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SUCCESSFUL RED DEER MANAGEMENT IN SOUTHERN TRANSDANUBIA AND ITS PHYSICO-GEOGRAPHICAL BACKGROUND

SIPŐCZ Márk[1], LÓCZY Dénes[2], TÖRZSÖK András[3]

[1]Institute of Geography, e-mail: kivu@freemail.hu
[2]Institute of Environmental Sciences, e-mail: loczyd@gamma.ttk.pte.hu
[3]Institute of Geography, e-mail: andrastorzsok@citromail.hu
University of Pécs, H-7624 Pécs, Ifjúság útja 6.

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Summary: The paper examines the factors of the physical environment which exert remarkable influence on the conditions of game management in Southern Transdanubia, a part of Hungary particularly rich in natural values. The focus is on the the traditional lead game of hunting in Hungary red deer, whose populations – although still rather isolated in space – have showed a spectacular upswing recently. The long traditions of deer management are briefly outlined. The demands of deer for a favourable habitat are analysed and international survey methods are presented. The landscapes of Transdanubia are suitable for red deer to variable degrees. The health conditions of red deer are described by the quality of their antlers. Regional differences in antler types are presented. Climatic, vegetation and soil conditions are evaluated from the viewpoint of providing favourable red deer habitat. As an example of game management problems, Gemenc Forest is cited, a well-preserved flood-plain area, which is rated excellent for big game hunting.

Introduction

The European red deer is among the largest game animals on the continent. It is an ungulate species of Holarctic distribution, endemic in Eurasia, North America and North Africa and was introduced to South America, Australia and New Zealand (Páll 1985, Csányi 2007). The red deer *(Cervus elaphus)* stock of Hungary developed along the border of the distribution areas of a Western European *(C. e. elaphus)* and an Eastern European and Balkanic *(C. e. hippelaphus)* subspecies – with the predominance of the former. Differences between subspecies are observed in body size, thickness of neck mane and length of tail.

By the first years of the 21st century Hungarian big game stocks have reached a level never seen before. This claim equally applies to quantitative and qualitative parameters and is particularly true for red deer.

Figure 1. Red deer
1. ábra A gímszarvas (*Cervus elaphus*)
Forrás: http://www.fotohaz.hu/fotoarena/showphoto.php?photo=175189&size=big&password=&sort=1&cat=507

Although there was some decline of stock in the early 1990s, the upward trend has continued ever since (Tóth and Szemethy 2000). This is an undoubtedly successful branch of game management, which shows a spectacular rise in comparison with other branches (Godó 2002).

Methods

The red deer population of Hungary in historical overview

Indirect evidence shows that it has been present in the Carpathian Basin from early Holocene times (Szederjei 1961). Their distribution must have been much more uniform than today since large areas were forested – even in the Great Plain (Csőre 1976), particularly on floodplains along major rivers and in higher-lying groves. The situation began to change following the settlement of Magyars in the Carpathian Basin and the growth in the density of human population. Human action – uncontrolled hunting, large-scale deforestation and expanding farming – are primarily responsible for the major decline of stocks in medieval times. The bottom was hit in the mid-19th century, around the date of the Austro-Hungarian Compromise, when according to estimates (Turós 1994) the red deer population of the Carpathian Basin could not exceed one thousand (!). Disappearing natural enemies, like wolves and lynxes, as well as the introduction of legal protection (the Act on Hunting in 1873, which marked the beginning of modern game management) contributed to an increase in red deer population. In 1884 the national statistics indicated that 2252 animals were shot in Hungary and new stocks introduced. The trend continued to World War I, when around 10 000 shootings were reported. Thus, half a century saw a 20-30-fold growth in total red deer population. By the 1940s the size of the Hungarian stock reached 12 000–14 000 heads within the present boundaries of the country. The losses of World War II can be illustrated by the 1946 figure: red deer numbers were estimated at less than 5000 then.

Due to the establishment of game reserves, organized winter feeding and a strict regulation of hunting (although professional expertise was far from being satisfactory), pre-war red deer numbers were restored by the early 1960s. The reorganization of agriculture into large-scale farming had a favourable impact on big game as large agricultural fields provide ample food and excellent shelter. (In contrast, small game like partridge suffered severely from large-scale farming.) Hunting was a favourite pastime of the communist party elite and also an important source of income of hard currency from primarily West German and Austrian hunters (Vajdics 2003), therefore, the maintenance and expansion of game populations was regarded a priority task in the regulation of land use and nature conservation – particularly in border zones of restricted entry, which were abundant in Southern Transdanubia (Figure 2). Consequently, by the 1970s population had grown to 30 000 and, according to optimistic estimates, it peaked at 176 000 around 1990 (Csányi 2000), while according to more conservative estimates (Turós 1994) it was only slightly above 100 000 (Figure 3). The real number could be somewhere between these two limits. The trophies of high award presented to the visitors of the World Hunting Exhibition of 1971 added to the esteem of Hungary as an important hunting nation. After the change of the political regime in 1990, a new Act on Hunting was not passed until 1996 and the position of hunting associations was strengthened. The growth of stocks also had deleterious impacts: as the extension of habitats available considerable reduced, it is certain that game density (and its pressure on the environment) had to increase remarkably over the decades and the age proportions shifted and younger animals became overwhelming.

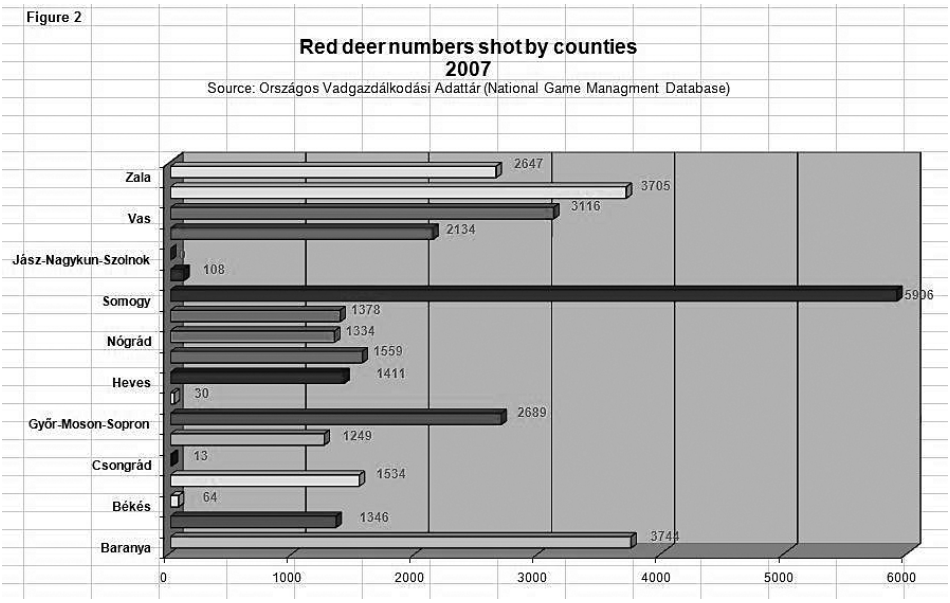


Figure 2. Red deer numbers shot by counties, 2007

2. ábra A gímszarvas elejtése megyénként, 2007

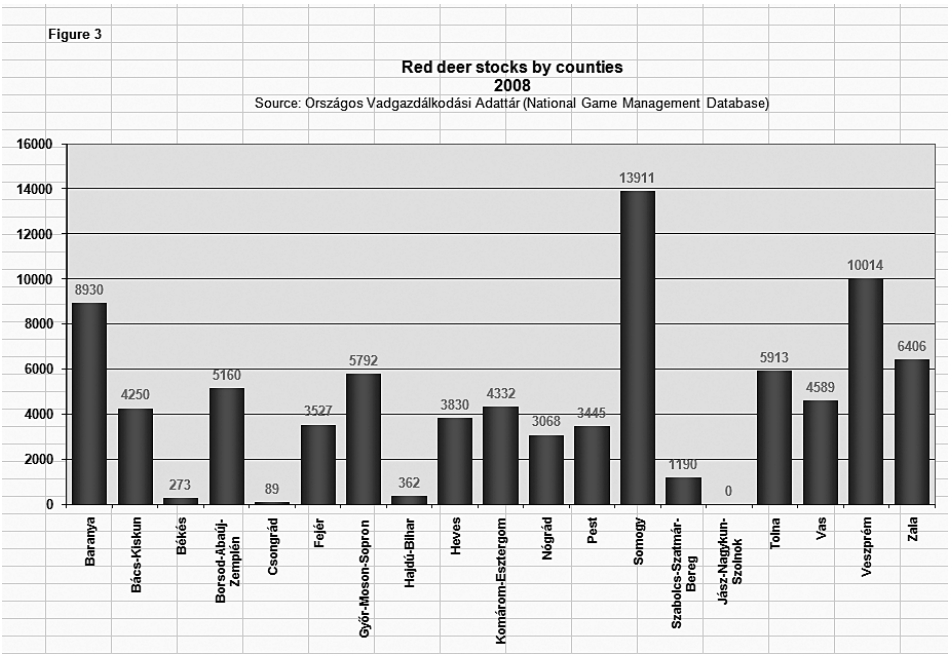


Figure 3. Red deer stocks by counties, 2008

*3. ábra*A gímszarvas állománya megyénként, 2008

Environmental characteristics of red deer habitat

Red deer is a forest game and prefers woodland of diverse composition (Ritter et al. 1999). Research (Szemethy et al. 2003) indicates that mixed forests of considerable extension, consisting of trees of various age, having dense undergrowth of high bushes are particularly favourable habitats for red deer. In an ideal case the proportion of deciduous trees (oak, hornbeam, beech and others) reaches 60 per cent in the woodland. The diversity and connectivity of the landscape are equally important characteristics for a red deer habitat.

Relying on fossil finds it was reconstructed that the original habitat of red deer was swampy floodplain woods and the shrinking of wetland areas forced it to extend its distribution to woodland on higher ground, i.e. in hills and mountains. Although open grassland or farming land are not among the favourable habitat for this animal, in the immediate vicinity of large forests they attract deer as foraging grounds as – in addition to tree shootings and bush leaves – they consume large amounts of grasses (and may cause considerable damage to neighbouring maize and other crop fields). Observations show that where the ratio of forests amounts to at least 15 per cent, red deer usually appear in Hungary (Páll 1985). The extension of uninterrupted forest stands also matters. Although normally the range of deer movement is relatively limited: 500–1200 hectares for hinds and 1000-2000 hectares for stags (Szemethy et al. 2003; Tóth and Szemethy 2000), during the mating season (the so-called „rut") movements intensify and acquire a wider range. Therefore, a diverse landscape of good connectivity is essential for the survival of a healthy red deer population.

Surveys of wildlife (including game) habitats form part of several major land evaluation systems. A classic approach is the interpretation of soil maps in the system of the US Department of Agriculture (USDA 1972) begins by scoring soil mapping units on a scale of four division (from 1 – good to 4 – very poor). Four major kinds of habitat are evaluated: open agricultural land, woodland, wetland and rangeland. Weighting factors are applied according to the composition of vegetation. Improved systems also include the estimation of the productivity of ecosystems (Bartelli 1978).

The Canada Land Capability Classification for Wildlife (Perret 1969) – in the framework of the Canada Land Inventory – expresses the carrying capacity of landscapes for ungulates and waterfowl in seven classes. The classes are identified according to the factors limiting the suitability of habitats for game. In the case of the deer such factors are considered as long-term predictable snow depth (symbol: Q), topographic barriers (T) and the quality of wintering areas (W). Maps of 1:250 000 scale are prepared. Caribou habitats are increasingly surveyed using digital satellite imagery (Thompson et al. 1980). Also in Hungary, thematic map interpretation and remote sensing techniques are useful tools in research alleviating the identification and evaluation of red deer habitats.

Results

Concentrations of deer stocks in Southern Transdanubia

The regions of red deer distribution in the Carpathian Basin were first studied by Szederjei (1961), who identified six regions, including Southern Transdanubia. Antler shape and quality is the best indication of the health condition of the animal and, thus, –

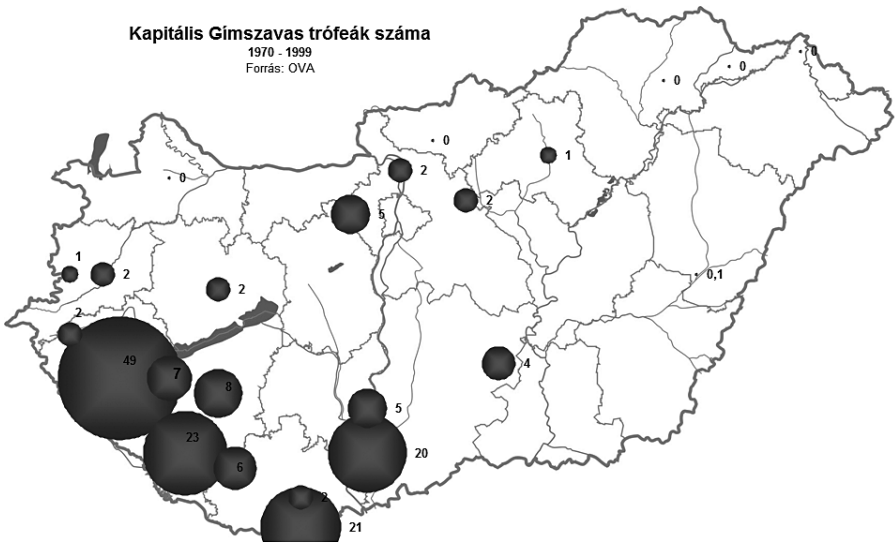
the influence of winter feeding disregarded – also of the quality of the habitat. Southern Transdanubia, which covers the counties of Zala, Somogy, Baranya, and Tolna is divided into five subregions (Table 1.), roughly corresponding to the landscape units delimited by physical geographers (Pécsi Somogyi 1980):

Table 1. Differences in the standards of red deer management based on trophy valuations, 1970–1999 score of best antler score of the 30 best antlers average score for the 30 best antlers number of capital antlers
1. táblázat A gímszarvasgazdálkodás minőségi különbségei az 1970–1999 közötti trófeabírálatok alapján, a legjobb agancs pontszáma, a 30 legjobb agancs pontszáma, a legjobb 30 agancs átlagpontszáma)

The qualitative differences of red deer management on the basis of trophy valuations from 1970 to 1999					
		The best trophy score	The 30 best trophies score	The 30 best trophies avarage score	The number of the awarded trophies
1.	Zala	261,29	245,59	251,95	49
2.	Dél-Somogy	255.34	238,14	243,56	23
3.	Gemenc	271	236,93	243,53	20
4.	Ormánság - Villányi-hills	254,43	236,76	242,69	21
5.	Észak-Somogy	269,89	232,82	238,94	8
6.	Zselic	247,42	226,74	234,51	6
7.	Tolnai-ridge	246,65	227,77	233,59	5
8.	Vértes-Gerecse	243,12	228,47	232,99	5
9.	Bakony	260,02	224,73	231,17	2
10.	Mecsek	249,26	223,47	230,65	2
11.	Cserhát-Gödöllő	242,82	223,39	229,19	2
12.	Őrség	252,62	221,09	228,53	2
13.	Keszthely - Kis-Balaton	251,14	220	228,38	7
14.	Kiskunság	252,72	216,64	228,26	4
15.	Vas	254,01	220,12	227,79	2
16.	Alpokalja	247,99	216,87	226,31	1
17.	Győr-Moson-Sopron	236,95	219,91	224,37	0
18.	Visegrád	243,6	215,71	221,97	2
19.	Lónya	235,9	210,77	221,5	0
20.	Zemplén	236,55	213,23	219,36	0
21.	Mátra	240,06	210,02	217,7	1
22.	Börzsöny	233,54	210,14	217,29	0
23.	Kelet-Alföld	217,35	210,2	214,83	0
24.	Bükk-Aggtelek	225,65	210,05	213,71	0

Forrás: Országos Vadgazdálkodási Adattár (National Game Management Database)

1. Antlers of the highest quality derive from *Zala Hills*. They are thick, finely arcuate and rugose, the fifth tines forming a broad crown. Trophies can weigh 16 kg, measure 120 cm in length, and may have tine numbers up to 36 (Map 1).



Map 1. Number of capital red deer trophies, 1970–1999
1. térkép A kapitális gímszarvas trófeák száma és elhelyezkedésük, 1970–1999

2. The antlers of red deer in *Gemenc Forest* have crowns of darker tone, weights up to 14 kg, and lengths below 120 cm. The number of tines is around 20.
3. The *Dráva floodplain* subregion covers the area of the valleys of southern Somogy Hills and the Ormánság ethnographic region. Antlers here are particularly wide, which is an oriental feature. The very thick tines have spans up to 115 cm and antlers can weigh as much as 14 kg.
4. In *northern Somogy Hills* deer wear antlers with straight tines of average number – almost as long as in the Zala Hills – and higher crowns.
5. In *Tolna Hills* V-shaped antlers with straight tines are typical. The crown is dense and narrow, while the lower antler seems relatively sparser. Trophies of outstanding quality are less common here.

Although game management has had a major contribution to the development of red deer stocks acknowledged world-wide, there are also physico-geographical factors which – directly or indirectly – provide favourable conditions for red deer habitats.

Discussion

Climate

Climate is usually considered a major limiting factor to the distribution of animal species and also determines speciation. In Southern Transdanubia warm temperate conditions prevail, accompanied by Atlantic and Mediterranean influences (PÉCZELY 1998). The former is observed in the amount, while the latter is rather in the distribution (secondary autumn maximum) of precipitation. Annual precipitation drops from 900 mm in the west

to 600 mm in the east, 350 to 550 mm falling during the growing season (Ádám et al. 1981).

The annual distribution of precipitation controls vegetation and, thus, the quantity and quality of game fodder. Abundant late spring and early summer rainfall provides sufficient fresh fodder for young animals. The nutrient demand in the lactation period of deer was found 2 to 2.5-fold higher than normal (Páll 1985). Red deer calves take on 300-500 g weight in the first months after birth and the source of this growth is exclusively suckling.

Similarly, sunshine hours in a year rise from 1900 hours in the west to 2150 hours in the east.

A favourable circumstance for red deer is that the mildest winters (-2 to 0ºC January mean temperature) are recorded here in Hungary. Antler growth takes place between February and August and may reach a rate of 6–7 g bone increase per day. Spring and summer nutrient supply greatly depends on the severity of winter and proper nutrition. The hunters' experiences show that the large number of sunshine hours and high precipitation are both favourable for antler quality. Solar radiation is important as it promotes vitamin D formation. Its impacts are reflected year by year in the valuations of antlers. The southern half of Southern Transdanubia has particularly favourable endowments in this respect.

Topography influences the duration (50–60 days at higher elevations) and the depth of snow cover (occasionally reaching 30–40 cm). Even slope exposure is of significance: deer favour cooler northerly slopes in summer, while in winter they prefer warmer south-exposed slopes. Deep snow cover in winter is not dangerous for red deer but the rain-on-snow phenomenon, a thick ice crust upon snow, cause injuries. Although snow cover is a highly irregular and unpredictable weather element, game has to be fed for periods of variable length almost every winter. Late snow in March is a hazard. Extreme weather is not too common but drought or cold spells recur time after time. Droughts between July and September present a danger and call for the setting out of watering facilities.

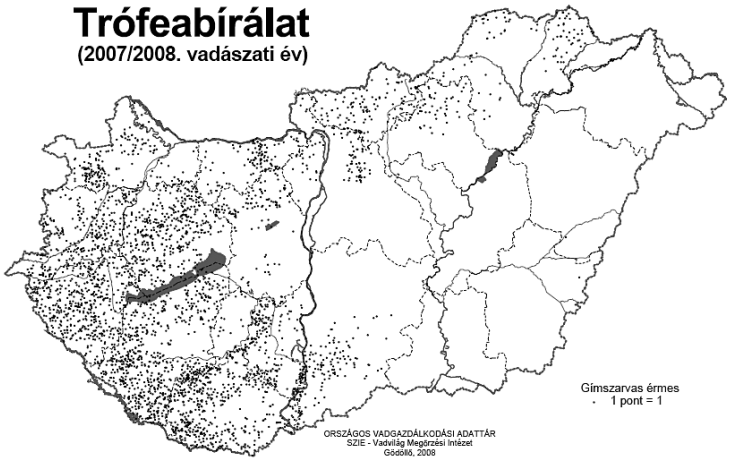
Climate change, also observed in Southern Transdanubia, may significantly disturb the temporary pattern of red deer behaviour (the date of rut, antler shedding, wandering etc.).

Natural vegetation

Before human settlement, the relatively abundant precipitation supported dense woodlands in Southern Transdanubia. The woods provided shelter for big game. The ratio if forest cover in Zala county is still above 50 per cent, which fact explains the high quality of deer trophies deriving from there. In Somogy, Tolna and Baranya the share of forested areas ranges from 20 to 30 per cent (still above the national average), but forests are divided by large expanses of agricultural land. In Gemenc Forest 90 per cent of the area is forested – providing ideal conditions for big game management.

As far as tree species composition is concerned, in western areas deciduous (beech) forests with Scotch pine are widespread, while towards the east they are gradually replaced by turkey and sessile oak stands. In the region of Inner Somogy oak and hornbeam forests on sandy soils are also excellent hunting grounds (for instance, near Lábod and Kaszó). Favourably, dry hill ridges are interrupted by waterlogged valleys. Wetlands are of great significance for big game like red deer as wallowing sites. The corridors along streams and rivers (for instance, the Boronka Forest) provide the necessary connection between habitats and promote the genetic improvement of populations.

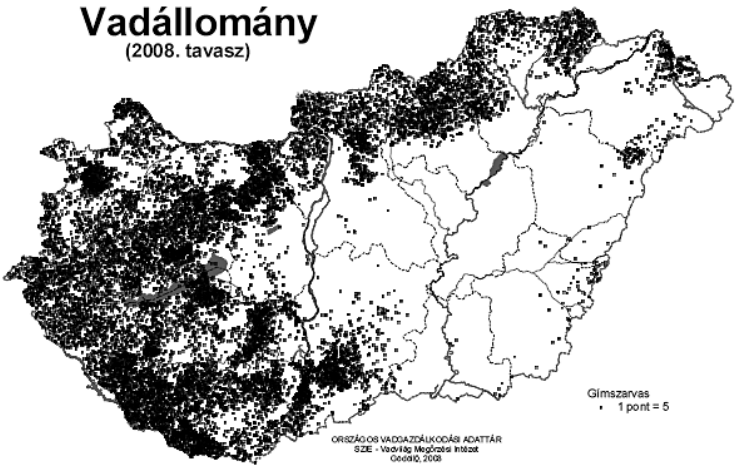
Red deer prefers young forests of mixed species composition, where fodder is abundant at all times. Turkey oak and beech forests are optimal and if ash and hornbeam are mixed among them, the conditions are even more favourable. Conifers and Robinia stands provide the least amount of food for the game. Unfortunately, in the past 50 years, the species composition of forests in Hungary has changed unfavourably: the share of conifers has grown from 6 to 15 per cent at the expense of oak and beech. The extention of homogeneous forest stands has increased too. In the Great Hungarian Plain, Robinia woods predominate, which are, even if closed stands, not the best habitats for big game. On the whole, however, the proportion of ecologically valuable forests is high (SOLYMOS 1998). According to EU directives long-term tree plantation programs are under way until 2050, particularly in areas with poor soils in the Southern Great Plain and in the Trans-Tisza region, and the percentage of forests is planned to be increased from 19 to 27 per cent. Thus, new areas, known for small game, will also be available for deer as habitats. A more even distribution of red deer is expected as it is already observable in Bács-Kiskun County (Map 2, Map 3).



Map 2. Trophies evaluated, hunting year 2007/2008
1 dot = 1 awarded red deer
2. térkép Érmes gímszarvas trófeák, a 2007/2008 vadászati évben
(1 pont = 1 gímszarvas)

Further plans envision that riparian forests are broadened and green corridors are formed for the spreading of game. The ratio of forests has to be at least 13 to 15 per cent for the permanent occurence of red deer in an area (CSÁNYI 2007). Following the above outlined measures, hunting areas with small game could be developed into ones with mixed game and later to big game. A similar transformation took place in Transdanubia between 1930 and 1970.

Reserving foraging lands for game is another important task. It would prevent the incursions of big game from forests into agricultural fields.



Map 3. Game stocks, spring, 2008
1 dot = 5 heads of red dear
3. térkép Országos gímszarvas állomány, 2008 tavasz
(1 pont = 5 gímszarvas)

Soils

In the United States, the Department of Agriculture related big game habitats directly to soil types (USDA 1972). A similar relationship can also be found in Hungary. In Southern Transdanubia types and subtypes of brown forest soils predominate. Lessivage and podsolisation is more intensive in the western hill region, while chernozem-like processes occur in the eastern zone (in Tolna and SE-Baranya). The latter is more favourable for red deer, which need large amounts of calcium in times of antler growth. In stream and river valleys alluvial and paludal soils are typical. (The importance of wetlands has already been mentioned.) The most fertile soils of the region are naturally used for farming. Farmlands are foraging grounds for big game in times of need but the damage caused to cultivated crops can be kept at tolerable levels.

Soil quality controls the type and amount of available fodder for game. Favourable site potentials, however, are joy and pain at the same time for game managers. The abundance of fodder allows the maintenance of large game stock of high quality on the one hand and crop damage can be rather considerable on the other. Monoculture agriculture reduces the success with scaring and repellant hunts.

The relationship between roe deer antlers and soil quality (primarily chemical properties) has been proved (Bán and Fodor 1980). Since the results are also valid for red deer antlers, some of the findings are summarized here. The dependence of the value of trophies and several soil properties were investigated in the chernozem areas of the Great Plain (Jászság, Nagykunság and the Körös-Maros Interfluve). Calcium and phosphorus concentrations were found to be very closely related, while sodium closely related to antler weight. Antler length showed a very close correlation with sodium concentration in the soils, while calcium concentrations closely correlated. Researchers assume that

other antler parameters are more controlled by genetic factors rather than environmental conditions. The investigation makes it very probable that antler development is a function of soil composition also in the case of red deer.

Hydrographic conditions

Hungary, and particularly Transdanubia, is rich in surface water. However, in the past a large part of the country (25 per cent) was permanently waterlogged (FRISNYÁK 1995). This situation was very favourable for red deer as the animals easily found hiding and foraging areas. The present extension of wetlands is only a fraction of the one-time area.

With the reduction of agricultural production, new areas will become available for expanding the habitat for wildlife. Water management has forced several animal species, including red deer, onto higher-lying hill or mountain areas. With the ongoing projects completed, red deer could return to its previous habitats. The potentials are much higher in the hills and mountains of Southern Transdanubia than in the Great Plain. In the former region game managers only have to establish wallowing sites, while in the latter, often stricken by drought, watering sites are to be provided too.

An example of game management: deer in Gemenc Forest

This floodplain forest along the Danube is almost unique in Europe. A property of the Bishop of Kalocsa, this section of the river was not affected by large-scale flow regulation and drainage activities in the 19th century. Waterlogged forests cover here 20 300 hectares – ca 90 per cent of the Danube-Dráva National Park area. The quantity and quality of the red deer stock here is equally world famous.

This environment of high biodiversity is, at the same time, highly vulnerable. In 2006 the flood wave affected one third of the active floodplain section (ca 18 000 hectares) and caused damage to the roe-deer, boar and red deer populations. (Young wild boars had to suffer the greatest loss: 90 per cent were destroyed in the flood.) A game stock survey revealed that only one third of red deer hinds had offsprings (Vilmos Fodermayer, pers. comm.). The forests on flood-free surfaces could not compensate for the losses and restrictions in hunting (60 per cent reduction of shootings) had to be introduced (Table 2). In the plans of floodplain restoration the demands of game management (for instance, establishing mounds of refuge for big game) also have to be observed.

Table 2. Estimates of red deer stock for Gemenc Forest, 1997–2008
Source: Fodermayer, V., Gemenc Company
2. táblázat Gímszarvas becslés a gemenci erdőben, 1997–2008
(Forrás: Fodermayer, V., Gemenc Zrt.)

Year		*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Red Deer	bull	501	271	412	341	305	365	402	420	415	420	420	355
	cow	993	398	339	393	425	460	549	515	520	545	460	430
	calf	338	181	190	256	373	295	256	345	320	315	125	295
Total red deer		1832	850	941	990	1103	1120	1207	1280	1255	1280	1005	1080

Conclusion

The case of red deer in Southern Transdanubia clearly shows the intricate relationships between the physical environment and game management. The conservation of the former is an essential precondition to the future success of the latter. Consequently, misconceptions on hunting have to be changed and the level of environmental consciousness of the population has to be raised.

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A SIKERES DÉL-DUNÁNTÚLI GÍMSZARVAS GAZDÁLKODÁS TERMÉSZETFÖLDRAJZI HÁTTÉRMAGYARÁZATA

SIPŐCZ M.[1], LÓCZY D.[2], TÖRZSÖK A.[3]

[1]Földrajzi Intézet, e-mail: kivu@freemail.hu
[2]Környezettudományi Intézet, e-mail: loczyd@gamma.ttk.pte.hu
Pécsi Tudományegyetem, H-7624 Pécs, Ifjúság útja 6.
[3]Földrajzi Intézet, e-mail: andrastorzsok@citromail.hu

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Összegzés: Munkánkban igyekeztünk érzékeltetni, hogy a világhírű gímszarvas gazdálkodásunk hátterében, milyen természetföldrajzi folyamatok állnak. Úgy gondoljuk, sikerült kapcsolatot találni a geográfiai tényezők és a vadgazdálkodás sikeressége között. Erre a Dél-Dunántúl kedvező természeti adottságai szolgálnak bizonyítékul, illetve azok az adatok melyeket cikkünkben is bemutatunk. Munkánkkal szeretnénk rávilágítani egyben a gím-szarvasra, e szép természeti értékünkre, amellyel a szakszerű gazdálkodás, a jövő generációinak is értéket jelent majd. A cikkel a földrajz népszerűsítését is szeretnénk elősegíteni. Úgy gondoljuk, témánk, rávilágít arra, hogy a földrajz mekkora jelentőséggel bír, mint tértudomány, és egyes természeti tényezők feltárásában milyen nagy a szerepe. A földrajzos szakirodalom, a mezőgazdaság ágaként, csak érintőlegesen foglalkozik a vadgazdálkodással. Pedig a téma komplex elemzése geográfiai szempontból, és a vadgazdálkodási ágazat szempontjából is egyaránt előnyös lehet. Ebben a cikkben egy általános képet szeretnénk kialakítani, a konkrét összefüggésekről, melyek a sikeres vadgazdálkodás hátterében állnak. A későbbiekben tervezzük a cikkben közölt egy-egy részterület feltárását is, majd annak a tudományos élettel való megismertetését.