

Joanna PLIT

Polish Academy of Sciences
Institute of Geography and Spatial Organization
Warsaw, Poland
e-mail: joannaplit1@gmail.com

**SECULAR FOREST EXPLOITATION
AND ITS LANDSCAPE CONSEQUENCES
EVOLUTION OF FOREST LANDSCAPES ON POLISH TERRITORIES**

**WIELOWIEKOWA EKSPLOATACJA LASÓW
I JEJ KRAJOBRAZOWE KONSEKWENCJE
EWOLUCJA KRAJOBRAZÓW LEŚNYCH NA ZIEMIACH POLSKICH**

Key words: Forests of Poland, changes during 10th centuries

Słowa kluczowe: lasy Polski, ewolucja lokalizacji, zasięgów, składu gatunkowego

Abstrakt

Location in this climatic-vegetation zone determined the natural landscape of Poland as originally closed. During the last millennium, human activity brought about very significant changes in the landscapes, with limitation of the surfaces covered by forests. This process was not unidirectional, encompassing changes in the ranges and distribution of complexes, their surfaces and degrees of fragmentation, specie and age composition of tree stands. The manners and the intensity of using forest resources changed over the centuries. Likewise, changes took place concerning the objectives and methods of protecting the selected complexes. The purpose of the study here presented is to recreate the course of this process on Polish lands. The analysis is based on the forests growing within the catchment areas of Vistula and Niemen, Comparison of the ways, in which forests were used centuries ago and are used nowadays, indicates a decrease in ecosystem services. The effect consists in the regeneration of plant ecosystems and forest habitats.

Streszczenie

Położenie w strefie klimatyczno-roślinnej lasów liściastych i mieszanych zdeterminowało naturalne krajobrazy Polski jako leśne. W ciągu ostatniego tysiąclecia pod wpływem działalności człowieka następowały bardzo istotne zmiany krajobrazów, głównie ograniczanie powierzchni pokrytej lasem. Proces obejmował zmiany rozmieszczenia kompleksów, ich powierzchni i stopnia fragmentacji, składu gatunkowego i wiekowego drzewostanów. W ciągu wieków różny był sposób i intensywność wykorzystywania zasobów leśnych. Zmieniał się również cel i sposób ochrony wybranych kompleksów, gatunków roślin i zwierząt. Odtworzenie tego procesu na ziemiach polskich jest celem niniejszego opracowania.

Podstawą analizy są lasy porastające dorzecze Wisły i Niemna, w których autorka prowadziła badania w czasie ostatnich 30 lat. Są to wielkie kompleksy leśne: Puszcza Augustowska, Knyszyńska, Białowieska, Piska, Kurpiowska, Kampinoska, Koziennicka, Świętokrzyska i Karpacka. Horyzontem czasowym jest ostatnie 1000 lat.

INTRODUCTION

Poland, as a country located in the zone of transitory moderate climate, represents the area of landscapes of the mixed and deciduous woods, as well as pine forests. Location in this climatic-vegetation zone determined the natural landscape of Poland as originally closed. Except for the water bodies, almost entire territory of the country was covered by forests. Open landscapes (or at least temporarily open ones) appeared only within the reach of the swampy habitats and bogs (shores of rivers and lakes, overgrowing lake and melt-out bowls, river deltas), occupied by peat-bogs, swards and reeds, as well as smallish enclaves of moorlands and xero-thermal grasses. Landscapes were also open in the mountains, above the forest line – the high mountain floor of the Alpine vegetation and rocks. The naturally non-forested areas accounted for just a couple of percent of the area of the country.

During the last millennium, human activity brought about very significant changes in the landscapes, with limitation of the surfaces covered by forests. This process was not unidirectional, encompassing changes in the ranges and distribution of complexes, their surfaces and degrees of fragmentation, specie and age composition of tree stands. Along with the increase of population density and developments in the technologies of production, forest areas shrank, while wars and epidemics, which decimated the inhabitants, would bring about the return of the forests onto the land having previously become agriculturally exploited. The respective processes were also modified by the natural climatic oscillations (like, e.g., the small ice age) and their consequences (catastrophic floods, hurricane winds). The manners and the intensity of using forest resources changed over the centuries. Likewise, changes took place concerning the objectives and methods of protecting the selected complexes, plant species and animals. The purpose of the study here presented is to recreate the course of this process on Polish lands.

The study area is constituted by the present-day territory of Poland, notwithstanding the fact that in history the territorial reach of the country changed many times, and from 1795 till 1918 the whole of Poland was under occupation of the three partitioning powers. The analysis is based on the forests growing within the catchment areas of Vistula and Niemen, where the present author has conducted investigations during the last 30 years. These are large forest complexes: the Forests of Augustów, Knyszyn, Białowieża, Pisz, Kampinos, and Koźienice, as well as the Holy Cross and Carpathian Forests. Their locations and contemporary reaches are shown in fig. 1.

The time horizon of the archival queries is the last 1000 years. The detailed investigations of changes in the reaches of the particular forest complexes encompass the last 200-300 years (the dates of charting determine the time span of the analysis). The method of enquiry consists in the detailed historical and cartographic analyses, verified in the course of the field studies.

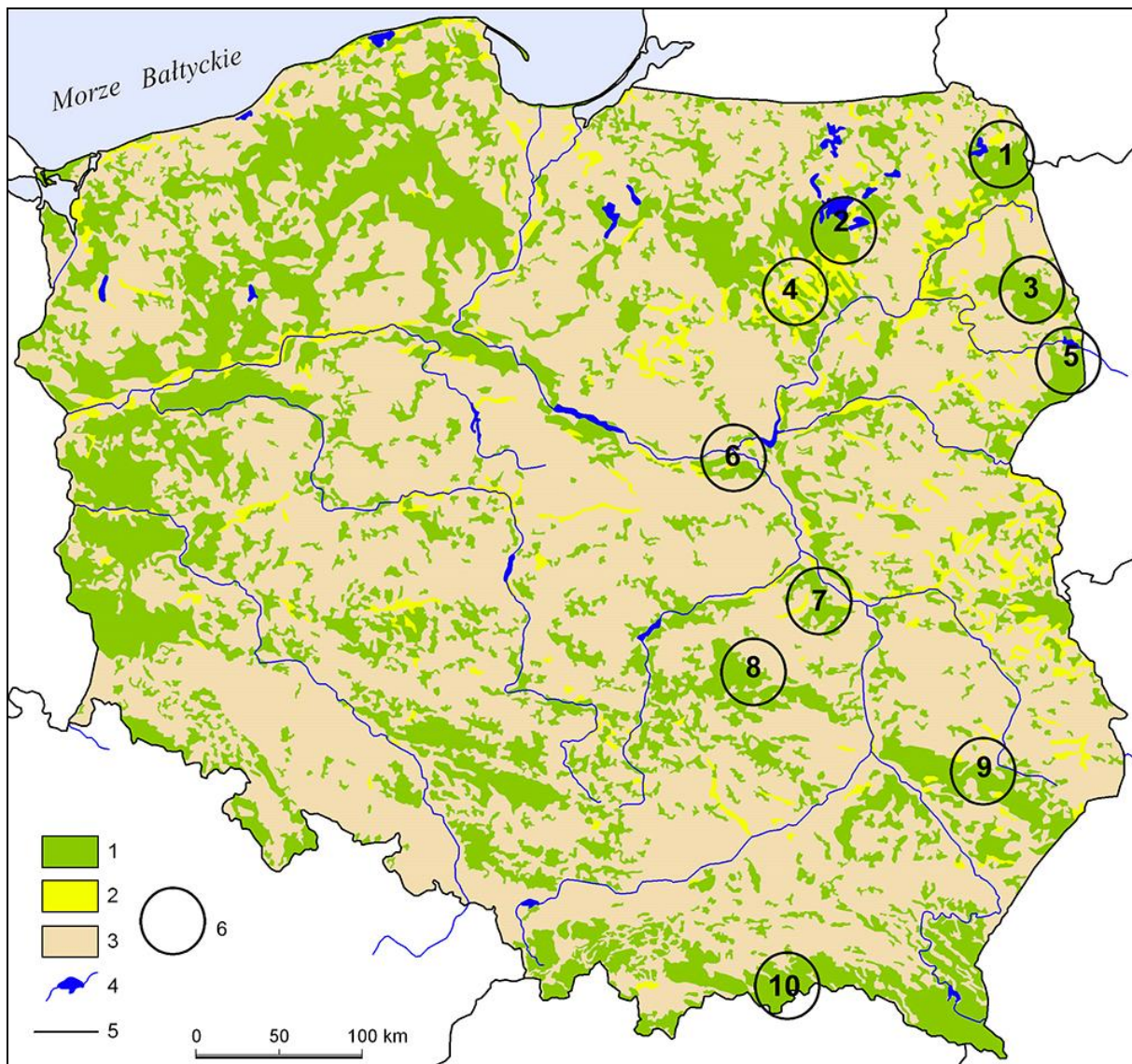


Fig. 1. Localization of the forests on the land use map:

1 – forest; 2 – meadow; 3 – cropland; 4 – river and lake; 5 – political border; 6 – forest (1 – Augustów forest; 2 – Pisz forest; 3 – Knyszyn forest; 4 – Kurpie forest; 5 – Białowieża forest; 6 – Kampinos forest; 7 – Kozienice forest; 8 – Świętokrzyskie forest; 9 – Roztocze forest ; 10 Karpaty forest).

CHANGES IN THE AREA AND LOCATION OF FORESTS

The interpretative maps of distribution of forests in Poland have been elaborated for a long time already. One can find them in atlases and handbooks. They illustrate the “state” from 1000 years ago, from the 18th and 19th centuries (Buczek, 1960; Buczek, Pacuski, 1996; Schultze, 1971; Maciejewski, 2000). The reaches of forest areas for the centuries far in the past have only hypothetical character and are highly debatable, and so the respective elaborates differ significantly among themselves. There are no direct sources, and the indirect reasoning is founded on the archaeological traces of settlements and the estimates of the population numbers implying

the land area necessary for maintenance of this population. The deforested areas were depicted around the settlements¹.

Historians are in agreement as to the fact that in the 9th-10th centuries the overwhelming majority of the territory of the country was covered by forests. This, naturally, does not mean that woods and pine forests had at that time the character of climax associations. The gathering-hunting communities, and later on the pastoral-hunting ones, had to intensively exploit the forests in order to survive. Forests provided them with food, construction material, and fuel. Forests were thinned, mature trees felled, underground was exploited, the numbers of big game were decreased by hunting. Inhabitants pastured larger livestock in the forests, cut out the bushes and the fresh branches in order to feed the livestock during winter. For purposes of establishing the fields they would burn out the clearings² (as witnessed by the charcoaled layers in the fossil soils). Since they did not use fertilisers on the fields cultivated, soil got quickly barren and fields had to be moved to other places. The abandoned cultivated fields have been overgrowing with forests after some years due to natural succession.

Primitive tools were used in cultivation and so only light soils were used – the sandy ones, easy to plough, but little fertile. It was also important that removal of trees and burning out were easy (felling of pines was facile). Farming concentrated on the habitats of pine forests, mixed pine forests, and – less frequently – of the poor dry ground deciduous forests (Kowalenko, 1938; Dobrowolska, 1961). In the Middle Ages forest covered the areas of heavy clayey soils, as well as swampy and boggy areas, and the river fen soils.

Along with the development of farming tools and technologies of cultivation, farming entered gradually onto the more fertile, heavier clayey soils (brown soils, rendzinas). Likewise, cultivated fields were being located increasingly higher on the slopes of the Carpathians and Sudety Mts. (Pietrzak, 2002). Land improvement operations allowed for the removal of excess water from the black boggy soils and river fen soils. Gradually, the territory was turning into agricultural land (like, e.g. the Delta of Vistula and the Plain of Błonie). This process lasted from the 12th century³ until even as late as 19th-20th century (Dobrowolska, 1961; Majkowska, 2002; Plit, 2010, Stepaniuk, 2010). Forests have been pushed away from the more fertile habitats, while cultivation of the poorer and acid habitats has been given up. Forests would then return through natural succession, and sometimes the process

¹ Archaeological investigations indicate that the oldest settlements were established overlooking the water bodies, on the areas, where the contrasting habitats neighboured one upon another – peat bogs or deciduous floodplain woods with dry ground deciduous forests, or the oak woods, beech woods, as well as pine forest habitats. Such locations facilitated the access to a broad food providing basis.

² According to Dobrowolska (1961) in the western part of the territory of Poland already 1000 years ago such way of farming had become a rarity, while it persisted over a couple of centuries longer in the eastern and central parts of the country.

³ The very first flood protection wall of more than a dozen kilometre length was constructed by the inhabitants of Gdansk within the Żuławy area of the Vistula delta.

of re-establishment of the tree stands was accelerated by men, who would bury on the fallow lands and clearings pine cones or acorns.

Thus, location of the forest complexes and the cultivated fields was different centuries ago than it is today. In the ancient times forests grew where arable fields dominate nowadays. There are, however, certain exceptions to this general rule⁴:

1. In the Middle Ages and for centuries afterwards large forest complexes and swamps were preserved along the state borders, as a thinly populated buffer zone, making access and penetration more difficult for the potential aggressors. Such functions were fulfilled by the Forest of Knyszyn, Pisz, Kurpie, as well as the Carpathian Forest.

2. The king and the barons would preserve large compact forest complexes as their hunting domains (these areas encompassing diverse types of habitats). This sort of function was fulfilled by, for instance, the Forest of Knyszyn for the families of Radziwiłł and Branicki (Czerwiński, 1995); the woods of Roztocze Hills for the Zamoyski (Skowronek, 2005), the Forests of Białowieża, Holy Cross, Kozienice, Niepołomice – for the royal court (*Dzieje...*, 1965; Zielony, 1997).

The process of rolling back the forests did not take place in a homogeneous manner across the entire territory of the country. It progressed from the West and the South towards the East and the North-East. At the latest, namely only in the 16th-17th centuries this process really reached the woods of the Carpathians, regions of Podlasie, northern Masovia, and Polesie (Chętnik, 1927). The true-to-life settlement action became possible on these areas only after the invasions of the Jacwingi and the Lithuanians⁵ into the lower floor of the coniferous stopped. The historians of cartography would identify the state of development of the region analysed in times far past, using for this purpose hundreds of dispersed archival information pieces. One of the pioneering elaborates of this type was the map of the county of Grodno, showing the image from the 16th century (Jakubowski, 1935). The charting background was used to outline the reaches of the forest complexes within the northern part of the region of Podlasie.

The unilateral course of the deforestation process was disturbed by the large wars, resettlements and epidemics, all of them having decimated the population. On Polish lands the biggest reversal of the trend took place due to the Tartar invasions in the 13th century, then after the Thirty Year war, the Swedish wars, in the 18th century, and the World Wars I and II. In many regions the abandoned areas were covered again by the forest. The changes in the distribution of forests have a distinct regional aspect.

⁴ These exceptions are important, for the respective forest complexes were protected by law or ruler's will, they underwent parcelling and excessive exploitation to a lesser degree than the other ones, and they largely persisted until today.

⁵ After the personal union of Poland and Lithuania had been contracted and the Commonwealth of Both Nations was established.

On the present-day territory of Poland the smallest forest cover was registered during the inter-war period and immediately after the World War II. It can be estimated at slightly above a dozen percent of the total area. The tree stands were damaged and thinned. Since that time, the forest shares are on a systematic increase, initially owing to the activity of the forest services (forestations of the fallow and waste lands, and joining of woods into bigger complexes). In the course of the recent two decades forest cover increases due to natural succession on the wastelands and fallow areas, and due to plantings on private plots. The forest cover in Poland is now at about 30%.

CHANGES IN THE SPECIE COMPOSITION OF THE FORESTS

Due to the significant exchange of the habitats, on which ancient forests used to grow, a change took place of the specie composition. In the ancient times, the dominating species in the forests were the deciduous ones: oaks, beeches, hornbeams, ashes, sycamores and maples, larches, yews, firs, and alders. As farming took over the more fertile habitats, and abandoned the less fertile ones, and the excessively wet lands were drained, the share of the coniferous species in the forests increased. The process of change in the specie composition of the tree stands in the forests was accelerated in the 19th century, when the artificial forest renewal became a routine, along with the growing of the monocultures of the single fast growing tree species (frequently irrespective of the actual potential of the habitat), see Duczyk, Latawiec (2007), *Dzieje...* (1965). So, in 1945, the coniferous stands constituted 87%, while the deciduous ones – only 13%. Cultivation of the forests brought about densification of the tree stands, and, at the same time, reduction of the multi-floor pattern of the setting of the plants to just two floors: the tall trees and the undergrowth.

Foresters observed that the monocultures are more vulnerable to the pest invasions and to forest fires, and have lower resistance to the stress, caused by environmental pollution. Owing to the increase in the ecological awareness, the reconstruction of the tree stands has been taking place since the 1980s. Deciduous trees are planted on a large scale in the forests. The deciduous second floor is being established. Forests grow slowly, and that is why this activity of tree stand reconstruction is not visible yet in the respective statistics. Nowadays, the primary forest-forming tree is Scots pine, followed by spruce, and birch, with a limited, but growing share of oak and beech. In the year 2011 the coniferous tree stands constituted 77%, while the deciduous ones – only 23% – the young tree floor not being accounted for in these figures.

CHANGES IN THE WAY OF USING FOREST RESOURCES

From the Middle Ages until the middle of the 19th century forests were used in a variety of ways, frequently very intensively, exploitation being concentrated within the field-and-forest borderland. The multiplicity of the use of forest resources

is really striking. J. K. Kluk (1778) listed 230 products made of wood, this list not being, of course, exhaustive. Thus, among the most important manners of forest exploitation one should mention: felling of trees for fuel, for production of tar, charcoal, ash, potash, and, of course – as construction material. Forests were pastured, hunting was carried out, litter was gathered, tans were produced by scorching the trees, herbs, fruits and mushrooms were collected, and honey bee hives set up. There was a degree of specialisation in the choice of particular activities within the individual forest complexes. The manner of exploitation depended, in particular, upon the specie composition of the tree stands and the location of the forest⁶). This is illustrated in a synthetic manner in two tables, showing the kinds of ecosystem services (tab. 1 and tab. 2). They present the ways and the intensity of exploitation of selected forests in ancient times. The selected illustrative examples related to the Forests of Kozienice, as well as that of Kurpie and of Pisz, are distinctly different, witnessing to the definite specialisation of the forest complexes.

The manner of exploiting the forest had distinct landscape consequences, with the biggest changes being brought about by the systematic secular activity of the following character:

1. Cutting the trees for construction and fuel, as well as for crafts, had also effects in terms of landscape. Initially, mature and good quality trees were cut, species being selected depending upon the purpose. Selective cutting brought about the decrease in the shares of larch, fir, linden, beech, oak, and yew. Next, younger trees were cut, as well as those of other species. Consequently, forest complexes shrunk, there were more and more clearings and hollow places within the forests, while the tree stands were getting younger and thinner. Many of the existing complexes were cut into pieces, the length of the forest-field border quickly increased, the specie composition of the forests, and of the animals living there, changed (there were more of roe-deer, hare and wild boar, while there were less of the big game). Determination of the feasible cutting age for the individual tree species was implemented only in the 19th century.

2. Pasturing in the forests did also change in a significant manner the structure and the specie composition of the forests. Since the most ancient times and until as late as the 1970s pasturing was carried out in all of the bigger complexes (including even the Forest of Białowieża)⁷. Cattle and pigs were pastured in the forests. Intensive pasturing resulted in the transformation of the compact multi-floor forests into clear woods of park type with poor undergrowth and sparse bush layer. Of special value for the herdsmen were the oak woods with acorns. Owing to the secular use of the dry ground deciduous forests, a part of them was transformed into oak woods. Depending upon the characteristics of the forest complexes the rights of entry, the admissible magnitudes of the herd pastured, the right to use the in-forest

⁶ Location on a river allowed for floating of wood and other forest products for sale, and that is why, for instance, the Carpathian or Kozienice Forests were felled more intensively than the Forests of Augustów or Pisz. The peripherally located forests were exploited more intensively in the direction of ash, potash, or charcoal production.

⁷ The pasturing continued despite the legal sanctions.

meadows, the fees and tributes, were established⁸. The consequence of the pasturing was the change in the specie composition of the undergrowth (the shadow-liking species would disappear, while the light-oriented ones appeared, particularly numerous were the meadow species). It is possible even now to identify the forests, where intensive pasturing was carried out. This fact is implied by the high shares of *Festuca ovina*, *Cladonia arbuscula*, *Triforium alpestre*, *Galium boreale* and *mollugo*, *Genista tinctoria*, juniper (*Juniperus comunis*), whose seeds were distributed by the artiodactylous animals (an example of an intensively pastured woodland is provided by the Forest of Kurpie). Beginning with the 1990s a rapid decrease of the shares of the meadow species has been observed (Matuszkiewicz et al., 2007). Pasturing in the Carpathians brought about the lowering of the coniferous forest floor level and the limitation to the range of dwarf mountain pine, both of which were partly replaced by the meadow-like areas, covered by the herbs and grasses.

3. Of very high importance was destruction of the forests due to extraction of wood for construction, fuel, and further processing. The intensive foreign exchange, conducted by the Commonwealth of Both Nations between the 15th century and the middle of 17th century, in, for instance, wood and its products, contributed to the destruction of forests. Goods were flown over the rivers to Gdansk and Elblag. Most damaging for the forests was mass production of ash and potash⁹. Vast areas of deciduous forests were felled, snags were dug out, and the forests were destroyed (Solon, Lityński, 1984).

4. Yet another significant factor, causing transformation of forests, was mining and metallurgy (metal ores were extracted in the forests, causing transformation of the relief and destruction of the soils, trees were cut for charcoal and for mining constructions, due to pumping away of water from the exploited mines the groundwater table level was lowered and the regeneration of the forest ecosystems was made more difficult, in the course of the technological processes waste and pollution was produced, contaminating the environment). Metal ores were processed on a large scale within the territory of Poland already in the Roman times (the centres of metallurgy of that time were the regions of Masovia and Świętokrzyskie). In later centuries, up till the 19th century, the turf ores were processed in many regions, mainly by small plants. Locations of melting of the turf ores were selected on the areas of co-appearance of appropriate tree species and presence of the ores. Ore processing was abandoned, when charcoal production in the vicinity was no longer possible due to lack of the wood material. Non-ferrous metal extraction – mainly of silver, plumb, copper and zinc – on a semi-industrial scale concentrated in Sudety Mts., Holy Cross Mts., and in the vicinity of Olkusz, where ores of these metals could be exploited on place. Melting and forging required highly caloric charcoal, which was produced out of the deciduous hardwood (hornbeam, beech, ash, maple, sycamore,

⁸ In the royal domains, the unified rights of use and protection of the great forests were introduced by the king Kasimir Jagiellon in the 16th century.

⁹ Potassium carbonate, obtained from the ash, was used in production of glass, soap, and tans.

alder, beech, and sloe). Hornbeam wood was used particularly eagerly, as it is brittle and breaks down easily¹⁰. Enormous amounts of charcoal were needed to implement metal production and processing under primitive technology. River valleys, as well as the surrounding fertile uplands were becoming deforested, and the settlements of the metalworking craftsmen were turning into villages. In this manner, the fragments of the valleys of Warta, Liswarta, Pilica, Kamienna, Bzura, Narew, Rozoga, Orzyc, Szkwa, and of many more rivers were deforested. The locations of ore extraction are visible in the landscape as the deformations of relief, and sometimes as changes in the vegetation specie composition, even centuries later¹¹. Charcoal was also used in glass production and working until the 19th century. Glass production was the main cause of decimation of, for instance, the Forests of Bolimów and Jaktorów, and of the fragments of the Holy Cross Forest. The role of mining activities in the destruction of forests can also be assessed through the data, provided by A. Połujński (1854) – the mining woodlands in, e.g., the province of Radom, accounted for close to 50% of all the forest areas.

5. The commonly practiced habit of raking and removing the litter caused impoverishment of the habitats, and, by elimination of the tree seedlings, made forest renewal more difficult. Litter was used for thermal protection of buildings, as fertiliser on cultivated fields, and as stable litter for the livestock. The habit of litter exploitation was legally limited already in the 17th century by establishment of frequency of raking and the number of carts of removed litter from definite surfaces. It was ultimately forbidden in the 19th century (first on the part of the territory, belonging to Prussia, and the latest on the part, occupied by Russia). The fact, though, that this habit lasted for many centuries, brought about the decrease of the habitat potential (like, e.g., transformation of the mixed pine forest habitats into those of pine forests, or of the dry ground deciduous forests into mixed pine forest habitats)¹².

6. Hunting and poaching caused total disappearance of aurochs, while bear and European bison were preserved only owing to the special protection undertakings.

¹⁰ It should also be remembered that charcoal constituted only 20% of the weight of wood, from which it was produced (Kozłowski, 1846; Heymanowski, 1970).

¹¹ And so, for instance, in the Suchedniów Woods (the northern fragment of the Holy Cross Forest) the miners, extracting copper ores, would pierce the layer of acid Zechstein sandstones and thus uncover the more fertile base rocks, located beneath. The mixed pine forests, covering this area today, contain numerous enclaves of beech woods in the locations of ore extraction.

¹² By comparing the forest-and-habitat maps, and the maps of the potential natural vegetation, dating from the 1970s and the current ones, one can observe the process of slow regeneration of the habitats. Nowadays, numerous areas are classified as more fertile. Naturally, abandoning of litter gathering is just one of the factors contributing to the tendency observed (Plit, Roo-Zielińska, 1996).

Tab. 1. Different contemporary and means of utilizing Kozenice forest in 13th-19th centuries (density of hachure corresponding with process intensity)

Kind of activity	Aim od activity										
	Preservation of nature	Rest	Gathering			Collection of building wood	Gathering of fuelwood	Production		Land for agriculture	Fertilizing of fiels
			amber/peat	of food	of folder			of pitch, charcoal, ash	of potash		
Cutting trees											
Pulling stumps											
Grubbing up snags											
Burning/cleaning forest											
Raking litter											
Gathering brushwood											
Stripping bark											
Foraging											
Keeping bees											
Huntuing and poaching											
Picking herbs/mushrooms/fruits											
Opencast mining											
Tourism and recreation											
Limiting access, renaturalising											

Tab. 2. Different contemporary and means of utilizing Pisz and Kurpie forest in 13th-19th centuries (density of hachure corresponding with process intensity)

Kind of activity	Aim od activity										
	Preservation of nature	Rest	Gathering			Collection of building wood	Gathering of fuelwood	Production		Land for agriculture	Fertilizing of fiels
			amber/peat and bog ore	of food	of folder			of pitch, charcoal, ash	of potash		
Cutting trees											
Pulling stumps											
Grubbing up snags											
Burning/cleaning forest											
Raking litter											
Gathering brushwood											
Stripping bark											
Foraging											
Keeping bees											
Huntuing and poaching											
Picking herbs/mushrooms/fruits											
Opencast mining											
Tourism and recreation											
Limiting access, renaturalising											

Basing on the written sources one can try to re-create the history of the individual large forest complexes. The reaches of the forest complexes during the last 200-250 years can be traced down in detail owing to the cartographic sources (Plit, 2001; Myga-Piątek, 2012). An instance can be provided by the elaborates, concerning the history of the Forest of Kozenice (Zielony, 1997; Duczyk, Latawiec, 2007; Plit, 2011), see fig. 2.

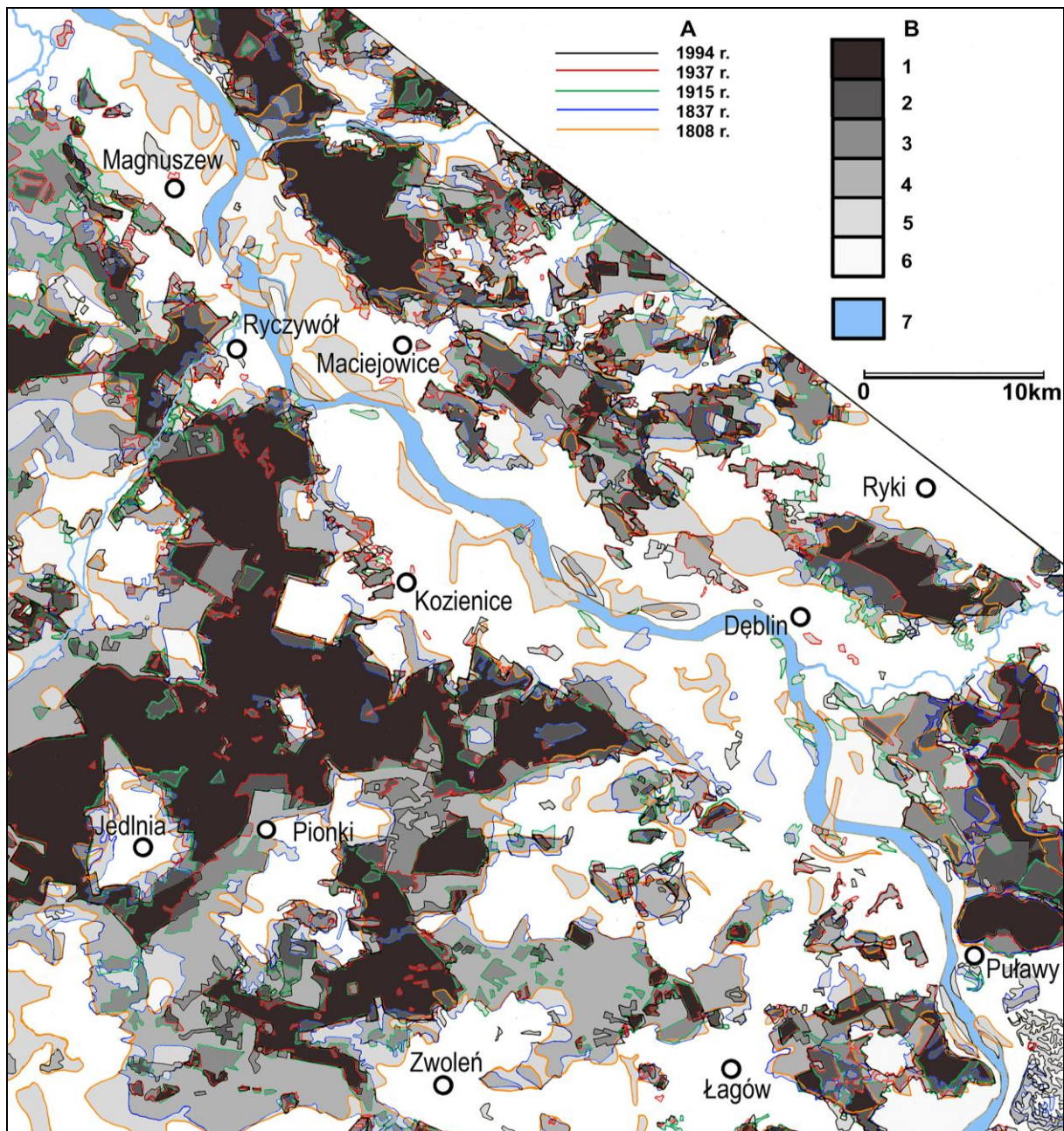


Fig 2. The permanence of forest use in Kozienice region in the 19th centuries

A – Limits of forest area; B – Permanence of forest utilization

- 1 – areas of permanent forest utilization; 2 – areas with dominant method of forest utilization;
- 3 – areas with a prevalent method of forest utilization; 4 – areas with alternating utilization of forest;
- 5 – areas with occasional utilization of forest; 6 – non forest areas; 7 – River.

A number of monographs have appeared, devoted to the entire territory, here considered (like *Dzieje...*, 1965), or individual forest complexes, e.g., Forest of Białowieża (Faliński, 1986; Hedemann, 1939), of Knyszyn (Czerwiński, 1995), of Kozienice (Zareba, 1974; Zielony, 1997), of Kampinos (Andrzejewski, 2003), of Kurpie and Pisz (Matuszkiewicz and associates, 2013, 2014), as well as the National Park of Wigry lake.

CHANGES IN THE MANNER OF USING FORESTS SPECIE PROTECTION OF PLANTS AND ANIMALS, PROTECTION OF FOREST COMPLEXES

At the earliest, namely already at the beginning of the 15th century, yews were subject to protection, due to observation of fast disappearance of their tree-like forms. This specie constituted a limited admixture in the dry ground deciduous woods, the trees were growing slowly, remaining for a long period in the bushy form. Wood of yew is very hard, flexible, and has a nice colour, turning into pink. It was perfect for making bows and cross-bows, and as a raw material for other crafts. Of animals – the specie that was put under protection at the earliest, namely already in the 11th century, was beaver. Although aurochs were put under protection in the 15th century, the very last individual was killed in 1627.

It was already in the 16th century that the first attempts were undertaken of introducing rational forest management and inspection. Yet, the ruthless exploitation of the forest resources was fully restrained only in the 19th century. The occupying powers, Russia, Prussia and Austria, took over the forests having belonged before to the king and to the clergy, along with all those complexes, whose owners were not capable of documenting the property rights. The new administration introduced formalised forest management, the boundaries were precisely delimited, forest complexes were split into parts by the grids of vistas, clearings and felling areas were being forested, the cutting ages were determined for the particular tree species, bee-keeping and poaching were severely limited. Likewise, the traditional peasant rights of entry and of gathering of forest products (raking of litter, collection of faggots for fuel, of mushrooms and berries) were abolished¹³. At the same time, the tree stands were being reconstructed, priority being put on the fast growing species. Numerous alien species were introduced through planting, thereby deforming the pattern of the native flora. Forest cultivation brought integration of the complexes, but, simultaneously, simplification of forest structure, homogenisation of the specie and age composition of the stands.

After the World War II virtually all of forests were taken over by the state. This allowed for the consistent way of managing, cultivating and protecting the forest ecosystems. In the state-owned forests the economic activity is being carried out (mainly wood production), but also the protective one. Damages, resulting from forest fires, floods, pest invasions, and effects of environmental pollution, are being liquidated. The process is observed in Poland of regeneration of not only forest vegetation, but also of the habitats, after the careless exploitation had been stopped (especially raking of the litter and burning out of the felling areas). Today, the potential of the forest habitats is evaluated as higher than 40 years ago.

¹³ The timing of the liquidation of these rights differed for the state-owned and private forests. In some cases, when the documents, confirming the respective peasant rights, related to forest exploitation, were preserved, the privileges were respected yet as late as the end of the 20th century.

The attitude of the society towards the forest changed. The present-day way of using forests differs significantly from that of 200 years ago. This is illustrated in tab. 3 – 4. Many complexes were put under protection in the framework of national parks, landscape parks, and nature reserves. Further, in the commercially exploited forests, partial protection was also introduced for definite objects – e.g. seed-producing stands, or water source areas. Specie protection is applied to a wide spectrum of plants and animals, hunting of game animals is limited in terms of time periods and numbers. Owing to the work of forest service the natural richness is preserved, and the inconsistencies between the potential of the habitats and the tree stands are being corrected. Forests are used nowadays on a large scale in tourism and recreation. They play an important role in environmental protection – in terms of water protection (storage of water, protection against floods by withholding runoff, water filtration), of restraining erosion and migration of contaminants, of limiting noise. State forest were, conform to the will of the people, not subject to the reprivatisation after 1990. Everyone can go into a forest, penetrate it and watch it, provided the common good is not being destroyed.

Paradoxically, forests in Poland are nowadays more natural and less destroyed than centuries ago. Forest economy is adapted to the habitat potential, guaranteeing habitat regeneration, and preservation of the resources of nature for future generations. This economy is close to fulfilment of requirements of sustainable development. (Such a statement is documented by a lot of detailed studies, see, e.g., Matuszkiewicz et al., 2014.)

Alas, errors and mistakes, committed in the domains of spatial development, in realisation of nature protection objectives, and in the subsidies to forestation, have negative consequences. The systematically expanding forests close the landscape, hide the specific forms of abiotic nature, and deform the cultural landscape, having been developed over centuries (Nita, Myga-Piątek, 2012). In many regions expansion of trees onto the xerothermal swards is observed, as well as expansion of the mountain dwarf pine and mountain coniferous forests onto the mountain meadows, which brings about the decrease of biodiversity and disappearance of some associations that are under protection. Excessive populations of some of the protected species (e.g. of beavers, or cormorants) cause a threat for the environment, while tree species, brought to Poland in older times (like, e.g., *Robinia pseudoacacia* or *Acer negundo*) turned out more aggressive and spread over increasing areas. Alas, the respective services that should take care of these problems, lack courage in resolving conflicts between various objectives of protection of nature and landscape. The increase of the scale of negative phenomena calls for a prompt intervention.

Tab. 3. Different contemporary and means of utilizing Kozienice forest in 21th centuries (density of hachure corresponding with proccs intensity)

Kind of activity	Aim od activity										
	Preservation of nature	Rest	Gathering			Collection of building wood	Gathering of fuelwood	Production		Land for agriculture	Fertilizing of fiels
			amber/peat	of food	of folder			of pitch, charcoal, ash	of potash		
Cutting trees											
Pulling stumps											
Grubbing up snags											
Burning/cleaning forest											
Raking litter											
Gathering brushwood											
Stripping bark											
Foraging											
Keeping bees											
Huntuing and poaching											
Picking herbs/mushrooms/fruits											
Opencast mining											
Tourism and recreation											
Limiting access, renaturalising											

Tab. 4. Different contemporary and means of utilizing Pisz and Kurpie forest in 21th centuries (density of hachure corresponding with process intensity)

Kind of activity	Aim od activity										
	Preservation of nature	Rest	Gathering			Collection of building wood	Gathering of fuelwood	Production		Land for agriculture	Fertilizing of fiels
			amber/peat	of food	of folder			of pitch, charcoal, ash	of potash		
Cutting trees											
Pulling stumps											
Grubbing up snags											
Burning/cleaning forest											
Raking litter											
Gathering brushwood											
Stripping bark											
Foraging											
Keeping bees											
Huntuing and poaching											
Picking herbs/mushrooms/fruits											
Opencast mining											
Tourism and recreation											
Limiting access, renaturalising											

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