of natural conditions on the development of settlement and economic activities and the transformations they cause to the environment.

This paper overviews the history of settlement and human activity in the Carpathian Foothills (Figs 1 and 2). The area of the study covers approximately 100 km² of its marginal zone between the Raba and Uszwica Rivers. The study covered the time period from the Neolithic period to now. It was based on archaeological and historical documents and also on documents and maps from the State Archive in Cracow, the Archive of the Regional Museum in Tarnów, the Historical Archive of Ukraine in Lviv,



Fig. 1. Study area: 1 - high mountains; 2 - mountains of intermediate and low height; 3 - uplands and foothills; 4 - intramontane and submontane depressions.

Ryc. 1. Obszar badań: 1 - góry wysokie; 2 - góry średnie i niskie; 3 - wyżyny i pogórza; 4 - kotliny przedgórskie i śródgórskie.

the Jagiellonian Library in Cracow, the Library of the Polish Academy of Sciences in Cracow, the Department of Land Survey and Cartography of the Municipal Office in Bochnia and data from the agricultural register carried out in 1988.

2. Prehistoric background of settlement

2.1. Settlement during the Stone Age

The beginnings of settlement in the marginal area of the Carpathian Foothills reach back to year 6000 BC (Hensel, Wiślański, 1979; Jodłowski, Skowronek, 1980) (Fig. 3, Tab. 1). First settlements of the comb pit pottery culture (KCWR) and the Lengyel-



Fig. 2. The investigated area on historical map by Rizzi-Zannoni (1772).

Ryc. 2. Obszar badań na mapie Rizzi-Zannoni (1772).

Rizzi-Zannoni Giovanni Antonio Battista, Carte de la Pologne divisee par provinces et palatinats et subdivisee par districts Construite d'après quntité d'Arpentages d'Observations et de Mesures prises sur les Lieux. Dedice á Son Altesse le Prince Prusse - Vindes Joseph Alexandre Jablonowski Palatin de Nowogrod Chevalier des Ordes du Saint Esprit, de l'Aigle blanc et de Saint Hubert Associé á l'Academie Royale des Sciences de Paris, ca. 1 : 690 000, Paris 1772, sheet 17, provided by the cartographic collection of the Jagiellonian Library, catalogue ref. No. 851, Atlases.

Polgar culture (KCL-P) appeared at the beginning of the Neolithic period. This population, originating from the Danubian areas, created a relatively dense settlement network, particularly during the early and mid-Neolithic (4500-3500 BC or 5300-4300 BC). The populations of these two early Neolithic cultures initially carried out intense vegetable production in alternating forest-fallow system, followed by bush-fallow and also household stock breeding (Machnik, 1987). This period was characterized by the grubbing of forests, setting arable fields in the cleared areas and shifting the cultures from site to site as soils deteriorated. Soils located on the borderlines between fertile lands and forests were particularly attractive to the comb-pit pottery culture populations, as they provided additional food sources.

During the mid-Neolithic period, a population originating from the North European Lowland appeared in this area. These are traces of the funnel beaker culture (KPL), delimiting the maximum range of Neolithic settlements in the Carpathian Foothills area. The culture of funnel beakers was based on agriculture and seasonal animal breeding. This population initiated extensive culture of cereals in alternating scorched land-fallow system and pastoralism. This type of agricultural practice and technical innovations allowed penetration of a large area and expansion over the Carpathians. The long period of scorched cultures and the intense breeding of cattle, goats and sheep caused a decrease in the environment's productivity. Therefore seasonal migra-

Tab. 1. Chronology of prehistoric and early medieval settlement in the marginal zone of the Carpathian Foothills between the Raba and Uszwica Rivers.

Tab. 1. Chronologia osadnictwa prahistorycznego i wczesnośredniowiecznego na obszarze progu Pogórza Karpackiego między Rabą a Uszwicą.

AGE	PERIOD	CULTURE	SETTLEMENT	ECONOMY
I R O N A G E	Mid 13th century EARLY MEDIEVAL PERIOD Mid 5th century AD		<ul style="list-style-type: none"> 10-mid 13th century, intensification of settlement, formation of castles (Chełm, Łapczyca), first towns (Bochnia), villages start to be built along roads or in oval and circular patterns 8th-mid 10th century, scattered settlement 5th-8th cc., regress of settlement invasion of the Hunnite tribes causes a great migration wave 	<ul style="list-style-type: none"> cultivation of a broad range of cereals fruit and vegetable raising intense exploitation of forests
	ROMAN PERIOD Beginning of AD	<i>Przeworsk Culture</i>	<ul style="list-style-type: none"> settlement on summit planes and terraces over flood plains settlements composed of several cottages small, open settlements (0.5-3 hectares) large settlements (up to 15 hectares) 	<ul style="list-style-type: none"> economy based on agriculture (one-and two-field systems and conversion to a fallowing system) clearing and grubbing techniques significant role of animal breeding intense penetration of the forests
	EARLY PREROMAN PERIOD 200 years BC CELTIC PERIOD	<i>Celtic-Przeworsk Culture</i> <i>Celtic Culture</i>	<ul style="list-style-type: none"> regress of settlement due to the invasion of Scythian tribes 	
	400 years BC HALSTAT PERIOD	<i>Lusatian Culture</i>	<ul style="list-style-type: none"> settlement of the summit p[lanes] 	<ul style="list-style-type: none"> the Lusatian Culture population was mainly involved in land cultivation
BRONZE AGE				
1800 years BC (2200 years BC)				
S T O N E A G E	LATE NEOLITHIC 2500 years BC (3200 years BC)	<i>Corded Pottery Culture</i>	<ul style="list-style-type: none"> lack of permanent settlements 	<ul style="list-style-type: none"> transformation of the environment caused by economic activity resulted in changes in human activity patterns pasture-type animal breeding economy based on agriculture and animal breeding
	MIDDLE NEOLITHIC 3500 years BC (4300 BC)	<i>Radial Decorated Pottery Culture</i> <i>Funnel Beaker Pottery Culture</i>	<ul style="list-style-type: none"> location of settlements in naturally defensive places, on the edges of summit ranges and on isolated land elevations (Chełm) subsequent geographical areas included in the settlement and economic penetration zone formation of small, medium-sized and large settlements (several dozen hectares) 	<ul style="list-style-type: none"> economy based on agriculture and semi-nomadic animal breeding large arable fields situated near the settlements and on distant summit planes grubbing
		<i>Lengyel-Polgar Cycle</i>	<ul style="list-style-type: none"> settlement of the summit planes increase in the size of existing settlements and creation of subsidiary settlements 	<ul style="list-style-type: none"> arable land located in river valleys and summit areas grubbing great significance of salt production
	EARLY NEOLITHIC 4500 years BC (5300 years BC)	<i>Comb-Pit Pottery Culture</i>	<ul style="list-style-type: none"> settlement of the summit planes settlements located on the edges of forests and areas with fertile soils range of direct activity of the settlement (from 0.5 to 3-5 hectares) 	<ul style="list-style-type: none"> clearing of forests animal breeding (in the settlement zone) migration caused by the degradation of soils gathering, hunting and fishing

ting pastures became a necessity. Finally this population split into two groups, one carrying out vegetable production in an alternating ploughing-fallow system and a nomadic shepherding population.

Later, the radial decorated pottery culture (KCP) appears with intense farming using the alternating ploughing-fallow system and pastoralism (Kruk, 1980). Such a cohabitation of different cultural groups was possible thanks to the fact that they occupied different habitats and carried out different activities. Such a situation probably allowed various types of contacts and links leading to the interpenetration of cultures. The variety of materials used for tool making is evidence of the intense contacts of populations cohabiting this area and other parts of the region (maybe an exchange-based salt trade). An important fact is that the local saline sources were continuously exploited starting from the beginning of the Neolithic period (Jodłowski, 1980). The lack of permanent settlements from later times and the distribution of burial sites suggest the appearance of groups of nomadic shepherds. Shepherding linked with a nomadic lifestyle is usually related to the corded pottery culture (KCS) from the late Neolithic.

The number and location of archaeological vestiges indicate a dense and permanent Neolithic settlement in this area. The comparison of archaeological sites

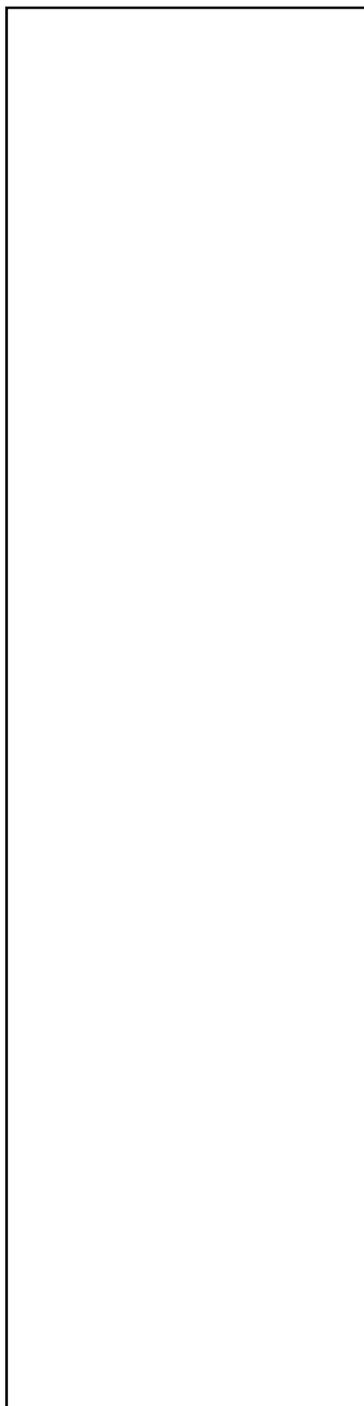


Fig. 3. Distribution of archaeological sites over the marginal zone of the Carpathian Foothills (based on the documentation of AZP, A. Cetera and J. Okoński - generalized).

Ryc. 3. Rozmieszczenie stanowisk archeologicznych na obszarze pogórza (na podstawie dokumentacji AZP wykonanej przez A. Ceterę i J. Okońskiego - treść zgeneralizowano).

from the Neolithic and later periods confirm the presumed high mobility of the Stone Age populations and their ability to adapt to different environmental conditions (Rydlewski, Valde-Nowak, 1979). The maximum range of Neolithic penetration is indicated by the traces of the funnel beaker pottery culture (KPL) occurring almost over the entire marginal area of the Carpathian Foothills. The most intense settlement occurred between 4500 and 3500 BC or about 5300-4300 BC (Hensel, Wiślański, 1979). Neolithic settlement was mainly concentrated in flat areas of the summit planes, relatively close to water courses. The settlements probably occupied areas of between 0.5 and four to five hectares.

The characteristic features of this period are the time-sequencing of cultures, the relative continuity of the settlement, the general knowledge of land culture and animal breeding practice (quite early first attempts of animal-driven ploughing appeared along hoeing techniques) and the uninterrupted exploration of the foothill area. Beside from the continued search for new land for culture and pastures, the populations returned to previously-exploited and abandoned land plots. The settlement patterns became more and more stable. New production skills - pottery, weaving, copper smelting and salt processing favoured intertribal contacts (Leciejewicz, 1989). The penetration of Neolithic cultures into a primary landscape and the destruction of the natural vegetation cover caused a change in the landscape and initiated the denudation processes which have continued and gradually intensified until the present (Klimek, 1987; Maruszczak, 1988; Starkel, 1988; Kalicki, 1977). Forms such as basins, open spaces, ravines, gullies and pits are younger than the archaeological sites from the Neolithic period (Kruk, 1973). During the time period between 3500 to 1800 BC (or 4300 to 2200 BC) settlement regressed considerably.

2.2. Settlement during the Bronze and Iron Ages

The application of bronze (alloy of copper and tin) for the manufacturing of tools and weapons resulted in significant cultural and economic progress. The limited distribution of copper and the processing of bronze by wandering craftsmen led to the integration of populations and the formation of a relatively stable Lusatian culture. This was reflected in the stabilization of settlement, demographic growth and the appearance of social stratification (Leciejewicz, 1989). A discernible development of settlement in the Foothill area occurred between 1300 and 400 BC, and it is linked with Lusatian culture. The main occupation of this population was land cultivation, which resulted in a stable and sedentary lifestyle (Gedl, 1975). Animal breeding (household scale) played an auxiliary role. Food sources were complemented by hunting, fishing and gathering. The population of the Lusatian culture inhabited rural settlements of open type. Similarly to the Neolithic period, settlements were sited on land elevations. The maximum range of influence of the Lusatian culture occurred at the end of the bronze age and beginning of the iron age but it was not as wide and intense as the human settlement during the Neolithic period (Rydzewski, 1986). As a result of social and economic development and probably due to threats from the Scythians, the settlements started to bear a defensive character (a typical example is the *grodzisko*

(town-castle) in Kopaliny, located on a headland-shaped elevation). The creation of town-castles resulted in differentiation of the layout and size of the settlements. They were sited in naturally defensive places (such strategic locations were also used during the Middle Ages). The final phase of the Lusatian culture is linked with a 200-year period of decrease in population in this area. Very few monuments of the Celtic-Przeworsk culture from the early phase of the preroman period (approx. 200 BC - beginning of our era) were found in this area (Cetera, Okoński - unpublished information).

The final stage of prehistoric settlement occurs during the period of Roman influence (beginning of our era - 400 AD) and it is linked with the Przeworsk culture. The influence of the highly-developed Celtic and Roman cultures caused significant technical and economic progress and also affected the social structures (Wielowiejski, 1981). This mainly included a massive popularization of iron (the basic material for tools and weapons) smelting, progress in agricultural practices, introduction of new techniques in many sectors of production (wood, metal and stone processing), development of craft specialization and commercial exchange. The level of social and economic development undoubtedly influenced the settlement patterns. The Przeworsk culture is linked with maximum expansion and population density in the area of the Carpathian Foothills. The peak period of prehistoric settlement took place between 180 and 400 AD (Cetera, Okoński, 1993). The population of the Przeworsk culture not only colonized hills and elevated parts of the summit planes but also the edges of flood plains.

The number and distribution of settlement sites indicates an active relationship with the natural environment, making use of all the available and even less favorable settlement sites. The sizes of settlements varied between 0.5 and one to three hectares, sometimes reaching fifteen hectares. The dominant type was an open layout of regular shape and structure. The characteristic feature of the Przeworsk culture is the mixed economy (Rydzewski, 1986). The population was mainly involved in nomadic agriculture based on the system of one or two alternating land patches and scorching. Later, the agriculture switched to an alternating ploughing-fallow system. Different systems were applied in fields located near the settlements and those occasionally cultivated in open spaces of the forest. The breeding of cattle, pigs, sheep and horses played a comparable role. Because of the high population numbers hunting was a significant source of food, causing intensive penetration of the nearby forests. Numerous archaeological excavations (including Roman coins and other artifacts) confirm the existence of commercial contacts of these areas with the Roman provinces till the 4th century (Cetera, Okoński - unpublished information).

Settlement regressed at the beginning of the 5th century. The scope of the archaeological investigations to date and the fact of numerous population migrations in the 5th and 6th centuries does not allow a detailed characteristic of the Roman-related culture transformation in the Slavonic culture to be formulated (Leciejewicz, 1989). The most certain fact is that there were no significant changes in the structure of the basic sectors of economy. Both at the beginning of our era and in the early Middle Ages the structure of agriculture and breeding was quite similar. The range of settlement was identical. Former organizational structures collapsed, which resulted in a general decline of living standards (Leciejewicz, 1989).

The first historical note on the Slavs was written by Jordanes (a Latin historiographer from the 6th century). He indicates the Slavic ethnic origins of the tribes of Slavins, Ants and Wends (Macinskij, Tichanova, 1976). According to the relation of Jordanes the Slavins occupied the areas between the lower course of the Danube River and the Dniester, reaching the sources of Vistula River along the Carpathian Mountains. The territory of the Ants stretched between the Dniester and the Dnieper. Written sources do not provide a clear picture of the ethnic situation of the Polish territory during the Roman period (Godłowski, Kozłowski, 1985). At present, some Polish archaeologists are opposed to the idea of autochthonic character of the Slavic tribes. They suggest that the basins of Oder and Vistula Rivers were home to different ethnic elements. They do not believe in the existence of language ancestors of the Slavic tribes before the great migration (Godłowski, Kozłowski, 1985). The difficulties in characterizing the early Slavic tribes and in describing the process of the formation of a Polish state also arise in the Carpathian Foothills area. The lack of archaeological material does not allow the history of settlement and economy to be recreated for the period between the 5th and 7th century (Cetera, Okoński - unpublished information).

The changes in the culture and settlement patterns were linked with the great migration of populations across the Polish territories. It is supposed that this period was characterized by a decrease in settlement activity and by the succession of forests over prehistoric arable lands.

2.3. Settlement in the early Middle Ages

The next phase of intense settlement expansion occurred during the early Middle Ages, starting from the 7th century to the first half of the 13th century. The distribution of the archaeological sites indicates that the expansion of settlement was initiated during the 7th century. The development of early medieval settlements was dependent on favorable relief, type of soil, course of commercial tracts and occurrence of saline sources. It was also reflecting the river network. The period between the 7th century and the first half of the 9th century was characterized by weak and scattered settlement (e.g. the open settlement site in Łapczyca from the 7th century). A strong intensification of the settlement, putting an end to the former deep regress, occurred after the demographic boom during the late Roman period. It took place between the first half of the 9th century and the first half of the 13th century. In the development of settlement forms, an important role was played by strongholds. They were sited in naturally defensive (rivers bends, isolated hills) or politically and economically strategic locations (commercial tracts, deposits of natural resources). Strongholds are linked with the first towns, established thanks to progress in social, economic and political relations. The early 9th century saw the beginning of the decline of tribal rampart settlements and of creation of a new administration by the Piast dynasty (Żaki, 1974).

The decisive factor for the significant economic progress during the early Middle Ages was the popularization of new forms of farming and breeding practices and the

application of iron tools and weapons. The progress was especially evident in the craft production: metallurgy, smithing, casting and pottery. This resulted in a significant revival of commercial contacts. Starting from the mid-10th century all the cultural, social and economic transformations resulted from the creation of a new feudal state system (Żaki, 1974).

The area of the Carpathian Foothills was part of the Cracow castellany. The archaeological studies to date confirm the existence of a network of several (to a dozen) settlements connected by economic and social links with a central unit in Chełm (Jodłowski, Skowronek, 1980). The importance of Chełm was due to its location on the commercial tract from Hungary to Bochnia and Cracow. The increase in the importance of Łapczyca occurred as a consequence of the exploitation of its saline sources. The taking over of the central function by Bochnia occurred after the discovery of important underground deposits of salt. At the end of the 12th century the settlement wave expanded towards the upper zones of the Carpathian Foothills (Jodłowski, Skowronek, 1980). The oldest type of rural settlement was a cluster of estates with a patchwork of fields. Typical villages were circular or oval in shape (which was a defensive layout). Another typical Slavic village layout was based on the axis of the road. Villages built within a net of intersecting roads were not always adapted to the natural landscape. They were set up by populations coming from areas where this form of settlement was dominant (Zaborski, 1926). It is also supposed that there were some periodical hamlet-settlements. The Tartar invasion during the 8th century caused an other regress in settlement.

A. Żaki (1974) and L. Leciejewicz (1989) give interesting estimates of the range of human activity and population density in the Little Poland (Małopolska) area during the Middle Ages. Their tentative estimates assume that until the 10th century about 6% of the entire region was economically exploited, whereas during the 10th century economic activities covered 24% of the region (Leciejewicz, 1989). This was the consequence of a shift from intense „gardening-like” farming (limited in terms of space) to a more extensive pattern. The initial phase consisted of scorching, followed by alternating ploughing-fallow culture system (after the impoverishment of the soil, the field was used as a fallow pasture and then reused as arable land). Archaeological studies identified a broad range of cereal cultures such as wheat, barley, millet, rye, oat and also the presence of gardening and fruit-growing. The most commonly grown vegetables were the turnip, carrot, onion and cucumber. The most typical fruit were pears and apples and occasionally peaches, grapes and walnuts (Dobrowolska, 1961). Other significant sources of food were stock raising, gathering and hunting. Generally this period is characterized by broad exploitation of forests (joinery, carpentry, coopering, birch tar making). It is estimated that Sandomierz Forest, connected to the Niepołomice Forest near Cracow, covered approximately 2,500 km². The Carpathian Forest, stretching along the southern border of Little Poland covered at least 7,500 km². The existence of large forest complexes significantly affected the diversity of population density. Excluding the forest areas, the population density index for Little Poland was 4.7 per km² in 1000 AD (Żaki, 1974).

3. Historic and present pattern settlement

3.1. Settlement during the Middle Ages

Based on the first written documents, the development of settlement in the Carpathian Foothills can be divided into four discernible stages of intense colonization (Mateszew, 1980).

The first stage covers the oldest settlements mentioned in historical sources before 1250, which is the beginning of colonization according to German law. The oldest type of rural settlements are the circular, oval and linear villages (Zaborski, 1926). Villages probably did not have strictly delimited borders, especially from the side of the adjacent forests. Agricultural practices were most frequently based on fallows and alternating two-field systems. The characteristic layout of the fields was similar to a checker-board. Arable lands did not cover the entire village area. Between particular fields there was enough room for a boundary balk and suitable access (Bujak, 1905).

The second period (from 1250 to 1333) is terminated by the death of the king Władysław Łokietek and the end of the provincial partition. At this time the population of Little Poland dropped by about one third (because of the Mongolian invasion in 1259). This stage was dominated by the German law-based colonization. The procedure applied involved land improvement and clustering and eliminated the former agricultural system. The characteristic feature of 'German' colonization was the introduction of a three-field system. The other new element in the rural landscape was the communal pasture. Parish, village administrator's and peasant's land was allocated in old and new villages (Mateszew, 1980). The shift from fallow and two-field systems to the three-fields practice, covering the total area of arable lands, regulated the settlement structure. The newly-located villages were usually based on a „chain” layout (Zaborski, 1926) with houses sited along the road, in regular intervals. Usually the house of the land owner was built on the road side of the field, and arable land stretched in a narrow strip from the house towards the forest. In some locations, such a land pattern, being a relic of the Middle Ages, altered by the increase in population density and the parcelling out inherited land, survived to date.

The third period of intense settlement in the Carpathian Foothills, linked with political stabilization and economic growth, occurred during the reign of King Kazimierz Wielki (Casimir the Great) between 1333 and 1400 AD. The three-field system dominated the agriculture and the legal status of towns and villages was based on German law locations. This was reflected in the intensification of agricultural production, development of the crafts and trade and also growth of the population. An adequate determination of population density in small settlement areas is very difficult. Taking into account the number of settlements and assuming certain default values (5.5 people per family, 70-80 inhabitants in a village) the average population density of the area investigated was 18 per km². Bochnia has been excluded from this estimation. In the 14th century this town, with its 2,500 inhabitants, counted as a city; the same group included Cracow, Sandomierz, Kazimierz and Nowy Sącz (Ładogórski, 1958). The average population density in Little Poland was approximately 6.6 per km², and

in strongly urbanized areas such as the Cracow region, it reached 20 per km².

During the fourth period, between 1401 and 1500, the progressing intensification of settlement mainly focused on the expansion of existing villages, creation of hamlets, farms and milling colonies (not on the creation of new settlements).

The number and distribution of main population concentrations in the 15th century compared to the later periods and modern times indicates that the medieval settlement activity terminated the human expansion process in this area. The basic church and state administration structures were also formed during the Middle Ages.

From the 10th to the 15th century 29 settlement concentrations were formed in the area of the Carpathian Foothills (including those which constituted an autonomous economic complex, had their own individual name and were mentioned in historical sources) (Figs 4-9). These were:

- settlements created before 1250: Bochnia, Babica, Dziedzictwo Wincentego, Chełm, Łączycza, Kolanów, Dołuszyce, Brzeźnica, Łopianka and Nieszkowice Małe.
- settlements created between 1250 and 1333: the town of Bochnia, Gierczyce Dolne, Gorzków, Jasień, Kurów, Łazy, Wiśnicz Stary and Nieszkowice Wielkie.
- settlements formed between 1333 and 1400: Siedlec, Mały Wiśnicz, Moszczenica, Dąbrowica, Biernaszowice, Książnice, Pogwizdów, Olchawa and Kobyle.
- settlements created between 1401 and 1500: the Bucharka farm, Gierczyce split into Gierczyce Górne and Gierczyce Dolne and Poręba Spytkowska (in this case the determination of a precise date is not possible).

Some of these settlements such as Biernaszowice (taken over by Nieszkowice), the Bucharka farm, Babice, Dziedzictwo Wincentego and Łopianka (taken over by Bochnia) did not survive and lost their original names. The remaining villages are still the main settlement sites in the region. Time caused the expansion of these villages, the creation of numerous suburbs and some changes in the administrative borders. The average population density increased from 5 per km² in 1250 to 31 per km² in 1500.



Fig. 4. Medieval settlement in the marginal zone of the Carpathian Foothills - ownership structure and first reference in written sources.

Ryc. 4. Osadnictwo średniowieczne pogórza Karpackiego - struktura własności i pierwszy zapis w źródłach pisanych.

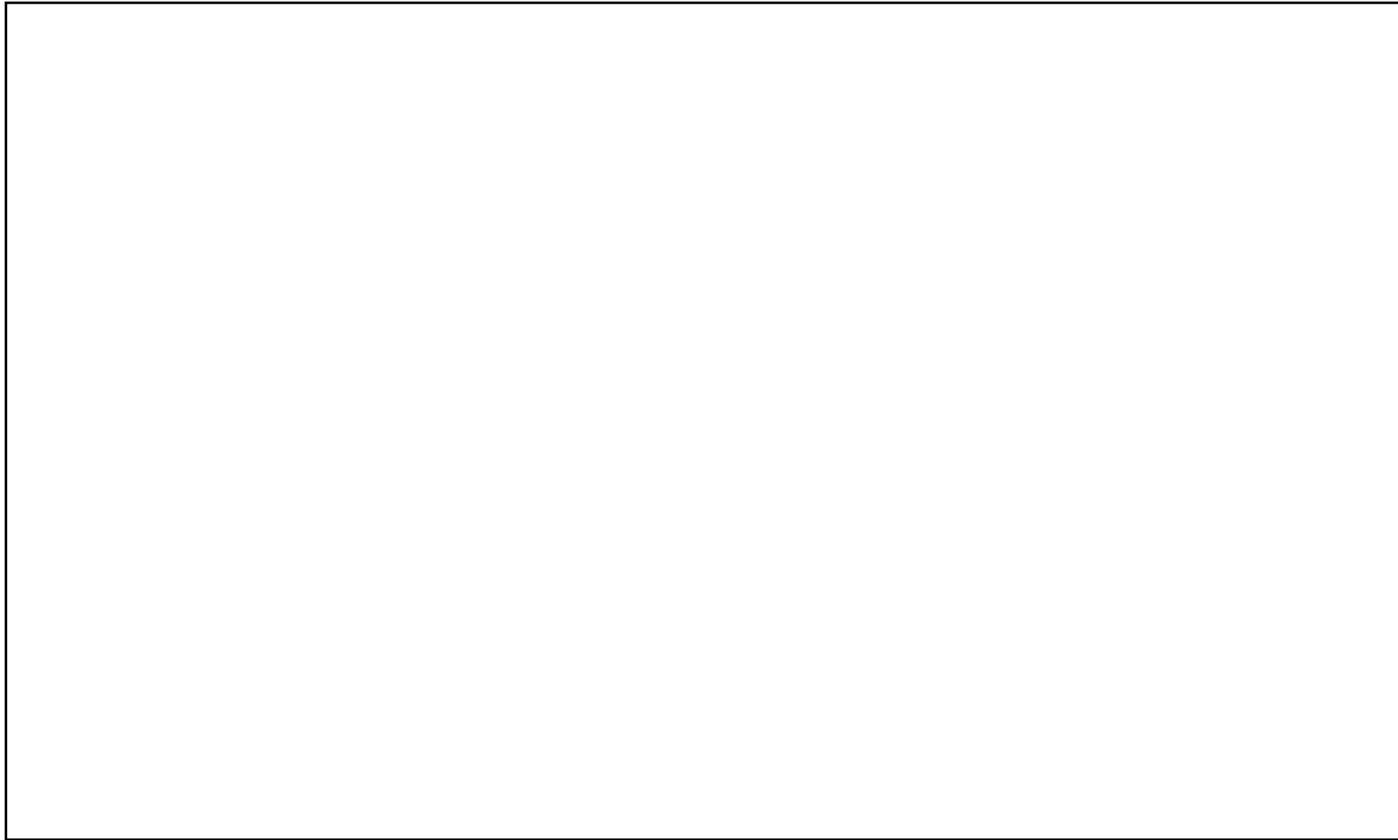


Fig. 5. Example of 'chain' settlement pattern - village of Brzeźnica. (Frame borders the area shown in fig. 6).

Ryc. 5. Przykład łańcuchówki - Brzeźnica. (Ramka obejmuje obszar przedstawiony na rys. 6).

The analysis of ownership structures provides some information on the historical condition of the natural environment. First, a major part of the area was the property of kings and was covered by forests. It is estimated that approximately 80% of the total area was forests and natural meadows. It is known that forests became the official property of the dukes around the 13th century, when the scorching agricultural practices were organized (Buczek, 1960). The descriptive names of some of the local villages are evidence of the former major forest coverage in this area. The so called '*łazy*' were settlements sited on land plots gained by scorching or clearing patches of shrubs or forests (Rospond, 1984). Such plots were most probably abandoned after a year or two of exploitation for the subsequent thirty years, to allow the forest to regenerate (Buczek, 1960).

Brzeźnica is the name of a place where there were (or still are) birch trees. The name Dąbrowica is derived from *dqb* - oak tree. Other names of villages derived from common tree species are Buczyna (*buk* - beech) and Grabina (*grab* - hornbeam). The name Jasień is derived from *jesion* - ash tree (or otherwise it can also be a possessive name - property of Grasz). Poręba is a cultural name reflecting the way of clearing the forest - felling. The name of Poręba was also given to industrial settlements created within forest complexes, producing charcoal and tar. The species composition of the medieval forests is also reflected in some of the historical documents (land sale documents), where long-living trees are mentioned as benchmarks. These are: beech, oak, linden, hornbeam, birch, apple tree and willow (Galas, 1959). The percentage of forests and meadows in the total area diminished from approximately 70% in the 14th century to about 50% in the 15th century.

The status of the royal estates varied depending on the intensity of new settlement location and allocations to the church and knighthood. The kings that were particularly active in developing settlement and economic growth were Władysław Łokietek and Kazimierz Wielki (Mateszew, 1980). They carried out a policy of recon-

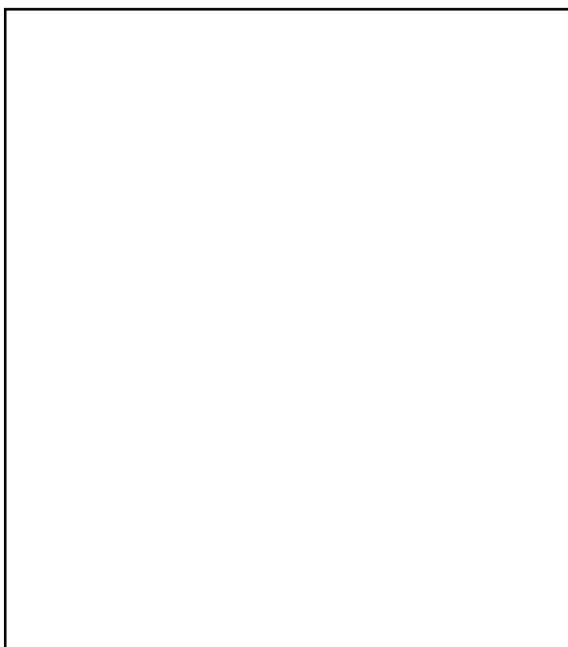


Fig. 6. 'Chain' settlement pattern on land register maps - village of Brzeźnica.

Ryc. 6. Łańcuchówka na mapach katastralnych - Brzeźnica.

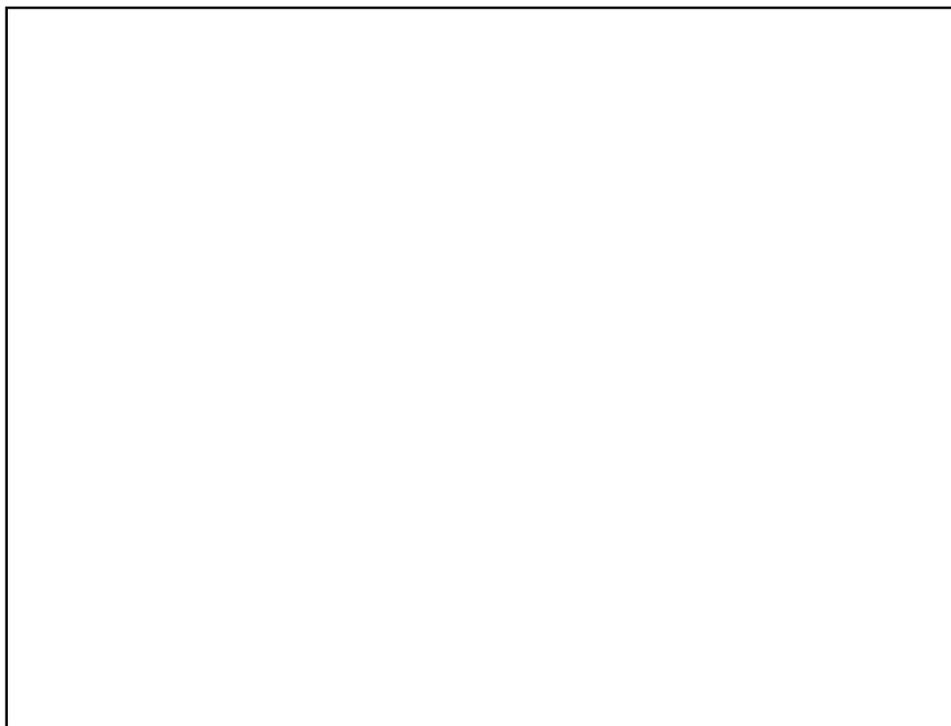


Fig. 7. Example of scattered settlement pattern - village of Gorzków.

Ryc. 7. Przykład wsi rozproszonej - Gorzków.

structuring the royal property, organizing and expanding large estate complexes such as for example the Bochnia estates. Bochnia and Siedlec were part of the royal estates (Bochnia was one of the richest royal towns). The main factor stimulating a fast development of this town was the salt, which was initially produced from the local saline sources and later on (starting from 1251) mined from the underground Tertiary deposits. An other important development factor was the very advantageous location of the town at the intersection of several important commercial tracts and the trading privilege granted to the town by Bolesław Wstydlivy (Boleslaw the Bashful) in 1253 (no other city in Poland received a similar privilege). The limitation of these privileges in favor of Cracow took place in 1485 upon a decision by Kazimierz Jagiellończyk. The disadvantageous changes taking place in the town of Bochnia had further effects, such as a reduction in settlement and economic activities in the entire region (Jodłowski, 1980).

Church estates in this area were the property of the bishop of Cracow, the monastery of the Benedictine sisters from Staniątki, the Benedictine monastery in Tyniec, the monastery of the Order of the Holy Sepulcher from Miechów and the Convent of Cistercian Brothers from Wąchock. A network of parish administration formed along

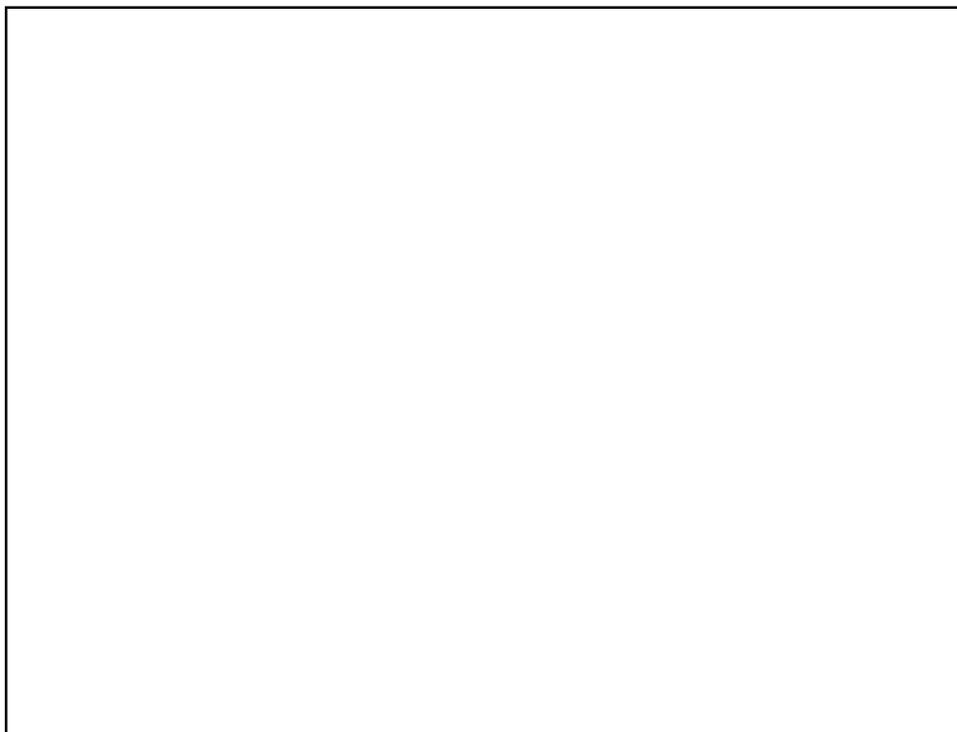


Fig. 8. Example of village built along several intersecting roads - Stary Wiśnicz.

Ryc. 8. Przykład wielodrożnicy - Stary Wiśnicz.

with the colonization and settlement of this region. The tithe invoices from 1326 and the subsequent years mention several villages being the seats of parishes or having their own churches, such as Bochnia (1253), Brzeźnica (1242), Chełm (1198), Jasień (1325), Łapczyca (1326) and Pogwizdów (1335) (Serafińska-Domańska, 1991). Some of the large church estates were preserved for over 600 years, such as the tabular estate in Brzeźnica and Gorzków (in 1897 they were part of the Staniątki Monastery estate) (Bigo, 1897).

The next category of land property were the nobleman's estates. The ownership structure of these estates varied over very short periods of time (therefore some of the villages mentioned in this study are linked with several family names). The oldest knighthood settlement in this area is represented by the Gryfita family. This family owned the villages of Chełm, Nieszkowice, Bochnia, Łopianka, Brzeźnica, Dołuszyce and many others. Turzynita was another old knight family. Their representatives, the Stradomski owned Nieszkowice Małe and another branch of the family, the Ligęza, managed Gierczyce Dolne, Gierczyce Górne and Dąbrowica. Another major family having estates in this area (Dołuszyce) were the Lubowita-Ogień. The Szreniawita and Kmita families also had very large estates in the 14th-15th cc. They controlled

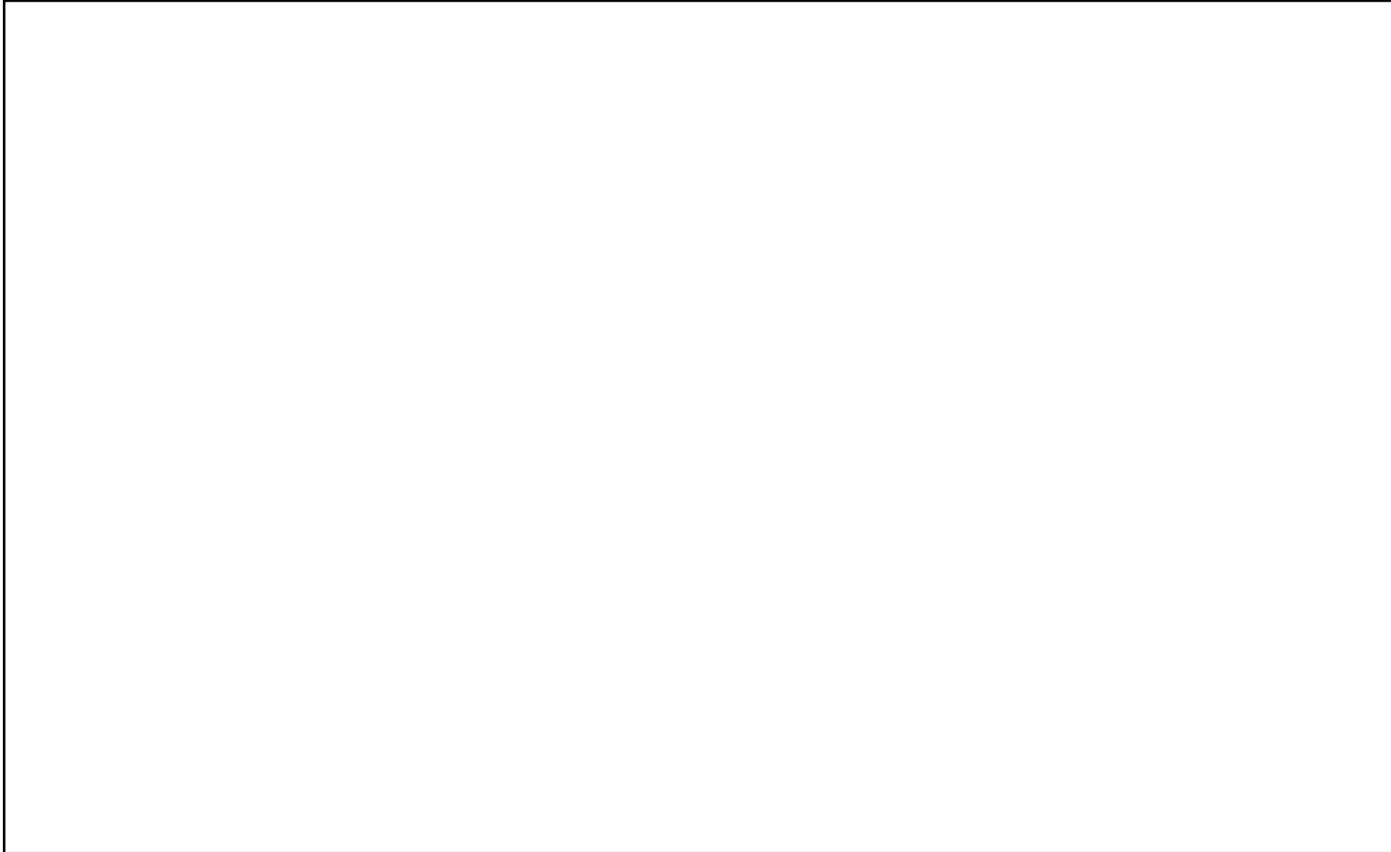


Fig. 9. Example of 'fork' settlement pattern - village of Poręba Spytkowska.

Ryc. 9. Przykłady widlicy - Poręba Spytkowska.

Wiśnicz, Gierczyce Dolne, Gierczyce Górne, Dąbrowica, Biernaszowice, Kurów, Dołuszyce, the Bucharka farm and many other villages. Other families from this area are Strzemieńczyk and Leliwita. The major forms of ownership in this area were nobleman's and church estates.

The most frequently cultivated cereals were: wheat, barley, millet, rye and oat. The most typical fruit trees were pears and apples. Vegetables included turnip, carrots, onions and cucumbers. The average yield in wheat was four grains from one, and three to five in barley and rye (Dobrowolska, 1961). According to the *Liber beneficiorum* by Jan Długosz, an average nobleman's farm covered three *lans* (one *lan* being 30 hectares) and was often similar in size to a peasant estate. This would indicate the social equality of the noble class and peasants in this period. In the times of Jan Długosz progressive farmers were reluctant in using the traditional land use pattern called the checker-board. The practices applied were based on the three-field method. The village was divided into three fields delimited within the *lan* units. Such a division is considered to be a characteristic feature of the German colonization. The human activities carried out throughout the Middle Ages permanently transformed the natural landscape into an agricultural landscape (Bujak, 1905). Starting from the 15th century arable land started to dominate in the Carpathian Foothills.

3.2. Settlement and economy between the 16th century and the terminal phase of the Old Poland period

Starting from the Middle Ages to the decline of the Polish Republic, Bochnia and its surroundings belonged to the Cracow Voivodeship, Szczyrzyc Province. The further fate of this region is linked with the legal and technical transformation of local economy. The development of industry and trade and the intensification of agricultural production were the result of a broader application of iron in ploughs, mining of salt, creation of fouling-mills, mills, sawmills and the inflow of skilled foreign craftsmen and merchants. In the 13th and 14th centuries the economic development and intense settlement were based on the rental law and in the 15th century feudal farm estate structures were created (Przyboś, 1995). The system moved to a land rental form also called soccage. The creation of farm estates was linked with a revival of feudal structures, causing a reduction in the production capacity of peasant farms. Due to the wars with Sweden, the Cossacks, Turkey and Moscow, Poland was invaded by aggressor armies. The country was deprived of legislative authority because of the internal political conflicts among the noble class.

The second half of the 17th century and the 18th century were very unfavorable to the Bochnia region because of the numerous wars. The war activities themselves did not cause as much damage as the marches and stationing of the armies. To prevent any riot in the occupied areas, the population was cruelly tormented and murdered and all material resources destroyed (Wojas, 1980). Systematic burning of the villages, plundering and destruction of the crops and livestock caused starvation and numerous epidemics. An additional factor destroying the population was the high frequency of na-

tural disasters (pest, heavy rains, floods, locust outbreaks). All these facts were reflected in a lack of population growth and the decline in the economy (Wojas, 1980). The degradation of the peasant's situation due to the continuous wars and political jumble in the country caused flights and numerous armed riots (16th and 17th centuries). At present it is difficult to estimate in detail the ways these facts affected the existing settlement pattern. It is known that the number of rural settlements did not change despite the changes in ownership structure. The so called middle class noblemen lost their importance in favor of the magnates. The first half of the 17th century was a time of prosperity for the town of Bochnia.

3.3. Settlement and economic activity in the rural areas during the 18th, 19th and at the beginning of the 20th cc

In June 1772 the town of Bochnia and its surroundings were incorporated to the Austrian Empire and remained Austrian for the next 146 years. In the 1782 reform a decision was made to create an administrative unit around Bochnia, whose borders were preserved until the second half of the 19th century. At the end of the 18th century, based on a decree of the Austrian emperor Joseph II, the area of Galicia was colonized with Germans brought from the Rhineland (Galicia was the name given to the Polish lands which came under Austrian rule during the period of partition - formal name: Kingdom of Galicia and Lodomeria). The colonists came to Bochnia in 1785. A total of 32 families were settled on the lands of the former Wójtostwo, Podedworze and Chodenice (the hamlet settlement of Trynity) (Kęsek - unpublished information). As these lands were almost unsettled, one can say that new settlements were created. Throughout the Bochnia province, colonists were also placed in many existing villages. They formed more or less numerous settlements being administrative subunits of particular villages.

The fact that Bochnia had been raised to the level of the administrative centre of a large province caused some economic revival in the entire region. This was one of the most densely populated and resource-rich regions of Galicia (thanks to the salt deposits, good arable soils, large forests and the location near one of the main commercial tracts). An unfavorable factor affecting the local economy was the policy of the Austrian authorities aimed at the fastest possible enrichment of the state treasury (Grodziński, Partyka, 1980). The poor condition of the farms was mainly due to the lack of stability in the land ownership structure (numerous sales and changes in ownership).

Based on emperors' patents from April 12, 1785 and August 23, 1817, general land records were carried out in 1787-1789 and 1817-1819. They provided information on the levels of land taxes and a detailed breakdown of land use patterns. Thanks to these records (referred to as the Josephite and Franciscan registers) it is known that arable land at this time occupied 61% of the total area, meadows accounted for 11%, pastures, bushes, gardens and fallow land covered 11% and the forests 17% (Fig. 10). The main cultivated plant species were cereals (wheat, rye and oat). The generally applied crop sequence was: wheat with manure fertilization during year one, rye during the second year and oat (or land fallowing) in year three. In less fertile areas the



Fig. 10. Change in land use patterns in the Carpathian Foothills.

Ryc. 10. Zmiany struktury użytkowania ziemi na obszarze progu Pogórza Karpackiego.

main crops were rye and oat (and less frequently barley). The land was usually cultivated along the slopes. Fertilization was used to increase the crop yields. The ravines and steep slopes limited the land easily accessible and the possibility to apply fertilizers and agrochemical procedures. Ploughed land was mainly concentrated on flat summit planes and gentle slopes. The meadows mainly covered the bottoms of the valleys. Areas which were not easily accessible for arable use were used as pastures. The average size of a farm ranged from five to ten hectares, the large ones covering a dozen hectares. The average size of a land plot reduced from 0.96 hectare in 1787 to 0.90 hectare in 1820.

Land division caused a fragmentation of the slopes in rural areas down to 103 plots per km² in 1787 and 110 plots per km² in 1820. Arable land over approximately 50% of the area investigated was extensively exploited or fallowed and part of it was abandoned (giving birth to natural plant associations). This is confirmed by the contemporary investigation of land suitability. About 21% of the area was classified as good quality soils (permanently cultivated), 37% as medium quality and 42% as the less suitable for agriculture (often fallowed or derelict). In Galicia, about 30% of the total arable area was covered by fallow lands.

The so-called Franciscan register provides information on a very slow process of increasing the arable area, converting some of the meadows and pastures into arable land and fragmentation of slope plots. A characteristic feature of this area is the presence of large forest complexes and numerous bundles of trees and bushes on the borderlines of fields. Forests were intensively exploited (pasturing, clearing, felling). About 18% of the forest area was covered by undergrowth and bushes. Unfavorable transformations in the numbers and species composition of the forests were the conse-

quence of negligence and the search for quick profit (Stupnicki, 1864). The species composition of 19th century forests differed significantly from the primeval one (when settlement began in this area), mainly composed of deciduous forests dominated by beech. Fast-growing species such as pine and larch were favoured, neglecting the natural conditions of the forest habitats (Gruszka, 1992). The Geographical Dictionary of the Kingdom of Poland provides information on fir forests near Kolanów, Kurów, Łapczyca and Jasień (when the primary forests were mainly pine) and the mixed beech, birch and fir woods near Kopaliny, willow woods and unidentified mixed forests near Łazy. A domination of deciduous forests was discernible near Olchawa and Mały Wiśnicz. The only mention of beech domination refers to Nieszkowice.

As compared to western Galicia the average yields of the four main cereals were higher in the Bochnia Province (Zdrada, 1980). Stock raising played an auxiliary role. All farmers (including yeomen) raised cows and pigs (only rich farmers had horses). The narrow diversity of crops caused additional problems during time of numerous acts of God such as hail, rainy years and cold winters (1838, 1839, 1844, 1845, 1853, 1874, 1884, 1889, 1902, 1903, 1904, 1905) and epidemics (1855, 1864, 1865-66, 1873). In his statistical description of Galicia F. Bujak (1908) records low yields of the main crops, an average of five grains from 1 sown (as compared to 7-10 grains from one in Germany). J. Zdrada (1980) explains this very inefficient management as being due to the application of obsolete tools and poor quality of sowing grain, the weed infestation levels, unskilled manure application, mistakes in crop sequencing and shallow ploughing. Additionally F. Bujak (1908) indicates poor management practices applied to the communal lands (transformation of pastures into derelict land due to a excessively frequent and intense pasturing of a broad range of livestock, with no care for the condition of the land). The progressive alteration of the natural environment was also reflected in the decline of bee keeping. In 1880-1900, impoverishment of vegetation by inappropriate agricultural practices and deterioration of the forests caused a 30% reduction in the population of bees (Bujak, 1908).

The high population numbers and poor economic conditions contributed to an intense wave of emigration, thus slowing down the natural population growth in the region. The abolition of soccage in 1848 made the peasant owner of the land, eliminating tributes and rental fees. In reality the tax load increased along with a limitation of the rights to use forests and pastures. Despite the division of former feudal estates, fragmentation of peasant plots continued. The domination of very small farms did not allow stock raising to develop. Gardening and fruit-growing were also in a poor situation. This improved at the beginning of the 20th century, with the popularization of agricultural cooperatives (Zdrada, 1980). The above processes are reflected when comparing the population density and land use patterns in 1897 and 1988. The smaller population in 1897 used more arable land than is done in 1988, and the percentage of forests was lower in 1897 by an average of 4.5%. In 1897 the main source of revenues in the rural settlements was farming.

When Poland gained independence, the key problem of rural areas was the fragmentation of land (most frequent size of a farm below two hectares. The average po-

pulation density was 123.6 per km²). Generally, during the interwar period the situation did not improve because of the economic crisis and also some natural factors such as numerous floods (Hampel, Zawistowski, 1980).

The postwar period is characterized by further land fragmentation. The number of land plots increased by 10-30% (Stelmach et al., 1990). The industrialization of the Bochnia province (1962-1972) contributed to a migration towards the industrial centers and to an increase in number of farmers-workers (Stolarczyk, 1980). The increase in the efficiency of farms resulted from the introduction of a broader range of machines, application of chemical fertilizers, land improvement and agricultural training. Despite the improvement of agricultural production standards, farms in this region were not production oriented. The current structure of agriculture is reflecting the industrialization and land fragmentation and is not linked with the local natural conditions.

3.4. Current status of settlement and agricultural practices

The distribution of population in the Carpathian Foothills between the Raba and Uszwica Rivers was shaped by historical events, the suitability of natural locations for settlement and farming and communication access. There are 18 villages in the area covered by this study. Three towns were also described (Bochnia, Brzesko and Nowy Wiśnicz) due to the important role they play in this region.

The region covered has an area of 158.36 km². It is inhabited by 65,654 people (1994). The average population density is 414 per km². Towns account for 74% of the total population and 29% of the total area. Typical industrial and services centres are Bochnia and Brzesko. Nowy Wiśnicz is an example of small town playing the role of a service and agricultural centre.

The number and distribution of villages follows the medieval location pattern. Rural areas account for 71% of the total area and 26% of the population. The average population density in rural areas is 160 per km². The largest villages (Jasień, Poręba Spytowska and Łapczyca) have c. 2000 inhabitants each, the smallest (Chełm) is inhabited by 162 people.

Over 80% of the rural population works outside the agricultural sector (Stelmach et al., 1988). The impossibility to make a household living from farming is caused by the major fragmentation of land plots. Due to the efficient transportation structure and vicinity of labor markets, all the villages in the borderline area of the Carpathian Foothills are focused on industry and services. Agricultural villages are concentrated in the southern parts of the marginal zone (Mały Wiśnicz, Olchawa, Kopaliny and Kobyle).

Almost 95% of the arable land is privately owned. The lack of profitability in this area is caused by the size and shape of the fields. The average size of a farm is only 2.98 hectares. An average farm is composed of 5 fields of 0.68 hectare each. Farms over 10 hectares account for 0.5% of the total number. The land plot layout is a follow-up of the medieval system of plots stretching between the road and the forest. The field is a narrow strip beginning at the farmer's house. Traditionally, ploughing is done

along the slopes. In spots where the patchwork of fields was preserved, ploughing of particular fields follows the plot and landscape geometry.

The agricultural character of the area is mainly linked with the fertile soils on gentle slopes. Agricultural land accounts for 70% of the area (51% arable). Grasslands cover 19% and are mainly located in the bottoms of valleys and on land creeping and sliding forms which are not suitable for ploughing. Forests account for 22% of the total area and cover the steepest slopes. The few major forest complexes survived thanks to the fact that in the past they were the property of kings or magnates.

4. Landscape transformation caused by agricultural practices

The measure of the human pressure is the extent of landscape transformation by man and the intensity of his economic activities (Figs 11 and 12). The assumed transformation coefficient is the ratio between the area of forests and grasslands and the area of built up land (according to Maruszczak, 1988). This index is multiplied by the average population density and referred to as the human pressure indicator. It was



Fig. 11. Human impact on the natural environment in the Carpathian Foothills (author's elaboration based on data from: J. Bigo, 1897, B. Chlebowski et al., 1880-1895, J. Długosz (15th century), Metryka franciszkańska, 1820, Metryka józefińska, 1787, Kataster bocheński, 1879, K. Kumor, 1984, T. Ładogórski, 1958, M. Stelmach et al., 1988, Teki Schneidra, 1801).

Ryc. 11. Wpływ człowieka na środowisko na obszarze pogórza Karpackiego (opracowanie własne na podstawie: J. Bigo, 1897, B. Chlebowski et al., 1880-1895, J. Długosz (15th century), Metryka franciszkańska, 1820, Metryka józefińska, 1787, Kataster bocheński, 1879, K. Kumor, 1984, T. Ładogórski, 1958, M. Stelmach et al., 1988, Teki Schneidra, 1801).



Fig. 12. Human impact on the natural environment in Poland (author's map based on H. Maruszczak, 1988).

Ryc. 12. Wpływ człowieka na środowisko w Polsce (opracowanie własne na podstawie H. Maruszczaka, 1988).

acknowledged that the intensity of human impacts on the natural environment depends on the land use pattern and the number of people inhabiting a particular area.

In the past landscape transformation was incremental. The first phase (to the 10th century) covers all the stages of prehistoric and early medieval settlement. With the gradual increase on population numbers and the creation of new settlements the area of economic activity took over some of the forests. This process caused a staged alteration of the landscape. The settlement and economic activity of man during the prehistoric times caused a significant transformation of the early medieval landscape of the Carpathian Foothills. The early medieval population worked on fields set up by their prehistoric ancestors. According to some estimations, about 20% of the land available for farming was used in 1000 AD. The environment transformation coefficient was then equal to 0.25. With an average population density of 4.7 per km², the calculated human pressure indicator was 0.1.

The second period (from the 10th to the 15th century) was characterized by a permanent transformation of the forest and farmland patterns into a typically agricultural landscape. The transformation processes, caused by human activities initiated a phase of adaptation of the ecosystems (soils, flora and fauna) to the new conditions. Based on historical documents it has been calculated that the environmental transformation coefficient in 1500 AD was equal to one. With an average population density of

31 per km², the human pressure indicator was three. A similar value of the indicator was calculated for the whole of Poland (2.9). It should be underlined that the average population density in Poland was lower in the Carpathian Foothills area (21 per km²), but the total area of arable land was higher (by approximately 10%) (Maruszczak, 1988).

The third period (from the 15th century to the 18th/19th cc) was characterized by the exploitation of the natural environment and stability of the entire geo-cultural balance. No catastrophic alteration of ecosystems occurred as response to human activities. The changes were natural, which means that the effects of internal factors such as the climate, hydrology, geomorphology and soil structure dominated over the anthropogenic factors. Starting from 1787 statistical data and maps are available. Based on these materials it was calculated that the environmental transformation coefficient in the 18th/19th cc. was 1.6. At an average population density of 82 per km² the human pressure indicator was 13. During the same period of time the value of this coefficient averaged over the entire Polish territory was similar (1.5) but the human pressure indicator is 300% lower (due to the lower population density of 27 per km²) (Maruszczak, 1988).

The last two hundred years are characterized by intense human pressure upon the natural environment. The social and economic situation caused an intense exploitation of all natural resources. The consequences of forest felling, further fragmentation of the farms, introduction of root crops and lack of professional skills in taking care of the soil were reflected in the landscape and ineffectiveness of the agricultural production. During this period the environmental transformation coefficient reached a maximum value of 1.7. This means, that over a thousand years this index for the Carpathian Foothills area increased by seven times (as compared to a tenfold increase for entire Polish territory) (Maruszczak, 1988). The human pressure indicator is slightly different. Due to the high population density (414 per km²), the human pressure indicator for the Foothill area is 2.3 times higher than the national average. During the last thousand years the value of the indicator increased almost 600 times (500 times during the last 200 years). It is interesting that the value is being decreasing over the last several dozen years, due to reforestation and land fallowing. The agricultural practices are reducing their environmental impacts. A question arises whether the growing population (living and working in this area) is generating environmental stress, and what is the extent of this influence?

5. Conclusion

The elements of the natural environment that were decisive for the size and range of economic activities of man were: water resources, fertile soils, oak and beech abundant forests, occurrence of mineral resources and advantageous landscape (defensive and communication considerations). It should be underlined that the set of conditions preferred by different cultural groups in different time periods varied. Besides the natural conditions, the development of settlement patterns was also influenced by political factors, the level of social interactions, tradition and many others.

Water needs are reflected in the location of settlements relative to the river network. The land morphology of the marginal zone of the Carpathian Foothills was not an obstacle to the settlement. The entire area was explored, but settlement focused on the summit planes and flat bottoms of river valleys. A significant factor of the attractiveness of the area explored was the fertility of the soils. Forests were not considered as a barrier to the migrating populations but as an opportunity to broaden the range of activities. The settlement of the loess soil-forest interface gave access to the forest resources and allowed effective crop culture. The exploitation of the local saline springs in the early Neolithic reflects the historical relation between settlement sites and the occurrence of natural resources.

Three phases of intense prehistoric settlement activity were identified in the Carpathian Foothills area between the Raba and Uszwica Rivers. Early Neolithic, bronze and iron ages and late Roman period. Significant regresses in settlement intensity occurred between these periods. The basic formation of a more definite settlement pattern was initiated in the early Middle Ages (10th century). Settlement occurred in stages, with social and economic consequences typical for the given historical time. They were expressed by the location basis, layout of the village, land allocation and use patterns and intensity of agricultural production. By 1500 AD the Carpathian Foothills were completely colonized. The network of settlement concentrations and communication routes formed at that time survived to date. The arable land patterns (strip-shaped fields) was also preserved, with the increasing fragmentation of plots due to the increase in population and parcelling out inherited pieces of land.

The relatively high population density and percentage of arable land in the land use structure over the entire period of historical exploration of the Carpathian Foothills by man indicates a relatively good adaptation of the historical populations to the existing environmental conditions and the tolerance of the local natural habitats to anthropogenic influence. The currently observed decrease of the extent of environmental transformation indicates a skilful adaptation of the agricultural practices to the natural conditions.

Further studies should be aimed at answering all the questions addressing potential opportunities of agricultural production in this area and the environmental consequences of increasing population number.

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Rozwój osadnictwa i gospodarki rolnej od neolitu po czasy współczesne na obszarze progu Pogórza Karpackiego między Rabą a Uszwicą

Streszczenie

Na podstawie materiałów archeologicznych i dokumentów historycznych scharakteryzowano osadnictwo i gospodarkę rolną w obszarze progu Pogórza Karpackiego (ryc. 1).

W rozwoju osadnictwa prahistorycznego wyróżniono trzy fazy wzmożonej aktywności osadniczo-gospodarczej: we wczesnym neolicie, na przełomie epoki brązu i żelaza, w późnym okresie rzymskim (tab.1).

Od wczesnego średniowiecza (X w.) do roku 1500 nastąpiło całkowite zasiedlenie progu Pogórza. Wytworzyła się wówczas sieć głównych skupisk osadniczych, ukształtowała się sieć komunikacyjna oraz powstał, zachowany po dzień dzisiejszy, łanowy układ gruntów (ryc. 4-9).

Okres od XV w. do przełomu XVIII/XIX w. - charakteryzowała eksploatacja środowiska przy zachowaniu stabilności całego układu geo-kulturowego. W okresie tym nie wystąpiły żadne katastrofalne przeobrażenia ekosystemów pod wpływem działalności człowieka. Zachodzące zmiany miały charakter naturalny, czyli wpływ czynników wewnętrznych - klimatycznych, hydrologicznych, geomorfologicznych, pedologicznych, dominował nad wpływami zewnętrznymi - antropogenicznymi. Dla przełomu XVIII/XIX w. stosunek powierzchni terenów leśnych i łąk do powierzchni terenów zabudowanych wynosił 1,6 (stosunek ten nazwano wskaźnikiem stopnia przekształcenia środowiska). Przy średniej gęstości zaludnienia 82 osoby/km² wskaźnik antropopresji wynosił 13. W tym czasie wskaźnik stopnia przekształcenia środowiska ziem polskich był podobny (1,5), ale wskaźnik antropopresji był 3-krotnie mniejszy (z powodu mniejszej gęstości zaludnienia - 27 osób/km²) (ryc. 11 i 12).

Ostatni okres dwustu lat cechuje się silną presją człowieka na środowisko. Sytuacja społeczno-ekonomiczna spowodowała intensywną eksploatację środowiska. Konsekwencje wyrębu lasów, dalszych podziałów gospodarstw, wprowadzenia upraw okopowych, braku fachowości oraz dbałości o stan uprawianej ziemi ujawniły się zarówno w kajibrazie, jak i w nieefektywnej produkcji rolnej. W okresie tym stopień przekształcenia środowiska był największy; wyliczony wskaźnik wynosił 1,7. Oznacza to, że w ciągu tysiąclecia wskaźnik stopnia

przekształcenia środowiska w obszarze Pogórza wzrósł 7-krotnie. Dla porównania na ziemiach polskich wzrósł 10-krotnie. Odmiennie kształtuje się wskaźnik antropopresji. Z powodu dużej gęstości zaludnienia (414 osób/km²), wskaźnik antropopresji w obszarze Pogórza jest 2,3 razy wyższy od wskaźnika dla ziem polskich.

W ciągu tysiąclecia wskaźnik antropopresji w obszarze Pogórza wzrósł blisko 600-krotnie, przy czym 500-krotny wzrost nastąpił w ostatnich dwustu latach (ryc. 11 i 12). Interesującym jest, że w ciągu kilkudziesięciu ostatnich lat spada wskaźnik stopnia przekształcenia środowiska, na skutek zalesień i pozostawiania części terenów odłogiem. Względnie duża gęstość zaludnienia i duży udział gruntów ornych w strukturze użytkowania ziemi poprzez cały okres historycznej penetracji człowieka na badanym obszarze wskazuje na dobre przystosowanie się człowieka do istniejących warunków środowiska oraz na tolerancję geosystemu na wpływy antropogeniczne. Gospodarka rolna zmniejsza stopień swego oddziaływania na środowisko.