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LANDSCAPE CHANGES OF THE LÓDRI-TÓ - KISIVÁN-SZÉK - SUBASA AREA IN THE DOROZSMA-MAJSAIAN SANDLANDS

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Összefoglalás - A tanulmány a Dorozsma-Majsai Homokhát egy mintaterületén (a Lódri-tó-Kisiván-szék-Subasa közötti területen) mutatja be CORINE Land Cover (CLC) és CORINE Élőhelytérkép (CÉT) kategóriák segítségével a táj változását a 18. század végétől napjainkig régi térképek, recens műholdfotók és terepi felvétel alapján. Egyidejűleg a tanulmány bemutatja a láprétfők és szikaljak sajátos biogeográfiai megjelenését a tájban. Egy szélbarázdán belül a talajvízáramlásoknak és a geomorfológiai adottságoknak megfelelően meghatározott rendeben helyezkednek el láprétek és kékperjés rétek, valamint a szikes élőhelyek. A lápi jellegű élőhelyek a szélbarázdák északnyugati részében, a talajvizek felszínközeli megjelenési pontjánál összpontosulnak, míg a szikes élőhelyek a mélyedések alacsonyabb fekvésű, délkeleti részére jellemzőek. A tanulmány bemutatja a lápi jellegű élőhelyek degradálódásának különböző fokozatait is.

Summary – This study presents the change of the landscape of the Dorozsma-Majsaian Sandlands since the 18th century on a sample area (Lódri-tó-Kisiván-szék-Subasa) with the help of biotop-mapping categories of CORINE Land Cover (CLC) and CORINE Biotop Map (CÉT) on the base of old maps, recent satelite images and my field-studies. Simultaneously the study presents a special biogeographical feature of the landscape: the moor-heads and alcali-sodic feet. The moors, the Molinia fens and the alcali-sodic vegetation-types are situated in a wind-furrow in a special order according to the ground water flows and the geomorphological conditions. The moor-like biotops are situated in the northwestern part of a wind-furrow at the point of the appearance of ground waters whereas the alcali-sodic biotops are typical for the lower-elevated, southeastern part of the depressions. This study shows also the steps of the degradation of the moor-like biotops.

Key words: Landscape history, landscape ecology, biotop-mapping, sandy, alcali-sodic and moor vegetation, degradation of the vegetation

INTRODUCTION

The examined landscape is situated in the Dorozsma-Majsaian Sandlands which is part of the 6 small landscapes situated in the sandy plains between the rivers of Danube and Tisza in the Great Hungarian Plain (*Mucsi*, 1990). The examined landscape belongs to the Praematricum flora district of the Eupannonicum flora area, which is part of the Pannonicum flora province. The vegetation of this landscape and especially the chosen area is very underresearched (see IBOA-atlas 2001). The first publications on the natural values of the Dorozsma-Majsaian landscape were mainly concentrated on the surrounding of Ásotthalom, Dorozsma or Zsombó published e.g. by *Kaán* (1931), *Kincsek* (1996), *Margóczi et al.* (1998). The floristical and coenological searches of the Dorozsma-Majsaian Sandlands became intensiver in the last few years (see *Margóczi et al.*, 1998). I began to create the first actual biotop-map of this landscape in 2002.

The lack of researches in this landscape is shown by the fact of the few nature reserves too: the nearest nature reserves to this area are are the Zsomboian ancient moor (3 km north) and Dorozsmaian Nagyszék (1 km northeast). The famous Ásotthalmian nature reserves: Csodarét, Bogárzói-rét, the memory forest, the Upper Forest, the Csipak- and Tanaszi-semlyék lay more distant (15-20 kms) (*Tardy*, 1996).

The chosen sample area covers the former alcali-soda lakes of Lódri-tó, Kisivánszék, Sáros-szék, Nagyszék-tó, Vereshomoki-tó and Subasa. This area belongs to the administrative area of Zákányszék, Domaszék and Szeged-Kiskundorozsma.

Although the natural areas (especially the wood-cover) of the Carpathian-basin has been decreasing since the iron-ages, until the mid-19th century Hungary could preserve a huge part of its natural vegetation cover, which included grasslands and wetlands in the Great Hungarian Plain. The process of loosing the natural vegetation cover became much faster during the 20th century. It can be seen also that the size and the economical position of the nearby settlements influenced this process, as the loss of the natural values was faster in the neighbourhood of the biger towns (see Szeged) because off the greater human impacts.

Describing the change of the vegetation-cover I created a landscape historical map-series using the CLC-CÉT (CORINE Landcover-CORINE-Biotop-map) categories on the base of old maps (maps of 1st, 2nd, 3rd military surveys) for the late 18th, mid-19th, early 20th centuries. The 2002 map was created according to Deák's own field searches with the help of *SPOT-4 satelite images* (1998). This work is part of the first attempt to create an actual vegetation map for Hungary in the now running MÉTA (Hungarian Biotop-Map Database) programme (2003-2004) which is coordinated by the Hungarian Academy's Institute of Ecology and Botany in Vácrátót.

METHODS

Using biotops (habitats) instead of plant associations has got several advantages. The classic coenological mapping puts more stress on the natural habitats, while the biotop-maping includes the highly human influncéd weed-communities, planted forests, introduced species dominated habitats, arable lands or even human settlements. This complex view is better for practical use as well as for the joint-sciences it helps to do real landcape-ecological researches and plannings.

The used 3 biotop category-systems in Hungary are good for different purposes, and on different scale as their focuses are different, but somewhat overlapping.

The first accepted system in Hungary was the *General National Habitat Classification System (ÁNÉR)* published in *Fekete et al.* (1997). In 2000 (*Modified General National Habitat Classification System (m-ÁNÉR)*) (*Molnár and Horváth,* 2000b) and in 2003 (mm-ÁNÉR, official category-system of the MÉTA programme (Hungarian Biotop-Map Database)) (*Bölöni et al.*, 2003) the system was refreshed. This system attempts the landscape from the side of the nature conservation. It groups the described plant-communities into bigger units. It includes comprehensive categories not just for the natural comminities but also for the disturbed grasslands, forests, arable lands and urban areas. This system is good on 1:25,000 or finer maping scale. This suitable just for mapping the actual vegetation because the categories are so fine that we can't use it several centuries back because of the less descriptive information of datas.

The *CORINE biotop-map (CÉT)* and *CORINE Land Cover (CLC)* (*CLC50 1.4. version, Molnár and Horváth et al.*, 2000a) systems were introduced together. The use of the CÉT is required, because the CLC is too general for natural or semi-natural habitats. However the CÉT is more general than the m-ÁNÉR, but finer than the CLC. These categories can be used from 1:50,000 to 1:200,000 scale to give a more comprehensive look at a certain landscape.

We need old maps to create landscape historical map-series. In Hungary the first reliable maps were resulted by the *Maps of 1st military survey* (1764-1787), which has a very fine 1:28,000 scale. This is the base of the late 18th century map. The *Maps of the 2nd military survey* (1806-1869) helped to describe the situations in the middle of the 19th century, as the Szegedian parts were made between 1863-1864 showing the state of the landscape at the beginning of the regulation of the riverways. The situation after the regulation of the riverways is shown on the *Maps of the 3rd military survey* (1872-1887) (1:75,000) and presented on the early 20th map.

The base-maps of the biotop-maps are the 1:25,000 and 1:50,000 *Gauss-Krüger topographical maps* (1992) of the Hungarian Military's Ágoston Tóth Cartography Institute in this work. All the different maps and their information are converted to the presently used Gauss-Krüger maps with GIS technology using ArcView 3.2. But doing a field-work was essential as in this sample area an error on the topographical map was discovered: according to the locals and my observations the forest of Kisivánszék has never existed.

The vegetation researchers can only trust in one reliable, fresh, official field-database now in Hungary at similar works: the State Forestry Service's forest-management plans (*ÁESZ*, 1998) and *Maps of the Hungarian forest-management plans* (1998).

RESULTS AND DISCUSSION

In this following section I will review the results of my landscape historical map series which has 4 parts (late 18th, mid-19th, early 20th and present situtation maps).

Landscape changes since the end of the 18th century

In the end of the 18th century (*Fig. 1*) the *Dorozsma-Majsaian Sandlands* was quit uninhabited, looked more natural as the matrix of the landscape was not arable lands like nowadays but sandy steppe-fields. Between the settlements of Kiskundorozsma and Szeged on the east and the towns of Kiskunmajsa and Kiskunhalas on the west and northwest no other villages or towns existed in those times on a 70 kms of distance. Even though that less than 10 kms away Szeged became a regional centre since the medieval times and Kiskundorozsma was also developing, these settlements and their population hasn't changed further the feature of this sandland landscape much for centuries during the medieval and early modern ages. The reasons could be the bare sand deposits and its bad quality soils, the traditional landscape use and the administrative shareness of hundreds of years.

While Kiskundorozsma belonged to the Kiskunság District, Szeged belonged to Csongrád county. The old county border crossed this sample area in the middle, so the western part of it belonged to Csongrád county, the eastern one to Kiskunság District. This Kiskunság District with its Kumainian population had special privilege in those times. By the way in the agriculturally intnsively used landscapes the most valuable natural areas remain at the borders nowadays, too! Probably because it is "noman's land". These inner periferic areas are far from the settlements and it was not economical to do intensive agriculture especially on the technical level of those times.

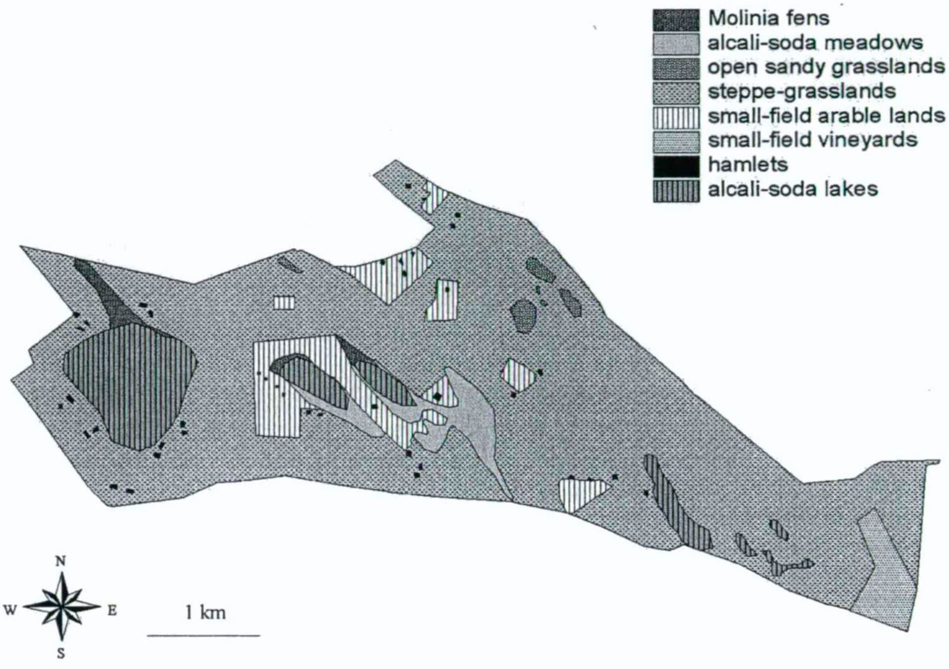

Fig. 1 CLC-CÉT biotop-map of Lódri-tó - Kisiván-szék - Subasa area in the late 18th century

The main landscape use was here the sheep and cow-farming. This extensive landscape use preserved many natural areas.

So at the end of the 18[th] century this are showed the last natural vegetation cover of the Dorozsma-Majsaian Sandlands. The landscape was typically tree-less. During the medieval times the last remains of the open sandy oak-forests, and the closed lily of the valley - pedunculate oak-forests *(Convallario-Quercetum)* have completely disappeared on the higher elevated dunes. The depressions could have been dominated by different kind of alder *(Dryopteridi-Alnetum)*, elm *(Fraxino pannonicae-Alnetum)* and willow *(Calamagrostio-Salicetum cinereae)* moor-forests but hese were cut out completely except in the Zsomboian ancient moor (willow and elm moor-forests). The continuous mowing and grazing was not ideal for the regeneration of the forests. Even the regeneration of the open sandy poplar-forests was rare.

The higher elevated areas were covered by closed *sandy-steppe-fields* (*Festuca pseudovina*- Cocksfoot *(Dactylis glomerata) -Holoschoenus romanus-Crysopogon gryllus* dominated grasslands: *Astragalo-Festucetum rupicolae, Chrysopogono-Caricetum humilis*), where the overgrazed areas - especially where higher sand-dunes existed - could become dry *open sandy grasslands* (mainly *Festucetum vaginatae*).

The most interesting places of this sandland are the depressions situated in sand-furrows. Their vergency and the sloping of these sand-furrows is the typical northwest-southeast direction according to the most common wind-direction.

Recent reserches pointed out that in one depression both the alcali-sodic and the fen (partly moor) vegetation can appear! My observation shows that the northwest side of the wind-furrow is mainly dominated by moors or *Molinia fens (Succiso-Molinietum)* (non-alcali sodic vegetation), whereas the southeastern part of the same depression is covered by *alcali sodic vegetation*. The moors could appear rarely in the past too, as the natural forest cover was lost and it began to dry out (the evapotranspiration increased), and the conditions were ideal just for the fens, but during the humider and cooler periods of the past (small ice ages) the moor could be more frequent in such geographical positions. This unique vegetation appearence of the moor and Molinia fen vegetation is named by me: fen-head, while the alcali-sodic part of the same depression is called: alcali-sodic foot.

The vegetation changes according to the Na-content gradient of the soil: the fen-head contains less Natrium whereas the alcali-sodic foot has more Na. So the *Molinia fens* changes first at the alcali-sodic foot to an Agrostis stalonifera, Festuca pratensis or Festuca arundinacea dominated *alcali-soda meadow*, then to a more alcali-sodic *Puccinellia limosa alcali-sodic-cape-vegetation* in the most sodic parts. As these sand-furrows slopes from the northwest to the southeast the water migrates to the southeastern part of the depressions, where it's collected, as these depressions are mainly without an outlet. As a result of it alcali-soda lakes are formed on the deepest part of the depressions (usually in the SE part). If the water remains for a longer time (regulary until May or June) in the depressions *Bolboschoenus maritimus dominated alcali-soda swamps* are formed on the shore, but if it dries out soon (by the end of the spring) only the Puccinellia limosa dominated alcali-sodic-cape-vegetation can appear.

According to our oppinion the ground-water is a mixed water. It appears on the surface or near-to the surface at the fen-heads (upper part of the depressions) because of the sloping of the deposit-layers (NW-SE). After then the water flows further according to the sloping slowly to the somewhat lower elevated southeastern part of the depressions. During this time the evapotranspiration affects these solution and it becomes concentrated, its pH increases. Until the boundary of its solution-capacity it can dissolve more salt from the near-to-surface layers and transport them further to the southeast. The salt-content is unloaded when the water is completely evapotranspirated. This could be the reason for the Na-gradient between the low-Na contented fen-head and the more alcali-sodic foot regions.

This phenomene was discribed on this study area at the Kisiván-szék and Sáros-szék, but at Lodri-tó can be seen too with a difference. Here the lake could have 2 soil-water well: one on the northeastern, one on the north edge of the square shaped depression. Here the Molinia fens are laying on the southwestern and the northeastern side of the depression according to the typical above mentined vergency.

In this area significantly more *alcali-soda lake* existed in the 18th century: Lódri-tó, Kisiván-szék, Sáros-szék, Nagyszék-tó, Vereshomoki-tó.

Small arable lands were existed mainly in the surrounding of Kisivánszék. Just few hamlets were there in those times, but vineyards were established in Subasa.

By the mid-19th century (*Fig. 2*) the human impact became stronger, as the position of Szeged increased with the growing population and the start of the industrialization. Except Vereshomoki-pasture and Sziksóstó area all the steppe-fields (base-matrix of the landscape) was broken up. Beside the small-field arable lands 4 patches of vineyards also were established to set the sand (Kisdónát-hegy, Csontos-hegy, Ördög-hegy, Széktói-szőlő). Next to the arable lands many hamlets and extended vineyards appeared. The group of the hamlets were called: Kapitányság (District). The searched area belonged copletely to the Domaszéki Kapitányság. The Kiskundorozsma (southeastern part of Kiskunság District) was connected to Csongrád county in 1886. The area of the Molinia fens and alcali-soda lakes remained the same.

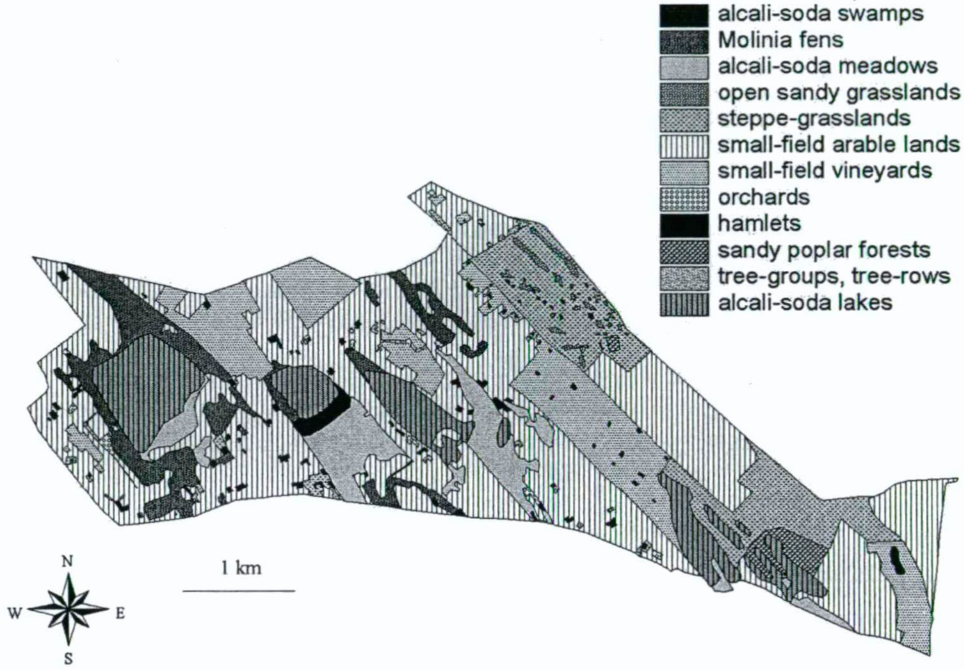

Fig. 2 CLC-CÉT biotop-map of Lódri-tó - Kisiván-szék - Subasa area in the mid-1860s

It is interesting that even bigger spontaneous steppe-forests appeared at Vereshomoki-tó. These forests could have been at the beginning of the succession: *white poplar dominated sandy forests* could be there (similar as nowadays the Ásotthalom Memory Forest Nature Reserve).

The beginning of the 20th century (*Fig. 3*) is the golden ages for Szeged in the Austrian-Hungarian Monarchy. The so called Southern Sandland Railway gave a further possibility for the people living in the hamlets, so the number of hamlets increased further as their product could be put to the market easily by the railway. The Filoxera disease caused heavy demages in the vineyards of the Sandlands. The 3rd military survey shows sometimes woodening, or grassing abandoned vineyards. Some of these vineyards were cut out and on their place orchards were established. During this time the *intensive cultures of vegetable production* (famous Szegedian red pepper) became prefered too. All these processes reduced the area of the sandy steppe-fields. But Molinia fens, and alcali-sodic meadows and swamps existed further.

The 2002 map shows the results of the landscape changes of the last 100 years (*Fig. 4*). During the socialism the authority tried everything to demolish the word of hamlets. New settlements were established (Domaszék, Bordány, Zsombó). Even though this hasn't attrackted everybody, and later it's become clear that fruits and vegetables can be produced in hamlets effectively. During the last 20 years new recreation settlements (dominated by houses, gardens, orchards or vineyards) grew up (Subasa, Vereshomok, Sziksóstó) which mean more environmental risk, as the sewage and waste problems are unsolved. The socialism hasn't influenced much the size of the arable land: small scale arable lands dominate the sandlands because of the geomorfology of the landscape (wind-furrows and dunes).

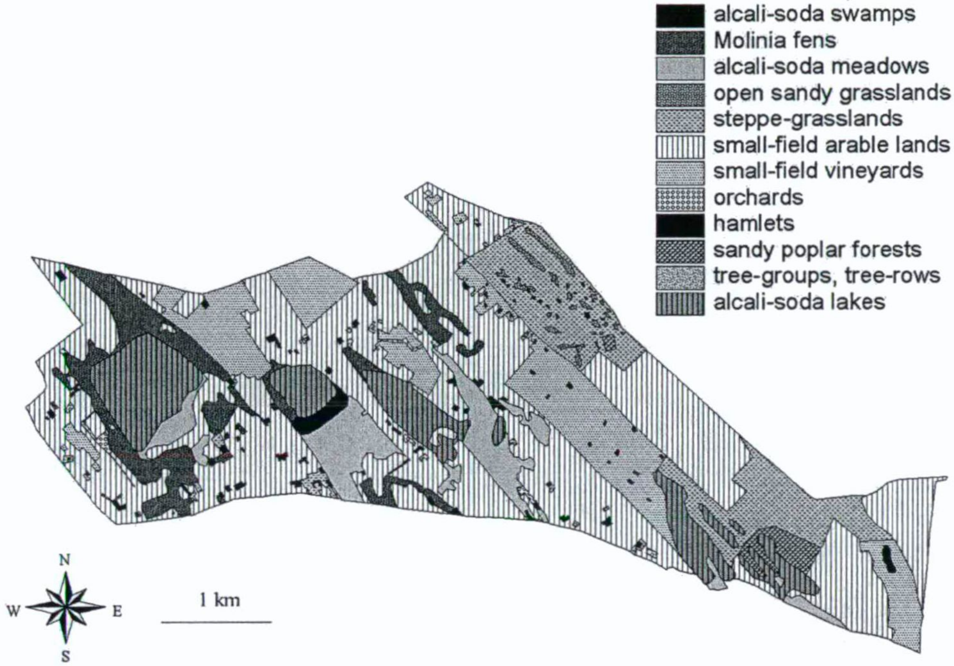

Fig. 3 CLC-CÉT biotop-map of Lódri-tó - Kisiván-szék - Subasa area at the beginning of the 20th century

Nowadays more and more arable lands and vineyards and orchards are given up. All the large-field socialis-type of orchards and vineyards are cut out in this sample area. On the abandoned lands the succession has started. The Dorozsma-Majsaian Sandlands shows a very good regeneration potential comparing this area with the other sandlands of Hungary. It means that all the abandoned lands are covered at least with some degradated Agropyron repens grassland. The ratio of the invasive species is under the national average. On areas where grazing or mowing is regular, the regeneration of the sandy steppe-grasslands is faster. On a 10 year-old fallow Dactylis glomerata-Festuca pseudovina dominated grasslands could appear. If the regeneration reaches a higher level Holoschoenus romanus and Stipa species could appear. The regeneration of the Chrysopogono-Caricetum humilis community is not so good, as it would require more water.

Nowadays the main problem of the Dorozsma-Majsaian Sandland is the decreasing ground-water level. The decrease is 2-6 meters. There are 3 resons for it:

1. During the socialism many draining channels were built to reduce the risk of inland water and gain more arable lands. It meant that the former depressions with fens, alcali-soda lakes or alcali sodic vegetation became to dry out to a steppe-field as all the standing-water is led away quickly. Many local inhabitants said that they were swimming in these depressions 30 years before! The disappearance of the alcali-sodic lake was the biggest landscape change in the Dorozsma-Majsaian Sandlands during the socialism.

2. There is less precipitation, and we had the 8 warmest year in the last 10 years during last 100 years period here in Szeged.

3. The landscape use: after the privatisation the intensive vegetable cultures became popular, but they require much water. So the farmers dig huge ponds, which are all evaporation windows decreasing the ground-water level further. These watering-holes make more alcali-sodic their surroundings.

Fig. 4 CLC-CÉT biotop-map of Lódri-tó - Kisiván-szék - Subasa area in 2002

The process of the degradation of the vegetation in the sandland connected to the out-drying is the following: the *moors* first became *Molinia fens*. After then if there is no sodification it's transformed into a *sandy steppe-grassland*. If there is sodification it is transformed to an *alcali-sodic meadows*. If the alcali-sodic meadow is leached later the Festuca pseudovina appears and is transformed to *degradated steppe-field*. If there is plus accumulation of organic materials the alcali-soda field becomes to an *Agropyron repens-Festuca pseudovina grassland*. If the accumulation of organic material happens on the Molinia fen, it changes into *reeds*. This accumulation is due to the loss of mowing, or to the infiltration of manure. The sandy steppe-fields, and the alcali-sodic biotops are attacked by an agressive introduced invador tree: the *Eleagnus angustifolia*. North from Szeged very huge forest of them exists. This tree was introduced to plant forests on sodic soils, but it has broken out. In this area the *Asclepias syriaca* is not as big problem as at other sandlands of Hungary, but it can spread easily if a grassland is broken up.

This area is not well forested. Unfortunately the most common chosen tree species are: the Locust-tree (Robinia pseudo-acacia), the Austrian Black Pine (Pinus nigra) and the cultivated poplar types. All these species are landscape-alien.

I studied the connection between soils and biotops according to Géczy's map of genetical soil-types published by *Keveiné Bárány* (1988) and the genetical soil map of the National Atlas (*Pécsi*, 1989).

According to these maps the sandy steppe-grasslands can be found on different kinds of chernozem soils formed on sand or highly humic sand. The chernozem soils formed on sands are mainly arable lands dominated by cereal production. The majority of the steppe-vegetation remained mainly on such places where the soils with higher organic content are enclosed in alkali-sodic or boggy areas.

The majority of these slightly humic sand dominated areas are forested with Scotch and Austrian Black Pine, Locust Tree, cultivated and native poplar species or became the place of fruit- and vegetable-production, so the open dry sandy grasslands disappeared.

The depressions of the Dorozsma-Majsaian Sanlands have either carbonated and moor-meadow soils - where the Molinia fens are typical - or are dominated mainly by carbonated solonchak, callous solonetz or solonetzic meadow chernozem. The alcali-sodic areas are covered with Achillea (Achillea-Festucetum pseudovinae) alcali-soda grasslands, and with alcali-soda meadows and swamps.

CONCLUSION

These mapping works are useful for nature conservation and we get a full picture of the present and past feature of the landscape. The presented maps can be a database for monitoring and planing the landscape and are good for purposes of rural development, forest and water management. They show the areal potential of rural ecotourism and helps the environmental education. They help the scientific experts, the policy-makers and land-users to make optimal decisions and do a really sustainable landscape use (*Dobrosi et al.*, 2002).

The regeneration potential of the landscape is relatively high, but the landscape is waiting for help. The reintroduction of the traditional extensive grazing and mowing could help the regeneration of the steppe-grasslands. The degradation of the Molinia fens, alcali-soda meadows could be stopped with better water regulation. Today nobody is responsible for it, and the farmers are still affraid of the high water-levels in the early springtime and lead the water with channels away. But in the early-comming hot summer period they don't have enough water and they have to use water from the decreasing ground-water table. It means, that more and more water should be kept in the depressions former alcali-soda lakes. It would help the humider vegetation to survive, but also could increase the decreasing ground-water.

To all these purpuses environmentally sensitive agricultural and landscape planning is required. Unfortunatelly so far the local agricultural policy wasn't so nature-friendly. But in the EU we should try to do such an agriculture which is good for the nature too. To make this a reality the environmental consciousness must be improved on local and decision-making level too.

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