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*Monika Mariothová **

HUMAN IMPACT ON THE ECOSYSTEMS IN TRNAVSKÁ TABUĽA LOESS PLAIN (SLOVAKIA)

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Trnavská tabuľa Loess Plain is a territory where humans have influenced the ecosystems since the Neolithic period. That is why agroecosystems are said to be "natural" in this countryside. Self-regulative mechanisms that dominated in the process of the evolution of the local original landscape have been strongly influenced, even destroyed. Analysis of historical development of ecosystems plays an important role in an effort to discover the causes of the contemporary ecological problems of landscape instability. The important changes that have basically influenced the biotopes of the area are shown on Fig. 1. After the World War II, the process of collectivization started and nowadays landscape structure has been created. Fig. 2 shows human interference to the structure of biotopes in the recent decades. Every human action have an effect on the living organisms - on the individuals, on population of species or on whole community (Fig. 3).

Key words: ecosystem, human interference, effects

INTRODUCTION

Analysis of historical development of ecosystems plays an important role in an effort to discover causes of contemporary ecological problems of the landscape instability. It can change our view of the landscape that now looks completely different from the past historical eras. Several characteristic features in the landscape have their roots in the distant past. We suppose harmonious interaction between the landscape and the society in time when a human society did not have crucial influence on the countryside. The influence of the human factor was significant only in the

* Geografický ústav SAV, Štefánikova 49, 814 73 Bratislava

changes of biotical landscape components. Abiotical components - water, soil, air changed slightly, or they did not changed at all.

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PRIMARY LANDSCAPE

The study area belongs to the temperate deciduous forest biome. We suppose that the original vegetation cover here was a forest and this formation is considered to be a probable climatic community. But presence of chernozem as the dominant soil type indicates that there had to exist a non-forest formation on the area at a certain period of time.

According to Krippel (1982) chernozem is a climactic soil type of grasslands. It cannot arise without a grass stand and a suitable clima. It needs arid or semi-arid weather conditions and long periods without bacterial activity in soil so that the organic matter in the top layer of the soil can be concentrated. Non-forest formations in the study area have probably existed in two phases. Based on pollen analysis we suppose that about 10000 - 8000 BC after retreating of the Würm glacial, open cold grasslands were common in the Central Europe. After a change of climatic conditions in postglacial period forest communities became to widen and the retreat of grassland was remarkable. The second phase of the development of non-forest formations was directly related to human activities.

THEN CAME A MAN ...

There are many important archaeological findings from the study area that demonstrate settlement of this region in different periods of primeval age. These findings give us information not only about different ways of living of various groups of people, but we can find out some important changes in ecosystems as well. Regarding the real vegetation cover humans have been one of the most important landscape-forming factor on this area for thousands of years.

According to present known facts, clues indicating first settlement are from the Neolithic period. The Neolithic revolution is considered to be one of the most progressive changes in the development of human society of primeval age. Humans got out of immediate influence of the nature. Cultivation of plants and breeding of domesticated animals are the most typical features of the Neolithic revolution.

Trnavská tabuľa Loess Plain with its optimal climatic and soil condition was a suitable living environment for the first peasants. An important role in the process of colonization was played by the streams Parna, Gidra, Ronava and some other brooks that do not exist anymore. So agricultural tradition on the area lasts over 7 000 years. The forests covering large plots were gradually detracted. A part of them was cut down and changed into arable land. Another areas were detracted naturally by fire, as wind throws, etc. and local meadows were created. As they were used as pastures, regeneration of forest vegetation was impossible. Together with soldiers and merchants who migrated across the territory some new species of plants arrived and they became the weeds later on. In the 5th century AD the Slavonic colonization began.

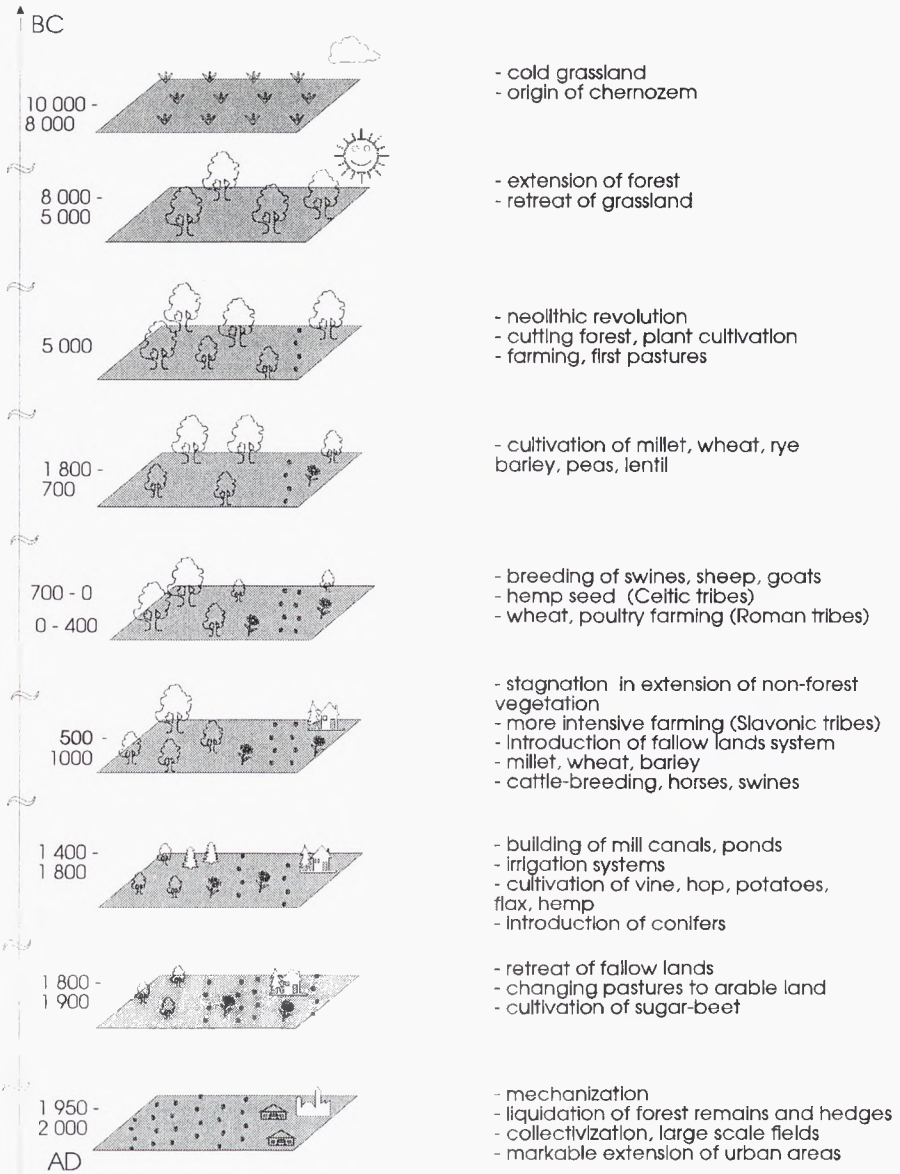


Fig. 1. The chain of the landscape changes up to the present days.

Slavonic peasants introduced fallow land system (rotation system) in the country. The chain of the important changes that have basically influenced the biotopes of the area are shown on Fig. 1. More details about development of the landscape can be found in Bernadič 1991, Ištók and Ižóf 1990. It seems that the Middle Ages involved a number of events which still have a marked impact on the morphology of the rural landscape. There were, for example, changes in social structure, in forms of settlement and cultivation. Especially important were changes in landownership.

At the beginning of the 19. century public pastures for oxen, horses, cows and geese were kept in numerous locations. Every spring some special pastures inside of arable land were created for oxen and horses to feed them easily. This pastures remained untouched until the end of field works. Just before the abolition of subjection, subjects who had lived in very difficult conditions wanted to unify their land and to separate landlord's fields from the others. Unification made farming more rational and more profitable. This change had a really important effect on the landscape structure although the subjects did not get more land than they had had before. As they wanted to improve their economic situation they have changed almost all separated meadows and pastures to arable land. Cattle-breeding slowly declined. Planting of some non-original but competitively stronger trees has influenced the degradation of genetic integrity of the bank and forest communities.

Until the end of the 19th century farmers worked without using any mechanization. They did not use any artificial fertilizers or pesticides. Although most of the study area was covered by arable fields, even large scale fields already existed round the landlord's farms, effects of human impact on landscape in that time is not comparable with contemporary situation. Basic differences in the landscape structure was the presence of hedges, groves and small woods. The fields were divided by lanes, that connected farms and villages. These lanes were surrounded by trees. There were also many orchards and vineyards on the study area. The trees helped to identify the borders of the fields and they provided an optimal shelter for having a noon rest as well. Because of the effort of every family not to depend on buying food different parts of fields were sown by various crops. That made the country motley and miscellaneous and it was optimal for the local fauna.

EFFECTS OF COLLECTIVIZATION

After the World War II. the process of collectivization started and the contemporary landscape structure has been created. Some new economic and technical arrangements aided to create certain number of geometrically equal plots and some new systems of sowing were imposed. The lanes have been removed, remains of woods, hedges and shrubs were felled and the landscape was ready for socialistic form of farming.

Today all the biotopes of the area have non-natural borders dependent upon human activities. Fig. 2 shows human interference in the structure of biotopes in recent decades. We recognize dry and wet biotopes and both categories have subcategories of patch and line biotopes. Negative interference is indicated by symbol (-), positive (+). The term "negative" means an activity that has been followed by decrease of stability, loss of diversity (e.g. disappearance of some species) and or impoverishment of the landscape. "Positive interference" means activities that has helped to improve living conditions for the organisms and to enrich the country. According to Fig. 2 the negative impact prevails. There is even a category (Wet line biotopes) where we cannot talk about any positive effects at all. Because of water contamination fish and crayfish which used to be common in the streams do not live there anymore. Similar situation is in categories of dry biotopes. Together with liquidation of refuges and killing mischievous insects and small animals, humans are making life of game animals and carnivorous birds impossible. There were some efforts to improve the mosaic of biotopes by wood plantation, but as the chosen trees were not suitable for this type of landscape, they could not permanently survive there.

As Fig. 3 shows, every human interference has an effect on living organisms - on

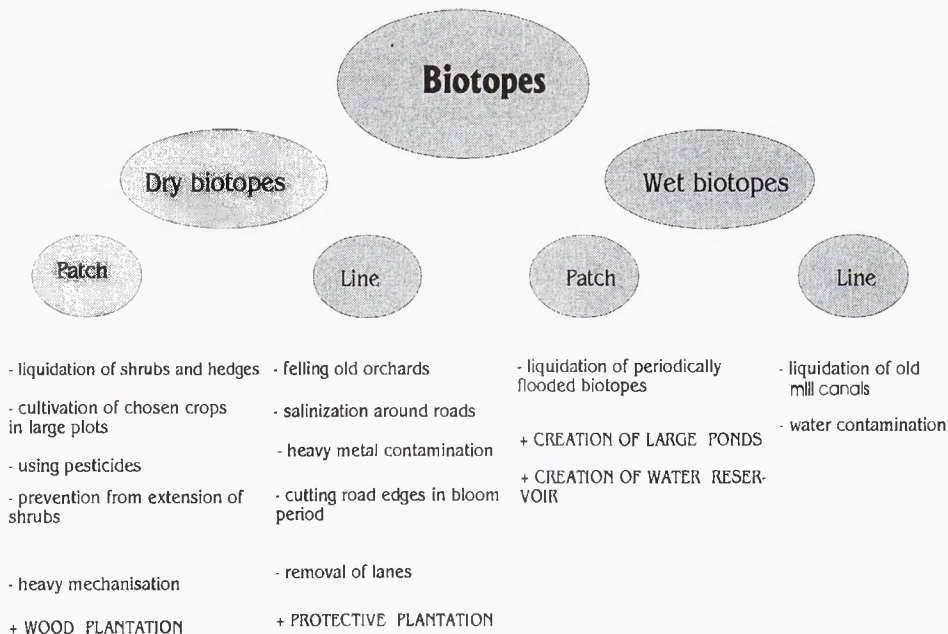


Fig. 2. Human interference to the structure of biotopes (1945-1995).

Level	Examples	Negative effects
1. Individuals	<ul style="list-style-type: none"> - removal of hedges - heavy mechanization - cutting road edges in bloom period 	<ul style="list-style-type: none"> - loss of carnivorous birds (Buteo, Falco) - destruction of nests, killing animals - destroying wild plants before creating seeds
2. Populations	<ul style="list-style-type: none"> - water pollution, removal of different biotopes, using pesticides 	<ul style="list-style-type: none"> - disappearance of some species (Astacus, Otis, Agrostemna, Cyanus)
3. Communities	<ul style="list-style-type: none"> - using pesticides - removal of different biotopes, felling orchards, liquidation of mill canals 	<ul style="list-style-type: none"> - affection to food chains - decrease of landscape diversity, loss of refuges

Fig. 3. Some negative effects of human interference on the study area.

individuals, on population of species or the whole community. The only category (Fig. 2) where positive effects prevail, is "Wet patch biotopes". Originally there were

no permanent biotopes of standing water in chosen area. The building of artificial ponds and reservoirs was of great ecological importance due to its effect of increasing the variation among the avifauna of the entire area. (Matoušek, 1968, Trnka, 1993). Before the ponds were built, there was no waterfowl there. After this biotopes were created, 191 species has been recognized there. 79 species out of this number have permanently their nests there. 78,5 % of the total number are legally protected by law.

CONCLUSION

To sum up, Trnavská tabuľa Loess Plain is a territory under a strong human impact for thousands of years. Unfortunately, from ecological point of view nowadays prevail negative interference. Some experiments to variegate the mosaic of biotopes in this landscape were unsuccessful because of unsuitability of the chosen trees. On the other hand, positive effect of artificially built biotopes of standing water is remarkable. Knowing functions of different biotopes and their mutual relationship is becoming one of inevitable assumptions of an optimal landscape planning.

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Monika Mariothová

VPLYV ČLOVEKA NA EKOSYSTÉMY NA TRNAVSKEJ TABULI

Analýza historického vývoja krajiny zohráva dôležitú úlohu v procese poznávania príčin súčasných ekologických problémov, postupne sa znižujúcej biodiverzity a celkovej stability krajiny. Trnavská tabuľa patrí medzi oblasti, ktoré boli významne antropicky ovplyvňované už od neolitu, čo dokazujú početné archeologické nálezy. S postupne sa meniacimi skupinami obyvateľstva na tomto území sa menili aj spôsoby hospodárenia a využívania zeme. Najdôležitejšie zmeny, ktoré sa podstatne odrazili v štruktúre a charaktere miestnych ekosystémov, sú znázornené na obr. 1. V posledných desaťročiach sledované územie ovplyvnili zásahy, v dôsledku ktorých sa vytvorila súčasná krajinná štruktúra. Z hľadiska živých organizmov sa tu udiali negatívne, ale aj pozitívne zmeny (obr. 2). Najzreteľnejším príkladom pozitívnych zmien bolo vytvorenie rozsiahlych biotopov stojatých vôd, vďaka ktorému sa krajina obohatila o množstvo druhov, ktoré sa tu predtým nevyskytovali. Záver príspevku je zameraný na dôsledky kolektívizácie a veľkoplošného obrábania pôdy. Ako je zrejme z obr. 3, ich negatívny vplyv sa prejavil na všetkých úrovniach - na jedincoch, populáciách aj celých spoločenstvách.

Obr. 1. Historický preklad dôležitých zmien v krajine.

Obr. 2. Príklady antropických zásahov do štruktúry biotopov v rokoch 1945-1995.

Obr. 3. Vybrané negatívne dôsledky antropických zásahov na sledované územie.