

# DEVELOPMENT OF RURAL LANDSCAPE IN WIELKOPOLSKA IN REFERENCE TO METABOLISM OF AGROECOSYSTEMS

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**ABSTRACT.** The purpose of this paper is to show the main features of landscape development in a regional scale with reference to socio-economic conditions and the processes of energy and matter flow in agroecosystems. Four main phases of rural landscape development have been distinguished during which the dominant processes determining the functioning of agroecosystems changed. After the initial phase there was a period of spatial expansion of the rural landscape at the expense of natural forests; this phase was followed by the intensification of use through increased external feeding of agroecosystems in energy and matter, and currently the diversification of human influence on environmental systems is becoming increasingly noticeable. The social role of farmers is going to be of fundamental importance to the future of the rural landscape. It is necessary to stimulate their behaviour to make sure that they acquire knowledge, skills and motivation to protect natural environment and the landscape.

**KEY WORDS:** history of landscape, energy and matter flow, environmental protection, rural areas

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## Introduction

Recently, because of undertakings concerning the global policy, we can observe a growing need for overall perspectives that would present environmental phenomena and processes in a manner that considers the social and economic contexts, i.e. in accordance with the sustainable development principle. It seems that landscape research has this quality since landscape can be viewed as a physiognomic reflection of interacting environmental processes and the influence of mankind on its environment (Łowicki, Mizgajski 2005). Thus, the landscape character-

istics reflect the entirety of the processes that occur in ecosystems, including the flow of energy, circulation of matter and regulatory mechanisms which are referred to as metabolism (Ryszkowski 2007). The purpose of this paper is to show – based on the example of Wielkopolska – the main features of environment development in a regional scale with reference to socio-economic conditions and the processes of matter and energy flow in agroecosystems. The above problems are the subject matter of the author's research, in particular in a local scale and in a synthetic form (Mizgajski 1990, 1992, 2002); the analysis presented has



a form of an overview and it underlines the regional dimension of the discussed problem. The considerations focus on the open landscape, which primarily reflects the manner of farming and development of settlement. The structure of this paper is based upon the proposed periodization of the development of the rural landscape in Wielkopolska with regard to changing conditions. Four main phases of landscape development have been distinguished during which the dominant socio-economic processes determining the functioning of agroecosystems changed. After the initial phase there was a period of spatial expansion of the rural landscape at the expense of natural forests; this phase was followed by the intensification of use through increased external feeding of agroecosystems in matter and energy, and currently the diversification of human influence on environmental systems is becoming increasingly noticeable. In the analysis of human impact on agroecosystems, the concepts of ecosystems services and their classification have been employed. The classification was developed within the global assessment of ecosystems conducted by a team of nearly 1000 experts under the aegis of UN (Millennium Ecosystem Assessment 2005).

The area of Wielkopolska, being part of the Central European Plain, is characterized by environmental openness, especially along the latitudinal axis. The recurrent morainic plateaus, outwash fans and valley depressions make Wielkopolska similar to the neighboring areas in the environmental aspect. Subsequent advances of the Pleistocene continental glacier were responsible for the diversity of the landscape from north to south. The reach of the latest glaciation, which split the area into two parts with different physiographic features, was of crucial importance. The peculiarity of the area may be attributed to the similarity of its history, especially in the last two centuries, when as a result of the so-called "agricultural and industrial revolution" the region's modern economic structure developed. What was very important was the fact that in the times of partitions an area roughly corresponding to today's Wielkopolska constituted a separate province, and for a substantial part of the last century and now Wielkopolska may be identified with the *voivodeship* as

a regional administrative unit with a surface area of about 30,000 km<sup>2</sup> inhabited by over 3.3 million people.

A characteristic feature of the present-day Wielkopolska is highly intensive agriculture and well-developed agricultural produce processing industry. The share of acreage of large farms (roughly 20%), in comparison to that of small peasant holdings is much higher here than in the central Poland. Throughout the entire history of the region agriculture was the most important form of anthropogenic impact on ecosystems, which was reflected in the landscape. Man's influence on the environment has caused the today's natural and close to natural ecosystems to occupy a marginal surface area of the landscape. Nature reserves - which make up 0.18% of today's *voivodeship* of Wielkopolska - can be viewed as very general indicator of the above.

### Landscape features in the initial phase

The concept of natural landscape is linked with the reconstruction of the physiognomy of animate and inanimate nature in the absence of human impact. As regards Wielkopolska's land relief and its origin, two basic types of natural landscape can be distinguished: plain and undulating lowland landscapes, and the landscape of valleys and depressions (Fig. 1). Within each of the types, there are several subtypes with their own morphogenetic specificity. A consequence of the different types of substratum development is the diversity of soil properties and relief which, in combination with climatic factors, are responsible for local peculiarities of vegetation.

The potential natural vegetation of Wielkopolska was forest communities (Wojterski et al. 1978, Wojterski et al. 1981). On relatively fertile soils of flat and undulating morainic plateaus, dry-ground forests developed, whereas poor habitats of mixed and pine forests grow on higher valley terraces and outwash deposits with diverse water conditions. Periodically flooded, river valley bottoms are mostly covered with riparian forests, and small, often peaty, depressions with poor water runoff support alder carrs (Table 1).



TABLE 1. POTENTIAL NATURAL VEGETATION AND STRUCTURE OF TREE STANDS IN LANDSCAPE UNITS OF WIELKOPOLSKA

Subregional Natural-Geographical Units	Dominant Sediment Type	Dominant Natural Landscape Type	Natural Potential Vegetation in Landscape Units of Wielkopolska	Percentage of Forests	Prevailing Tree Species in Tree Stands
Pradolina Warty [Pre-Valley of the Warta River]	Sands of fluvial terraces, alluvial soils and sands, peats	Flood plains, terraces with dunes	Leucobryo-Pinetum, Ficario-Ulmetum	43%	Pine 92,8% Oak 2% Beech 0,5% Alder 2,2%
Puszcza Notecka [Wood of the Noteć River]	Outwash deposits, sands of fluvial terraces, alluvial soils and fluvial sands, eolian sands	Terraces with dunes, flood plains	Leucobryo-Pinetum	51,5%	Pine 93,6% Oak 1,1% Beech 0,3% Alder 1,5%
Równina Nowotomysko-Kargowska [Plain of Nowy Tomyśl and Kargowa]	Sands of fluvial terraces, alluvial soils and fluvial sands	Terraces with dunes, outwash, lake district	Leucobryo-Pinetum, Pino-Quercetum	41,3%	Pine 88,1% Oak 3,6% Beech 0,6% Alder 4%
Dolina Środkowej Noteci [Valley of the Middle-Noteć]	Peats, alluvial soils and fluvial sands	Flood plains, terraces with dunes	Fraxino-Alnetum	19,8%	
Pojezierze Wielkopolskie [Wielkopolskie Lake District]	Glacier tills, morainic sands with boulders	Hilly, lake district	Galio-Carpinetum	17,3%	Pine 80,8% Oak 7,4% Beech 0,4% Alder 4,7%
Sandry Gnieźnieńskie [Outwash Plains of Gniezno]	Outwash deposits	Outwash, lake district	Pino-Quercetum	19,4%	Pine 81% Oak 5,7% Alder 4,8%
Dolina Konińska [Warta Valley by Konin]	Sands of fluvial terraces	Terraces with dunes, flood plains	Leucobryo-Pinetum	31,9%	Pine 93,1% Oak 0,5% Alder 3%
Dzielnica Krotoszyńska [District of Krotoszyn]	Glacier tills, glacial sands with boulders	Periglacial plains	Galio-Carpinetum	17%	Pine 61,7% Oak 23,6% Beech 0,3% Alder 5,3%

Source: Trampler et al., 1990 - revised

Undoubtedly man has been exerting impact on the environment since the dawn of mankind, however, societies were originally an integral part of natural ecosystems. On the area of Wielkopolska groups of hunters and gatherers appeared approximately 10,000 years ago, when, after the retreat of the continental glacier, the development of animate nature gave them an opportunity to find food. The influence of the man on the environment was not in any way different than that of other species, and the number of members of individual populations was regulated on an ongoing basis by environmental conditions, such as the availability of

food and water, weather factors as well as inter- and intraspecific competition (Pianka 1974).

The initial phase of the rural landscape formation might be associated with the transition of man's lifestyle into settled, which involved the acquisition of the skill of food production, i.e. farming and domestication of animals. The period was connected with the outset of the process of emergence and expansion of the rural landscape at the expense of natural ecosystems. It is assumed that the process of developing settled communities of food producers in the area of Wielkopolska started together with the so-called Neolithic revolution roughly 6,000

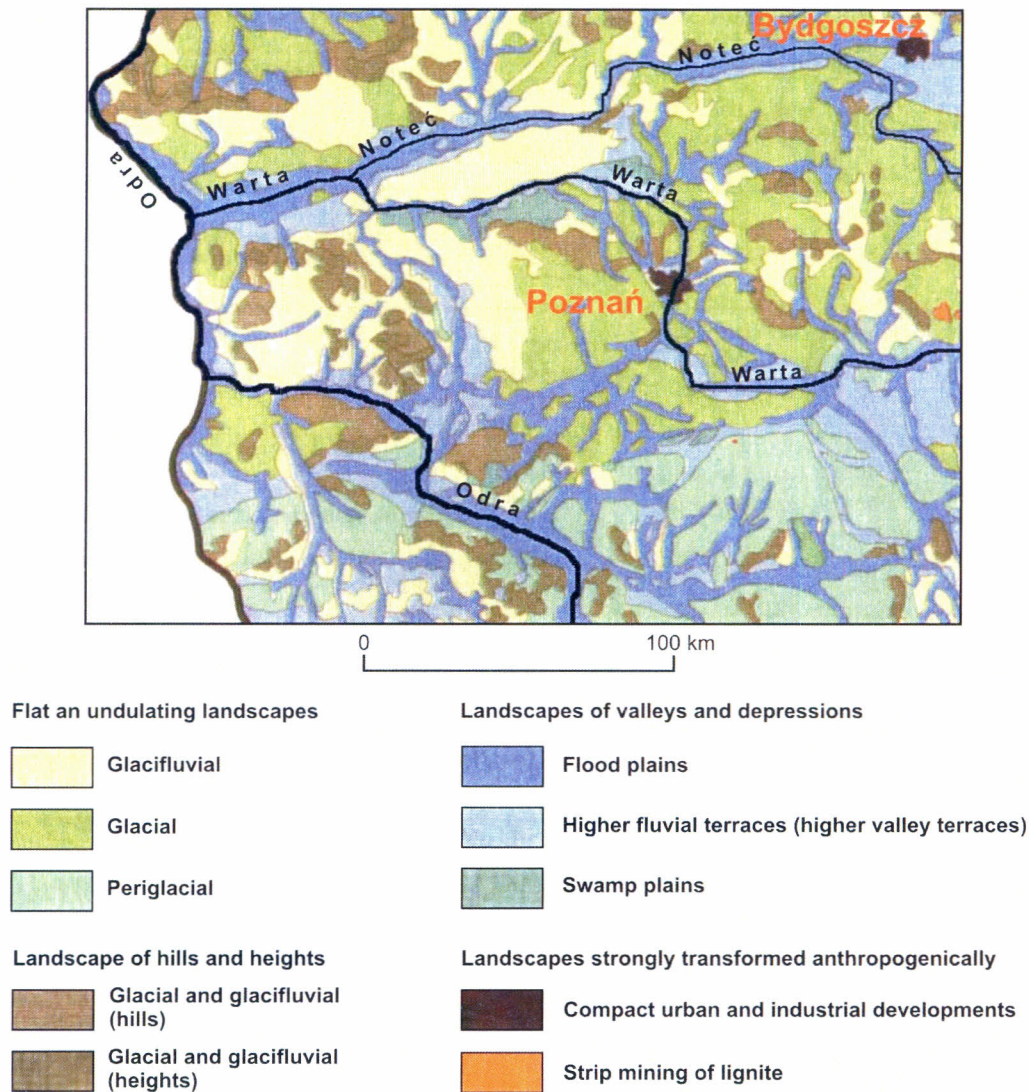


Fig. 1. Natural landscapes of Wielkopolska (according to Kondracki J. 1991)

years ago and lasted until the early Middle Ages. The earliest cultivated areas appeared on middle-cohesive soils in locations with good ground and water conditions. This means that the first stretches of agricultural landscape appeared in river valleys and other depressions, and the latest terrains used for farming were watershed areas.

### Spatial expansion of the rural landscape

It has been assumed that this period included the Middle Ages and later periods until the industrial revolution of the 19<sup>th</sup> century.

The pace in which farming spread was at first slow but it gained momentum as the population of Wielkopolska increased. It is estimated that in the 10<sup>th</sup> century the share of farmland in Wielkopolska was still below 10% (Kurnatowski 1975). At that time different types of usable land not yet appeared as separate. (Wiśniewski, Gwiazdowicz 2005). Within the swidden farming, the concepts of forest, farmland and grassland were not separated but overlapped.

In consequence of intensive colonization in the 14<sup>th</sup> century, the percentage of forested areas fell to about 50–60% (Hładyłowicz 1932; Błaszyk 1976) to reach its minimum level of about 20% in the 19<sup>th</sup> century (Baur 1842; Janczak 1965). In the



late phase of the self-supportive economy, drainage and cultivation of wet and marshy valley areas, which were the last large fragments of natural landscape in Wielkopolska, was ceased. As a result of large-scale regulation works carried out in the large valley bottoms of the Warta, Noteć and Obra in the last quarter of the 18<sup>th</sup> century, approximately 200,000 ha of valley bottom was included in agroecosystems. (Falkowski, Karłowska 1961; Henning 1978).

It must be emphasized however, that the rural landscape in the period of its spatial expansion was not composed of clearly differentiable elements with a separate manner of use. Individual fragments were characterized by prevalence of a particular form of use, not by its exclusive occurrence. The same areas, though with different intensity in given years, were cultivated, used for grazing or as a source of timber.

The above is well exemplified in the Prussian statistics for the Grand Duchy of Posen concerning the period of 1801–1806 (Meitzen 1868

–1871). According to the data, grasslands, pastures, used forested areas and wastelands considered as a whole made up 69.6%, the percentage of continuously used farmland was 23%, and forests covered 7.4% of the land. Comparison with other sources, including cartographic data, shows clearly that one category included both farmlands and forests, degraded to a various extent as a result of felling for timber and grazing. It can be assumed that at the beginning of the 19<sup>th</sup> century over half of the region’s area was covered by extensively used elements of landscape, including forest pastures, heathland and land lying fallow.

A common feature of various agricultural systems throughout the entire period was a self-supporting type of economy (Fig. 2). It was characterized by the dominance of internal feeding of agroecosystems in matter and energy. The fertility of soils in self-supportive land cultivation systems was maintained by burning spontaneous vegetation (swidden farming), fer-

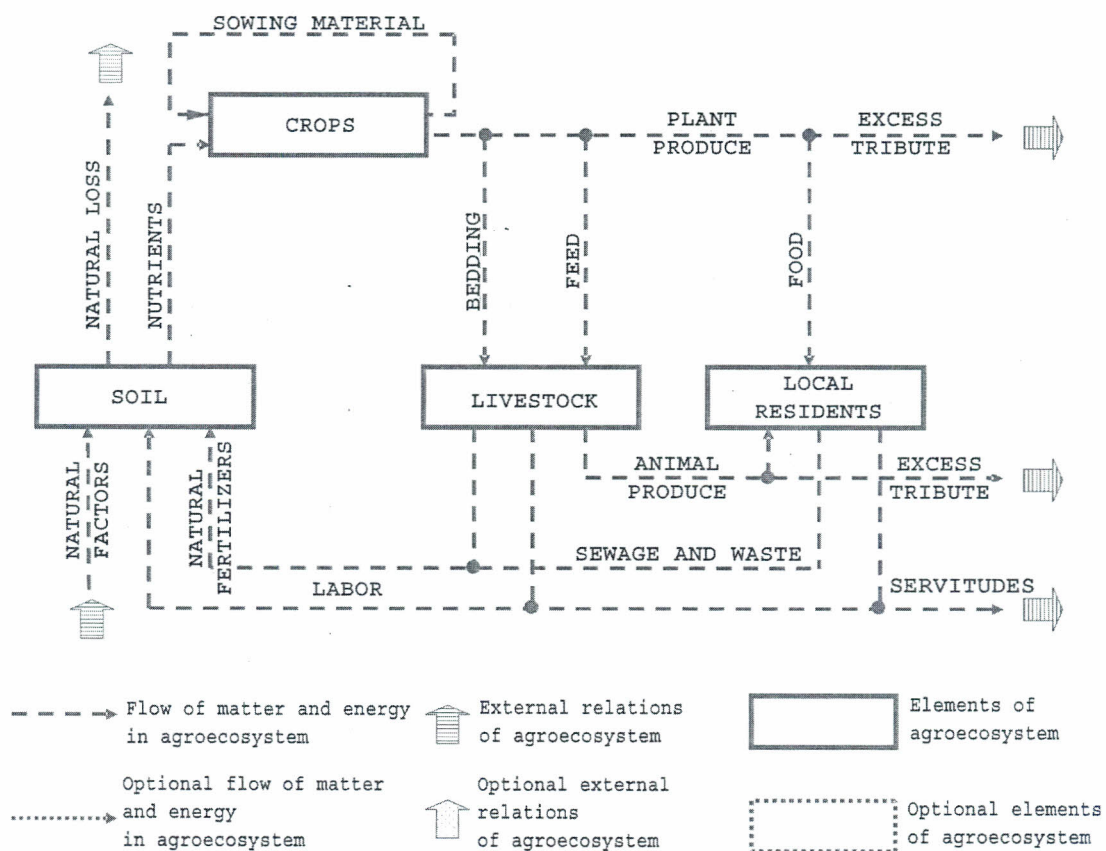


Fig. 2. Flow of matter and energy in agroecosystem – self-supportive economy. Explanations for figures 2–4

tilizing with livestock excrements and natural regenerative processes (fallow farming). With the increase of population and development of the farm produce market, the output of biomass from agroecosystems grew, which, without significant external feeding in nutrients, lead to increasing impoverishment of ecosystems and decreasing soil fertility. As a consequence ever-newer areas were used for cultivation at the expense of natural forest landscape. This process continued in Wielkopolska until the first decades of the 19<sup>th</sup> century, when areas used for farming reached their peak acreage, and the percentage of forested areas fell to its historic minimum. The unprecedented deforestation in conjunction with land dehydration triggered intensive erosion and increased the frequency of river flooding, in particular the Warta. The problems of agriculture, with a concurrent population increase, lead to more frequent and more severe food shortages. Although Wielkopolska was at an advantage compared to more densely populated European regions, the situation was still dramatic during lean years.

### The phase of intensification of ecosystem use

In the 19<sup>th</sup> century a new quality of human influence on the environment emerged as a result of the departure from the self-supportive economy. It consisted in increased external feeding of agroecosystems in matter, especially through fertilizing, and in energy, especially derived from fossil fuels. It is assumed that different stages of this phase lasted approximately 150 years, until the transformation of the political system in the 1990s. The primary stimulus for agricultural changes was the emancipation of peasants and gradual drawing of them into the system of market economy. The major part of Wielkopolska was at that time within the borders of Prussia, where agrarian reforms were implemented in the 1820s and 1830s. Ownership and economic changes resulted in the increased human influence on agroecosystems (Fig. 3). It consisted in the increased feeding of ecosystems in matter and energy, which involved the introduction of artificial fertilizers, and later intensi-

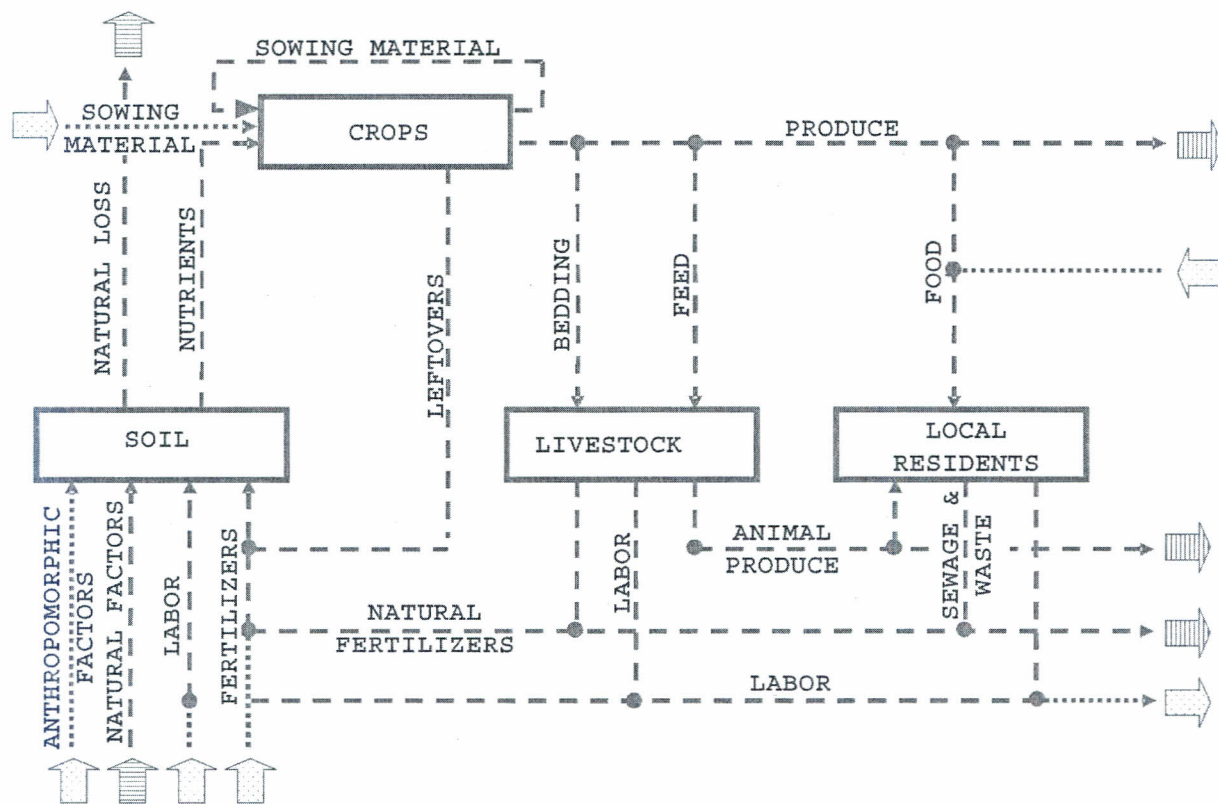


Fig. 3. Flow of matter and energy in agroecosystem – extensive agriculture. For explanation, see figure 2



fication of cultivation through mechanical work. The result was a stop to oligotrophication of agroecosystems and a systematic improvement of soil fertility.

The share of arable land in the 1860s was approximately 60%. It must be considered, however, that part of this area lay fallow. Fallow farming was gradually replaced by crop rotation in Wielkopolska in the course of the century. Arable land reached its peak share in 1921, when it occupied two thirds of the region's area. The reason for this increase was food shortages during World War I and immediately afterward.

The intensification of farming was associated with a departure from varied use of individual areas. From the mid-19<sup>th</sup> century the statistics distinguish areas of specialized functions within farmland. Likewise, forestry was devoted to the function of supplying timber.

Another feature of the rural landscape is the size structure of individual holdings. In the 19<sup>th</sup> century as little as about 30% of farmland was taken up by small peasant holdings. Complexes of such holdings made enclaves among huge estates of great landowners. Profound changes in the structure of individual holdings were brought about by parcellation, which affected the largest number of holdings between Poland's regaining of independence in 1918 and World War II. As a result, the proportions were reversed and the share of small peasant holdings exceeded two thirds. Essentially, the size structure of holdings developed at that time remained unchanged until today.

A characteristic feature of the evolution of Wielkopolska's landscape over the past two hundred years is the elimination of infertile sandy land from cultivation and afforesting it instead. The acreage of forests fell slightly in the 19<sup>th</sup> century but profound structural changes in their distribution occurred. In the wake of the Napoleonic Wars in what was at that time the territory of Prussia serious crisis broke out. A shortage of capital made many owners cut down their forests. This was further encouraged by industrial development and a growing demand for timber. In parallel the state supported afforestation, which became especially intensive in the latter part of the century. Heathland and the poorest cropland were afforested by fast-growing conifers, especially pine. Since the

1920s the share of arable land has been systematically decreasing as opposed to the share of forests. According to the statistics, between 1921 and 1973 the forested area in the *voivodeship* of Wielkopolska grew by nearly 170,000 ha, which meant an increase from 18.1% to 23.5%. Later, however, the share of forests remained stable. Afforestations carried out in the inter-war period were primarily a consequence of a downturn in agriculture and poor profitability of cultivating the least fertile soils. After World War II a significant amount of afforestations was necessitated by errors in methods of farming on the sandy soils of state-owned or collective farms. In an effort to maximize crop yield at minimum outlays, it was a common practice to use large doses of fertilizers, in particular ones with nitrogen, and to abandon fertilizing with manure. Such cultivation of light sandy soils led to a dramatic decline of the organic content of soil and its rapid depletion. Consequently afforestation was necessary to reclaim the soils. A good illustration of this process is the change in the landscape structure in the *powiat* or county, of Międzychód, where forested areas increased by as much as 60% (Fig. 4). Such intensive afforestation was a result of the prevalence of poor soils in this area.

Next to tree felling, changes in water relations are a major influence exerted by agriculture on the landscape. The present state of the landscape owes much to the regulations of the Odra, Warta, Noteć and Obra rivers, which increased the runoff rate. Vast regulation projects were undertaken in the last quarter of the 18<sup>th</sup> century making approximately 200,000 ha of valley bottom part of agroecosystems. Betterment drainages of land were continued until modern times, and their intensity has noticeably decreased only recently. The area where betterment drainages have been carried out exceeds 1,000,000 ha, i.e. 55% of farmland, in the *voivodeship* of Wielkopolska. The disappearance of water mills, sawmills and fuller mills, whose operation involved the retention of water to drive the machines, also contributed to the dehydration of the landscape. It is estimated (Gołaski 1980) that toward the end of the 18<sup>th</sup> century in the lower Warta drainage alone there were 420 such establishments, and after 150 years they were almost entirely gone.



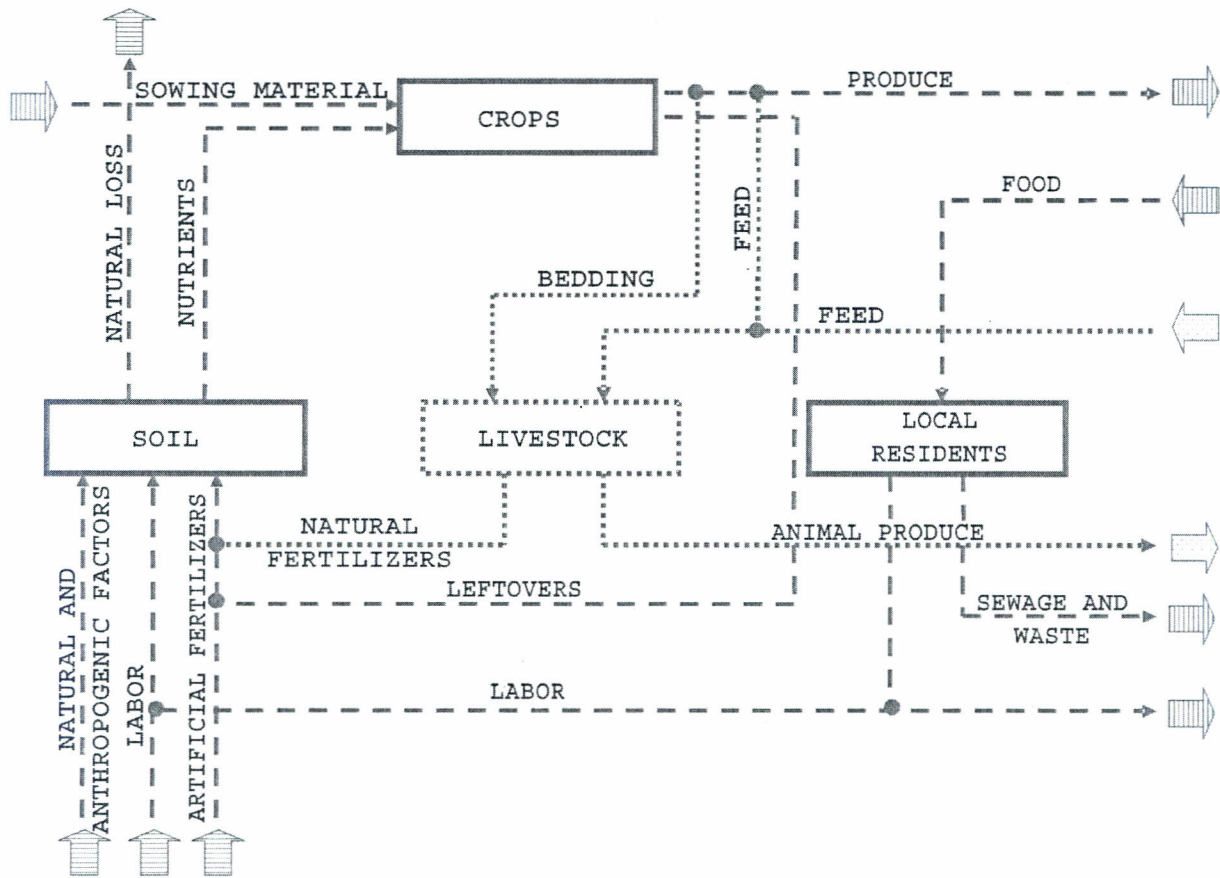


Fig. 4. Flow of matter and energy in agroecosystem - intensive agriculture. For explanation, see figure 2

Human activity aimed at increasing the rate of water runoff from ecosystems have led to profound qualitative changes in the landscape of Wielkopolska (Kaniecki 1991). One such change is the lowering of subsurface water from several dozen centimeters to two meters that was recorded in various parts of the region. Another is the lowering of lake surfaces by 13% on the average between 1890 and 1980, which is evident from cartographic analysis. However, the process was faster in the case of small lakes (up to 20 ha), where the decline in surface area reached 50%. A total disappearance is characteristic of the smallest bodies of water (up to 1 ha). It has been established that from about 1890 to about 1960 their number fell from over 11,000 to about 2,500. Because of drainages, the acreage of farmland has indeed grown but problems related to the overdrying of land have appeared as well. Those problems become more acute with more intensive crop production.

The landscape and ecological consequences of anthropogenic changes in water relations led to the hypothesis that "Wielkopolska was turning into a steppe" (Wodziczko 1947), which was associated with the following changes in ecosystems:

- Hydrological parameters: lowering of low water marks and ground-water table;
- Soil properties: overdrying, gleying recession, quicker mineralization of organic substance and related decrease in humus content;
- Vegetation cover: elimination of swamp and riparian forests, increased spreading of xerophytes and plant associations characteristic of dry habitats;
- The fauna: decrease in the number of forest species in favor of species living in an open landscape. Appearance of xerophilous mollusk species.

The above list of consequences must be supplemented with a list of landscape changes



brought about by the elimination of surface waters, such as the disappearance of belts of spontaneous vegetation that serve as biogeochemical barriers determining the buffer capacities of agroecosystems (Ryszkowski 1999). An illustration of the extent to which this process took place in the second half of the 20<sup>th</sup> century may be the recorded changes in the landscape surrounding the village of Zamorze, located about 50 km west of Poznań (Mizgajski, Kafel-Głębowska 1990). In an area approximately 12 km<sup>2</sup>, about 50 point and linear changes of topographical landscape elements that occurred in 1940–1982 were recorded. The most frequent type of change was the drying up or burying of ponds and eliminating the surrounding spontaneous vegetation communities. In many instances drainage ditch burying was recorded, which often was accompanied by the elimination of tree and bush belts growing by them. Furthermore, trees were felled along abandoned roads and ploughed field margins. A vast majority of changes consisting in the elimination of small landscape elements were indirect or direct consequences of drainage works carried out mostly in the 1970s. In this respect, the example of the village of Zamorze can be treated as representative of the whole of Wielkopolska.

In the latter part of the 20<sup>th</sup> century, despite the new political conditions of the so-called real socialism, the tendency to use farmland with an increasing intensity, in particular in large state-owned farms, remained essentially unchanged in Wielkopolska. Many of them were characterized by extremely large input of matter and energy into agroecosystems, which was reflected in very high doses of artificial fertilizers and pesticides.

Such practices were accompanied by the simplification of landscape structure, consisting in the elimination of spontaneous vegetation and fragments of ecosystems that were unused, as well as the progressive overdrying of land due to intensive dehydration. The rise of large pig farms resulted in breaking the ties between the crop and stock farming within the farm. Farmers ceased to rely on the supply of manure from their own animals because it was replaced by artificial fertilizers and catch crops. Owing to industrial feeds, the size of stock became inde-

pendent of the amount of feed produced by the farm, i.e. of the acreage of cropland. It led to the emergence of very large animal farms devoid of the capacity to use fertilizers in an agrotechnical manner, in particular liquid and mixed liquid and solid manure. The inability to store those fertilizers for treatment results in using them in excessive doses out of the vegetation period. This is a very important factor contributing to the pollution of water and eutrophication of ecosystems, in particular in the southern Wielkopolska, where the pig breeding sector is well-developed.

Moreover, farmers, who used to be bound to their farms, which were their sources of subsistence, turned into workers supplying labor, and the farms ceased to be the sources of produce for them. Thus, agroecosystems changed from closed systems dominated by internal flows of matter and energy into open systems, where external relations are of primary importance (Fig. 5).

Any errors in controlling such systems lead to their destabilization, and further to a decline in production, regulation and cultural ecosystem services (Millennium Ecosystem Assessment 2005). This translates into measurable economic, cultural and environmental losses.

Some of the forms of limiting the production and regulation services of ecosystems are the deterioration of physical properties of soil through the mineralization of its organic substance, and the formation of the plough sole as a result of cultivation. Betterment drainages and increased transpiration of intensively farmed crops worsen the problem of water shortage in agricultural areas. The reduction in ecosystem services is also a result of the decreased variety of ecosystems and landscape in agricultural areas. One might point to the elimination of tall spontaneous vegetation as a cause of the intensification of wind erosion of soils and increase in biogens permeating into the water. (Ryszkowski et al. 2002). This in turn leads to over-fertilizing depressions with limited or no runoff (allochthonous ecosystems). It has a special economic, socio-cultural and environmental dimension in the case of lakes, when their recreational function is restricted or eliminated.



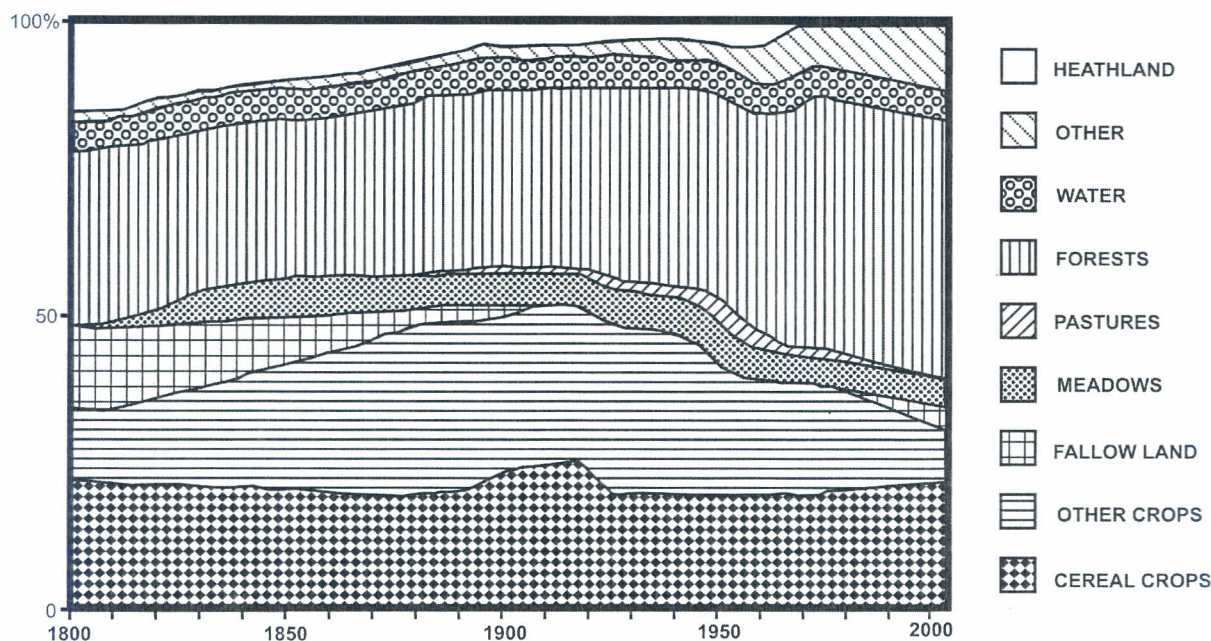


Fig. 5. Changes in land use structure in the *poviát* of Międzychód (Mizgajski 1990 – revised)

### Modern processes of diversification of pressure on the landscape of Wielkopolska

The transformation of the political system that took place in the 1990s involved the introduction of political pluralism, fundamental restructuring of the legal system and introduction of free market solutions to the economy, which has resulted in profound changes in the structure and functioning of the society. It has caused a great qualitative change in the manner man influenced the landscape. The restrictive function of spatial planning was limited in urban areas, which spurred vital city expansion processes and related changes in the structure of land use that consisted in utilizing farmland for investment (Parysek 1998). The factors that were crucial to the changes in rural landscape were the abolition of farming subsidies and privatization, or commercialization of state-owned farms. The deterioration of the relation between the prices of agricultural produce and that of industrial goods, including goods use in farming, caused the profitability of farming to decrease. In consequence, farmers left poorer soils laying fallow and began to forest them, which practice was most conspicuous in the north-western part of the region.

The development of the cultural landscape of the *voivodeship* of Wielkopolska in the period of political transformation was documented by an analysis of land use structure in communes (Łowicki 2006). It has been shown that changes in the share of individual land use categories were slight in the scale of the whole *voivodeship* (Table 2) but the differences between individual

TABLE 2. PRESENT-DAY CHANGES IN THE SHARE OF LANDSCAPE ELEMENTS IN THE SURFACE AREA OF THE VOIVODESHIP OF WIELKOPOLSKA

LAND USE CATEGORIES	1989	1995	2000	2005
Farmland	64.9	64.3	63.8	63.5
• arable land	53.3	52.9	52.6	52.3
• orchards	0.8	0.8	0.7	0.7
• permanent meadows	7.7	7.5	7.4	7.4
• permanent pastures	3.1	3.1	3.1	3.1
Forests and forest land*	25.2	.	25.5	25.9
Land under water	2.1	2.1	2.1	2.2
Mineable land	0.2	0.2	0.2	0.2
Transportation areas*	2.8	.	3.1	3.0
Settlement areas	2.6	2.9	3.2	3.2
• developed	2.2	2.4	2.6	2.8
• non-developed	0.2	0.2	0.4	0.2
• green	0.2	0.2	0.3	0.3
Miscellaneous areas	0.7	0.7	0.6	0.5
Wasteland, ecological land, and small groups of trees and bushes	1.5	1.6	1.6	1.6

Source: Łowicki 2006 (supplemented)



communes and subregions appeared significant. This is illustrated by the diversity of changes in the landscape development index in communes, which was calculated as a ratio of the surface area of the land where technical processes prevail to the land where environmental processes prevail (Łowicki, Mizgajski 2005). The appended cartogram (Fig. 6) shows that in the vast majority of Wielkopolska's communes, the area invested or planned for investment – in particular at the expense of farmland – increased slightly. Urban areas of the *voivodeship* stand out above the rest in this respect. This applies particularly to the Poznań metropolitan area, including the city itself and the surrounding communes.

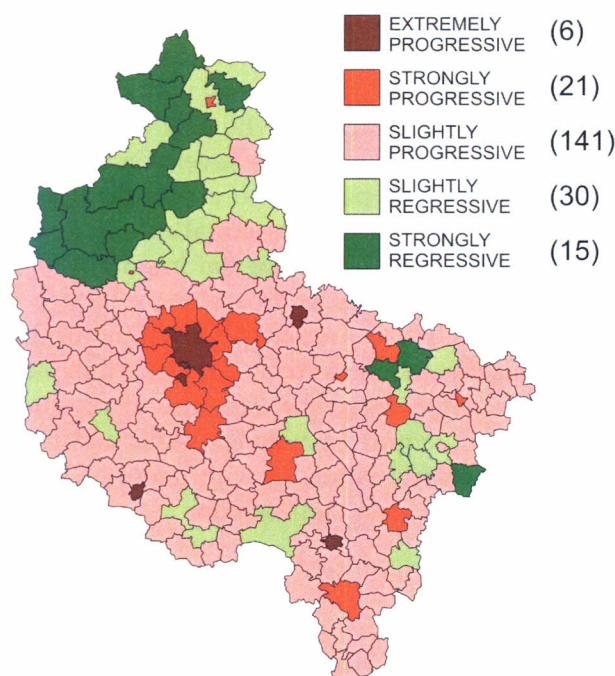


Fig. 6. Trends in landscape development in Wielkopolska in the period of political system transformation (according to Łowicki 2006)

The landscape of the northern part of the *voivodeship* changes in a reverse direction. The processes consisting in the extension of landscape use prevail here. They are mainly expressed in the afforestation of post-agricultural land and the decrease in the share of transportation areas, which are incorporated in forest

areas. Large-scale afforestation of post-agricultural land with poor soil is considered harmful from the perspective of the sustainable growth and in the environmental context. The problem concerns poor sandy soils in outwash areas and the marginal zone of the Pomeranian stadial in the northern periphery of the *voivodeship*. The share of forest areas in communes has already reached 70%. In nine communes of the subregion of Pila, between 1989–2000, forested areas grew by 4000 ha, which made up 44% of the entire *voivodeship's* growth.

Such a process must provoke serious social, economic and environmental consequences. Land becomes less accessible, the demand for farming labor decreases and the recreational attractiveness of the area diminishes because open areas become restricted to enclaves between forests. This creates positive feedback causing further rapid depopulation of such areas. The problem has occurred in the area of the Schwarzwald Mountains, Germany, where for many years research has been done and action taken to preserve the open landscape in order to protect the recreational values of the area (Schreiber 2000). In respect of the environment, creating large and compact forest areas reduces the ecosystems diversity of the mosaic agricultural and forest landscape.

New trends regarding the rural landscape appear as a result of Poland's accession to the European Union. The direct subsidies for farmers are calculated proportionately to the farmland that is properly maintained. This may contribute to the reduction of the acreage of land lying fallow. Agricultural and environmental programs are European Union's instrument which, among other things, reduces the pressure exerted by agriculture on the environment and shapes the landscape in rural areas. These functions are especially emphasized in nationwide Subprogram II. Organic agriculture is a new farming system whose aim is to supply high-quality produce without adversely affecting the natural environment. The development of this program is supported by one of agricultural and environmental subprograms. It must be pointed out, however, that it takes time to assess the effect that the above instruments may have on landscape.



## Conclusions

The modern landscape is a result of a combination of environmental features, predispositions and processes, as well as human influence on the environment throughout history. It is agriculture that has played the most important role in the landscape transformation process. The pace and directions of the rural landscape development changed with great breakthroughs in the farming systems. Each of the "revolutions" in farming at first helped overcome the crisis in ecosystems services but after some time they caused new crisis phenomena to accumulate.

Gradual expansion of rural landscape lasted to the early 19<sup>th</sup> century and led to the most severe deforestation in history. For about 150 years forests have tended to expand at the expense of the agricultural landscape, and in the recent decades also urban areas have been growing. Those changes bring about ecosystemic polarization of the region through the increase in the share of forest complexes in areas with already large forest cover, further intensification of agriculture in areas with more fertile soils, and expansion of urban zones around cities.

The rural landscape of Wielkopolska developed according to the following phases connected with the dominant forms of metabolism of agroecosystems:

- Initial phase: nomadic societies of gatherers and hunters constituted an integral part of natural ecosystems. This phase continued until the so-called Neolithic revolution, ca. 6000 years B.P., when settled farming societies started to emerge.
- Phase of spatial expansion of rural landscape: emergence and expansion of agroecosystems, which often included used forests and extensively exploited degraded areas, e.g. heathlands. This phase involved the systems of self-supportive economy which resulted in gradual depletion of agroecosystems, and continued to the so-called "agricultural and industrial revolution" in the first half of the 19<sup>th</sup> century.
- Phase of intensive use of agroecosystems: increasing feeding of agroecosystems in

matter and energy. At the early stages this phase involved a rapid growth of the fertility of agroecosystems. Over its last decades adverse effects on the man's natural environment increased.

- Phase of diversification of the use of ecosystems: emerged in the modern time and still continues. This phase involves the polarization of landscape in a regional scale, which consists in landscape urbanization in the vicinity of urban areas and along the nearby transportation areas, as well as in the expansion of landscape use characterized by afforestation and population decrease in peripheral areas with low-quality agricultural production conditions.

Further trends in the rural landscape development are going to result from economic and cultural conditions, and legislation. European Union's financial and legal instruments regarding agriculture and rural areas will definitely influence the character of human impact on agroecosystems but only after several or a dozen of years it will be possible to assess the scope and quality of changes. The social role of farmers is going to be of fundamental importance to the future. It is necessary to stimulate their behavior through economic and legal mechanisms, as well as education to make sure that they are not only compensated for agricultural production but also acquire knowledge, skills and motivation to protect natural environment and the landscape of the area they farm in.

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