University of West Hungary

PhD thesis

ECOLOGICAL PRINCIPLES OF THE MANAGEMENT OF THE DÉVAVÁNYA GREAT BUSTARD CONSERVATION SITE

LÁSZLÓ TIRJÁK

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PhD School: Roth Gyula Forestry and Game Management Sciences
Supervisor: Prof. Dr. Sándor Faragó doctor of Hungarian Academy of Sciences

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Science: Forestry and Game Management Sciences

Advisor: Prof. Dr. Sándor Faragó

INTRODUCTION, OBJECTIVES

The Körös-Maros National Park Directorate completed the enclosure of the Dévaványa Great Bustard Conservation Site on 21 November 2002, and started to operate it in 2003.

The 398-hectare enclosure contains mainly grasslands (237 ha) and arable lands (156 ha). Medium-sized and large mammals that pose a threat to ground-nesting birds, such as Red Fox, Golden Jackal, Feral Dog, Raccoon Dog, European Badger and Wild Boar were removed upon enclosure and subsequently excluded from the site. The project opened up new opportunities for Hungary's nature conservation, but further operation necessitates that a number of novel technical questions that have arisen since be addressed without delay.

The collection and continued recording of the experiences of the initial period of operation are indispensable in order to answer the question whether the „fox-free" condition can be ensured in the long run, and what kind of developments are necessary to maintain the facility. The ecological effects of the 8250 metre long and 2 metre high fence and whether it causes mortality among the free-ranging wildlife of the site need separate analysis. In this regard, the risk of injury or even death of Great Bustard hens that typically fly low and move around intensively during the mating season must be studied with particular care.

The Réhely-Szarkalapos plot allocated for the project had been an important lekking, nesting and feeding site for Great Bustards even before the enclosure, therefore, it must be analysed how the construction of the fence, the partial lack of predators, the changes in land use and the reduction of human disturbance influenced the population. How did the local Great Bustard population, in a stronghold of the species in Hungary, react to these rapid and significant environmental changes? What are the chief parameters like of the population living in the Great Bustard Conservation Site?

Knowledge of the presence of raptors is indispensable for the conservation manager. What is the effect of Eastern Imperial Eagles and Western Marsh Harriers nesting as well as Eastern Imperial Eagles and White-tailed Eagles wintering in the study area on the breeding, feeding and resting Great Bustards, is there a need to intervene in favour of the bustards?

The research also opened the possibility to compare the population parameters of passerines nesting on or near the ground within the Great Bustard Conservation Site on one hand and on a nearby control plot on the other, thereby evaluating the consequences of the partial absence of predators.

The dissertation puts special emphasis on Brown Hare, as it is preyed upon by large raptors occurring regularly in the site, such as White-tailed Eagle, Eastern Imperial Eagle and Golden Eagle. The Brown Hare population in the Great Bustard Conservation Site, insofar as it has a higher density than in neighbouring areas, is a major attraction for eagles, which may, among certain conditions, pose a threat to Great Bustards. A naturally arising question is whether Brown Hares need to be culled inside the site in order to protect Great Bustards. In order to answer this, a detailed study of the internal and external Brown Hare populations is by all means justified and necessary, whereby the predatory impact of the Red Fox and the consequences of culling can also be clarified. The population dynamics of the internal, isolated Brown Hare population also deserves a separate analysis, since the nearly 400-ha large, „fox-free" enclosure may yield plenty of new information.

In fact, the study constitutes applied conservation research, whose results are not only applied, but are actually incorporated into everyday conservation practice.

MATERIAL AND METHODS

The Great Bustard Conservation Site

The fencing and enclosure of the Great Bustard Conservation Site, as well as the removal of the individuals of certain mammal species and the regulation of other species (Roe Deer, Brown Hare) remaining within took place in 2003. The period studied by the author embraced the first 14 years of operation (2002-2015). Analysis of the experiences of operation was based on the regular records made by the staff, on the compulsory weekly reports and on the facts registered in the Control Forms.

The author made a separate analysis of the efficiency and risks of the second generation Great Bustard repatriation programme (2003-2004).

Occurrence characteristics of Great Bustards in the Great Bustard Conservation Site

In order to maintain intactness of the enclosure, the technical staff are compelled to walk around the external side of the fence every 2-3 days, during which they also collect biotic data. The regular Control Form protocol prescribes an all-inclusive, detailed population survey for the Great Bustard. The author analysed these data from the Control Forms for a seven-year (2009-2015) period. The amount of data available made it possible to carry out a comprehensive analysis of Great Bustard occurrences in the site. The author analysed and evaluated the number of Great Bustard observations (N) and the monthly (P_h) and half-monthly (P_{fh}) probability of Great Bustard occurrence.

The number of breeding Great Bustards can be estimated indirectly. Hens leading chicks (M) can be counted with relatively great precision from fixed observation points and from carefully placed lookout towers. These observations provide a minimum number of nesting birds.

The occurrence and effects of raptors within the Great Bustard Conservation Site

The dissertation analyses the detailed breeding and occurrence data of significant raptor species (White-tailed Eagle, Western Marsh Harrier, Eastern Imperial Eagle) for a five-year period between 2008 and 2012. Complete population estimates (FARAGÓ & NÁHLIK, 1997) were made for the breeding and wintering populations in the study area.

The Dévaványa area is one of the most outstanding wintering sites of eagles in Hungary. Thanks to this, regular surveys are made in the Great Bustard Conservation Site and in the surrounding area of nearly 50,000 hectares, recording every important aspect (age, sex etc). In this period, a complete survey is carried out at the time of the synchronised winter raptor census. The study of wintering populations was based on the data of 5 winter censuses.

Point-counts of passerine communities

The author carried out comparative studies on the passerines nesting on or near the ground within the „fox-free" Great Bustard Conservation Site and on a nearby control plot with similar habitat characteristics. The observation points were determined after habitat mapping in the Great Bustard Conservation Site and in the Gabonás control site by Dévaványa. The point-count method entailed three surveys each year (15 April – 20 June; a minimum of 14 days between two surveys), with ten minutes of observation at each point, and the radius of sampling was 100 metres (BÁLDI *et al*., 1997). The sampling points

were allocated preliminarily, using a GIS grid system, and could not be altered in the field. Research period: 2009-2010. The author calculated Shannon Diversity Index (*H'*) and Pielous Evenness Index (*J*), where the values of Shannon Diversity Index were compared using the t-test proposed by Hutcheson.

The comparative study of Brown Hare populations

The research containing the comparative study of Brown Hare populations started in autumn 2008. Three survey plots were identified (Réhely – 134.54 ha, Szilasok – 140.23 ha, Great Bustard Conservation Site – 60.48 ha), that differed in the presence or absence of Brown Hare taking and in the occurrence of Red Fox. Populations were estimated twice a year (spring and autumn) on the plots, applying Pielowski-type night surveys using spotlights (PIELOWSKI, 1969). Surveys began one hour after sunset, and were carried out on three consecutive days, shifting the survey areas. The occurrence of Brown Hare was recorded, noting the habitat type as well as data on other species of mammals and birds observed. The research included 9 survey periods between autumn 2008 and autumn 2012. Data obtained were evaluated with regard to weather conditions, habitat changes and actual vegetation parameters. The analysis of the effects of extreme weather events received special emphasis. The author determined habitat preference using the Ivlev electivity index (E) and the Jacobs index (D), which will provide indispensable information to habitat management.

RESULTS AND THEIR EVALUATION

The technical defence of the Great Bustard Conservation Site

The Great Bustard Conservation Site is an innovative technical facility of nature conservation which had to be operated without prior experience. Assessing the sustainability and efficiency of the technical defence system has practical implications, since it can greatly contribute to implementing conservation schemes and target-oriented measures in the future.

Out of the species affected by exclusion, Golden Jackal, Feral Dog, Raccoon Dog, European Badger and Wild Boar did not manage to enter the enclosure. The underground reinforcing steel, the anti jump fence and the two wire electric fence proved sufficient to deter these species. The defence system could not keep out stray cats, prowling specimens regularly turned up within the site.

The weak point of the defence system proved to be the exclusion of Red Fox. Within the study period, Wild Boars tore gaps on the fence on three occasions (25 May 2009, 4 November 2010 and 2 September 2012), opening the way to young foxes that followed the Wild Boar tracks. Locating and removing the foxes went smoothly. In the future, damage by Wild Boar will be the greatest security hazard.

The studies confirmed that the Great Bustards had no problem seeing the fence made of 2.5 mm thick wire mesh with 60x60 mm holes, and the 200 centimetre tall structure was avoided by the birds that often fly low over the ground, so it does not cause accidents. Thus, the technology applied in Dévaványa can be safely used in other Great Bustard sites, too. This wire mesh type only occasionally caused the death of other species, but mass accidents never occurred.

Second generation Great Bustard repatriation programme

The Körös-Maros National Park Directorate made three experimental attempts (24 individuals in April 2003, 19 individuals in September 2003 and 13 individuals in August 2004) for the implementation of a second generation Great Bustard repatriation programme. The conclusion from the releases is that an artificially created, flightless Great Bustard population cannot be sustained with the methods applied in an enclosure of this size (398 ha). The flightless bustards were not able to tolerate the ecological consequences of extreme weather events. In order to re-launch the programme, the technology of second generation repatriation will have to be improved.

Occurrence of Great Bustards in the Great Bustard Conservation Site

At different times of the year, in line with their annual life cycle, Great Bustards use the habitats of the Conservation Site for different purposes and in different ways. Their presence during the breeding season, which consists of lekking and nesting periods, fundamentally differs from their occurrence patterns in the rest of the year.

During the 7 years studied (2009-2015), 3.20%-7.91% of the entire population counted by the staff in the Dévaványa area during the spring synchronised censuses were seen within the Great Bustard Conservation Site in the lekking period. The true number of Great Bustards present is supposedly higher, since, in case vegetation is tall, it may reduce the efficiency of counts during fence controls, thus, numbers can be underestimated.

The favourable habitats, tranquility and protection of the Great Bustard Conservation Site attract Great Bustards of the surrounding area, which particularly prefer to nest in this safe habitat. The enclosure was populated by Great Bustards gradually between 2003 and 2006. The number of nesting Great Bustards no longer increased in the second half of the studied period, reaching a stable population size corresponding to a population density of 2.98 „hens with chicks"/100 hectares. This density can be considered the actual carrying capacity of the site with regard to the nesting population.

Based on the yearly observations, it can be concluded that apart from the lekking and nesting seasons, Great Bustard flocks do not have a preference for the „fox-free" Great Bustard Conservation Site neither by day nor for roosting. In these months, winter rape fields outside the enclosure represent the most important feeding and resting sites, providing plenty of green biomass. The highest monthly probability of Great Bustard occurrence (P_h) inside the site occurred in April (0.80), while the lowest figure was in October (0.08). The number of Great Bustards in half-monthly periods in March and April (R_{fh}) was between 20.70 and 24.65.

During the study, the fence did not cause mortality or even injury to Great Bustards. This proves that the fence does not hinder the movement of Great Bustards capable of flight, their activities are in no way restricted by the defence system of the Great Bustard Conservation Site.

The occurrence of raptors

The analysis of the occurrence of large raptors that may pose a threat to Great Bustards is important for various aspects. If the high density of Brown Hare within the Great Bustard Conservation Site concentrates raptors to the site, this may affect the nesting, feeding or resting Great Bustards unfavourably.

During the studied period from 2008 to 2012, the breeding population of White-tailed Eagles in the region consisted of 2 pairs, the members of which only occasionally

turned up at the site. As for Eastern Imperial Eagle, 7 resident and numerous occasional pairs made up the region's breeding population. Every year between 2009 and 2012, 1 pair successfully nested and raised young within the Great Bustard Conservation Site (2.25 nestlings/year).

The population of wintering White-tailed Eagles is significant in the region, with numbers varying from 14 to 31 between 2008 and 2012 according to the winter censuses. As for Eastern Imperial Eagle, the number of individuals registered by the staff according to the protocol changed between 9 and 43 in the same period. Neither species showed higher concentrations in the Great Bustard Conservation Site than in neighbouring areas. However, significant concentrations occurred in the vicinity of Gyomaendrőd, hosting one of the largest duck raising and hunting estates of the country, with the constant presence of injured Mallards.

White-tailed Eagle is described as an important predator of both young and adult Great Bustards in Germany, and it is considered the single most important predator of repatriated specimens (LANGGEMACH, 2013). During the study period, predation of flightless adult Great Bustards by large raptors did occur, however, this did not create such a high risk of predation as in Germany.

A pair of Eastern Imperial Eagles nested successfully in the Great Bustard Conservation Site every year between 2009 and 2012. The eyrie built on a poplar tree was located 250 m northwest of the centre of the site. Data from the study showed that the presence of Eastern Imperial Eagles breeding within the site did not result in any change in the total number of Great Bustards either breeding in or otherwise using the Great Bustard Conservation Site.

Between 2008-2012, 3-6 pairs of Western Marsh Harriers and 1 pair of Montagu's Harriers bred in the Great Bustard Conservation Site. Despite the fact that the breeding population of Western Marsh Harriers and Eastern Imperial Eagles covered the entire site, Brown Hares were able to reach an outstandingly high population density (2009: 2.51 individuals/ha).

White-tailed Eagles and Eastern Imperial Eagles did not concentrate on the Brown Hare population of the Great Bustard Conservation Site neither in nor outside the breeding period, therefore, Brown Hare culling is not necessary to protect Great Bustards from eagles.

The breeding population of passerines

Breeding passerine populations were censused in 2009 and 2010 by point-counts in the Great Bustard Conservation Site and in a control site called Gabonás. The number of breeding or migrating species recorded was 54 on the Great Bustard Conservation Site and 40 in the Gabonás site. 9 passerine species nested within the sample circles. Four species were constantly present as breeders in the sample sites in every year of the survey: Eurasian Skylark *(Alauda arvensis)*, Yellow Wagtail *(Motacilla flava)*, Reed Bunting *(Emberiza schoeniclus)* and Corn Bunting *(Emberiza calandra)*. The highest relative density was shown for Eurasian Skylark. In Gabonás, which possesses more favourable habitat conditions for this species with Artemisia salt steppes and its various formations, the relative density was 3.82 pairs/10 ha in 2009, while in the extremely rainy year 2010, this figure was somewhat lower, 2.12 pairs/10 ha.

The comparison of data from the two years and the two sites brought interesting results, as precipitation significantly differed between the two years (2009: 469 mm; 2010: 769 mm). Inland floods became typical by the beginning of the second year, temporarily creating new habitat types in the Gabonás site, best characterised by the appearance of

Sedge Warblers *(Acrocephalus schoenobaenus)* as a breeding species. In all other species, relative density declined due to the cool and rainy period in 2010. The effects of habitat condition changes can also be detected in total density values: Gabonás 8.28 pairs/10 ha – 5.52 pairs/10 ha; Great Bustard Conservation Site 7.64 pairs/10 ha – 5.31 pairs/10 ha. The Shannon Diversity Index increased from 2009 to 2010 in both sites, but the increase did not prove significant, using the t-test proposed by Hutcheson, neither in the Great Bustard Conservation Site (t=0.0576; $p<0.10$), nor in the Gabonás site (t=0.2662; $p<0.10$).

Parameters of the Brown Hare population in the Great Bustard Conservation Site

The research programme dealing with the population of Brown Hare included 9 survey periods between 2008 and 2012. A total of 3 sample plots were designated, differing in the presence or absence of Brown Hare taking and in the occurrence of Red Fox. The figures of estimated population density were between 0.99 ind./ha and 3.76 ind./ha in the Great Bustard Interior Sample Site, 0.15 ind/ha and 0.77 ind./ha in the Réhely Sample Site as well as 0.18 ind./ha and 0.67 ind./ha in the Szilasok Sample Site. The surveys detected the greatest population density in the Great Bustard Interior Sample Site, with 3.76 ind./ha estimated in October 2008. During the studied period, there were three weather situations (2010: extreme rainfall, 2012: long snow cover, 2012: extreme drought) that severely affected the Brown Hare population. The extreme weather events had different effects on the isolated and on the free-ranging Brown Hare populations, with the isolated population reacting much more sensitively.

The trend of the Brown Hare population in the Great Bustard Interior Sample Site shows a marked decline in several stages between autumn 2008 and autumn 2012. First, the population density declined significantly due to the rains and floods between autumn 2009 and autumn 2010 (t=12.814; $p<0.05$), causing a population loss of approximately 50%. Afterwards, the population increased between autumn 2010 and autumn 2011, but this trend was halted by the frozen snow cover in February 2012. The drought in late summer and autumn of 2012 caused a further, slight decline, but the difference was not significant (t=0.485; $p<0.05$). The comparison of data between autumn 2011 and autumn 2012, however, showed significant decline (t=19.721; $p<0.05$). Estimated population density reached the lowest figure (0.99 ind./ha) at this time.

The results of the studied period confirmed that professional game management did not influence the population size of Brown Hare in the external sample sites. The predatory effect of Red Fox was unambiguously demonstrated and it was of outstanding importance.

NEW SCIENTIFIC FINDINGS

1. The author's studies confirmed that the wild Great Bustard population uses the Great Bustard Conservation Site in a natural way, completely filling up the available habitat in the breeding season. Outside this season, Great Bustards do not have a preference for the „fox-free" area, food availability being the decisive factor in habitat choice.

2. The author's studies provided evidence that the Great Bustard Conservation Site at Dévaványa had no negative effect on the local, wild Great Bustard population, even though it is an artificial construction and a large enclosure. In spring, a minimum of 3.20%-7.91% of the Dévaványa population can be found within the enclosure, using the habitats of the Great Bustard Conservation Site.

3. The author's studies proved that the type of fence (200 cm tall wire mesh of 2.5 mm thickness and 60x60 mm mesh size) applied in the technical defence system does not restrict the movements of wild Great Bustards capable of flight and does not lead to their injury or mortality.

4. The author evaluated the second generation repatriation method applied in 2003-2004. Based on the experience of the first two experimental years, re-launching the programme can only be proposed after improving upon the critical points identified in his analysis.

5. The author's studies concluded that the appearance of a pair of Eastern Imperial Eagles breeding in the Great Bustard Conservation Site (2009-2012) did not influence the number of Great Bustards nesting in the site. The presence of the pair did not influence the number of Great Bustards using the habitats of the enclosure in any season of the year.

6. The author's studies did not detect significant difference in the ground-nesting or low-nesting passerine communities between the populations breeding in the Great Bustard Conservation Site that excluded medium-sized or large carnivorous or omnivorous mammals (Red Fox, Golden Jackal, Feral Dog, Raccoon Dog, European Badger and Wild Boar) and the open control site.

7. The author proved that Brown Hare can reach an outstanding population density (2.51 ind./ha) even when breeding Western Marsh Harriers and Eastern Imperial Eagles completely occupy the available habitat. These raptors do not threaten the survival of the Brown Hare population.

8. The author's studies showed that the populations of large raptors (White-tailed Eagle, Eastern Imperial Eagle and Golden Eagle) that pose a threat even to Great Bustards did not concentrate in the Great Bustard Conservation Site, even despite the high population density of Brown Hare. It can be concluded, therefore, that Brown Hare culling is not necessary and is not justified for Great Bustard protection.

9. The author's investigation provided evidence that the Brown Hare populations living in the enclosure on one hand and in open areas on the other reacted to extreme weather situations differently. While no difference could be detected during cool and rainy

periods, the free-ranging population was able to seek out alternative food sources during a long-lasting frozen snow cover and during extreme drought, but the enclosed population had no such opportunity and massive death decimated them.

10. During the studies, the highest estimated Brown Hare population density was 3.76 ind./ha in the „fox-free" Great Bustard Interior Sample Site. The author was able to unambiguously demonstrate the predatory effect of Red Fox on Brown Hare populations and the size of this effect in the external sample sites.

11. The author proved that the technical defence system of the Great Bustard Conservation Site can be maintained in the long run, its security elements can provide suitable conditions to Great Bustard protection as well as to experimental exclusion of species, and it can be efficiently used for nature conservation projects.

PUBLICATIONS

Publications connected to the theme of the thesis

Publications in periodicals

1. GYURANECZ, M., RIGÓ, K., DÁN, Á., FÖLDVÁRI, G., MAKRAI, L., DÉNES, B., FODOR, L., MAJOROS, G., **TIRJÁK, L**. & ERDÉLYI K. (2011): Investigation of the Ecology of *Francisella tularensis* During an Inter-Epizootic Period. *Vector-Borne and Zoonotic Diseases* 11 (8): 1031-1035.

2. **TIRJÁK L.,** SZÉLL A. & VIZES T. (2013): A dévaványai Túzokvédelmi Mintaterület kialakítása, az első 10 év üzemeltetési tapasztalatai és élőhely-kezelésének tapasztalatai (2003-2012). [The establishment of the Dévaványa Great Bustard Conservation Site, and the experience from the first 10 years of operation and habitat management] – *Magyar Apróvad Közlemények* 11: 113-166.

3. TIRJÁK L. (2016): A mezei nyúl (Lepus europaeus) állományának változása a Túzokvédelmi Mintaterületen és két kontrollterületeken (2008-2012). [Population changes of the Brown Hare (Lepus europaeus) in the Great Bustard Conservation Site and in two control sites (2008-2012)] – *Magyar Apróvad Közlemények* 13: (approved for publication).

4. **TIRJÁK L.** & SZÉLL A. (2016): A túzokállomány (Otis tarda) előfordulási jellemzőinek vizsgálata a Túzokvédelmi Mintaterületen. [The study of occurrence characteristics of the Great Bustard (Otis tarda) population in the Great Bustard Conservation Site] – *Crisicum* 9: (approved for publication).

Conference presentations

1. **TIRJÁK L**.: Introduction of the nature conservation activities in the border region through the sample of the Great Bustard Study Area
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Vasile Goldis University, Arad - Macea, 7-8 May 2010.

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Conference: Conservation aspects of the maintenance of small game habitats. XI. Természetvédelmi Szeminárium [11th Nature Conservation Seminar], Túrkeve, 3-5 June 2011.

3. **TIRJÁK L**.: Habitat restoration activities and species protection programs in the Körös-Maros National Park
Conference: Effectiveness of Protected Areas. Central European University. Budapest, 15 November 2012.

4. **TIRJÁK L.:** Habitat rehabilitation activities in the Körös-Maros National Park (Élőhely-rehabilitációs tevékenységek a Körös-Maros Nemzeti Parkban). Conference: Nature conservation biology researches in the region of Criş and Mures (Természetvédelmi biológiai kutatások a Dél-Tiszántúlon) Szarvas, 19-20 February 2013.

5. **TIRJÁK L.:** A mezei nyúl állományváltozásának sajátosságai a Túzokvédelmi Mintaterületen. [Characteristics of population changes of the Brown Hare in the Great Bustard Conservation Site]. Researchers' conference: Körös-Maros National Park Directorate. Szarvas, 26 February 2015.

Publications on other nature conservation topics

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1. **TIRJÁK L.** (2012): A Körös-Maros Nemzeti Park bemutatása. [Introduction to the Körös-Maros National Park] – In JAKAB G. (szerk.): A Körös-Maros Nemzeti Park növényvilága. [The flora of the Körös-Maros National Park] – KMNPI, Szarvas. pp.16-23.

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2. TIRJÁK, L. (1994): Nemzeti Park a Körösök mentén. [National Park along the Körös rivers] – *Természet világa* 125 (3): 138-139.

3. TIRJÁK, L. (1995): A Körös-Maros Vidéki Természetvédelmi Igazgatóság megalakulása. [The establishment of the Körös-Maros Region Nature Conservation Directorate] – *Szarvasi Krónika* 9: 21-25.

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5. BÍRÓ, I. & **TIRJÁK, L.** (1997): Új nemzeti park az Alföldön (Pecsét az alapító okiraton). [A new national park on the Great Plain (Foundation decree sealed)] – *TermészetBúvár* 52 (2): 20-22.

6. TIRJÁK, L. (1997): A Kis-Sárrét és gyöngyszemei: Mágori-halom és Fás-puszta. [The Kis-Sárrét and its treasures: Mágori Hill and Fás Steppe] – *Természet világa* 128 (4): 180-182.

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8. **TIRJÁK, L.** (1997): Új nemzeti parkkal gazdagodott Csongrád megye. Biotechnológia és környezetvédelem 9 (különszám - 1997. szeptember): 13-14. [County Csongrád has been enriched with a new national park. In: Biotechnology and environmental protection 9 (Special edition – September 1997)]

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10. **TIRJÁK, L.** (1999): A természetvédelem és a hulladékok kapcsolata a Dél-Tiszántúlon. [The connection of nature conservation and waste materials in Southeastern Hungary] – I. Országos Hulladékhasznosítási Konferencia előadás-gyűjteménye. – pp. 53-54.

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12. **TIRJÁK, L.** (2007): A víz szerepe a Kígyósi-puszta élővilágában. [The role of water for the wildlife of the Kígyósi Steppe] – In FEHÉR F. (szerk.): *Vízgazdálkodás*. 2007/ 3. pp. 2-3.

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14. **TIRJÁK L.** (2010): A Körös-Maros Nemzeti Park. [The Körös-Maros National Park] – In BÁRDOS ZS. (szerk.): Orosháza Város Általános Iskolája és Pedagógiai Szolgáltató Intézménye Kiadványai 3. pp. 37-46.

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1. **TIRJÁK L.:** Élőhelyrekonstrukció a Vásárhelyi pusztán. [Habitat restoration on the Vásárhelyi Steppe]
Conference: Vízgazdálkodási Konferencia - Víz Világnapja. Szarvas, 21 March 2003.

2. **TIRJÁK L.:** A földhasználat változása a Körös-Maros Nemzeti Parkban [Changes in land use within the Körös-Maros National Park]
Conference: Értékalapú történeti kutatások Szarvason. Szarvas, 3 June 2009

3. **TIRJÁK L.:** A Körös-Maros Nemzeti Park természeti értékei [The natural assets of the Körös-Maros National Park]
Conference: XXXVIII. Országos Honismereti Akadémia. Szarvas, 28 June – 3 July 2009.

4. **TIRJÁK L.:** A Hortobágy-Berettyó védett hullámtere [The protected flood plain of the Hortobágy-Berettyó]
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5. **TIRJÁK L.:** Aktuális természetvédelmi feladatok a Dél-Tiszántúlon [Actual conservation tasks in Southeastern Hungary]
Conference: Jövőre Szabadegyetem - Barabás Villa. Budapest, 23 March 2011.

6. **TIRJÁK L.:** A természetimélő gazdálkodás gyakorlata a Körös-Maros Nemzeti Park területén [The practice of nature-friendly management in the Körös-Maros National Park territory]
Conference: Természetvédelem és gazdálkodás. OMÉK Budapest, 20 September 2011.

7. **TIRJÁK L.:** Élőhelyrekonstrukciós feladatok a Körös-Maros Nemzeti Parkban [Habitat restoration tasks in the Körös-Maros National Park]
Conference: Az élhető város és vidéke - MTA Szegedi Akadémiai Bizottsága Békéscsaba, 22 November 2012.

Educational activity

1998 –2007 Course leader of the „Nature conservation" course
Tessedik Sámuel College, Faculty of Agricultural Water and Environmental Management

2006 - Honorary associate professor (Tessedik Sámuel College)