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Nature conservation versus agriculture in the light of socio-economic changes over the last half-century–Case study from a Hungarian national park

Jenő Zsolt Farkas *,[1], András Donát Kovács

Centre for Economic and Regional Studies, Great Plain Research Department, Hungary

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ABSTRACT

National parks and other forms of protection ensure the natural values in the European Union. However, a significant part of protected areas is under agricultural cultivation, and the two sectors have been kind of opponents to each other for a long time. In the last 50 years, because of various socio-economic changes, the European and Hungarian agricultural policies had opposing concepts and goals, even related to protected areas. In our work, we identified the policy and institutional changes, examined their effects, and the conflicts that accompanied them by exploring the area of Kiskunság National Park (KNP) in Hungary. Based on literature and document review, in-depth interviews, GIS, and statistical analysis, we present the main reasons and symptoms of the two sectors' counter-interest. We found that farming objectives and agricultural subsidies have an essential influence on nature conservation. In contrast, the KNP as an institution has less and less control over the landscape management of conservation areas. The historical turning points have fundamental impacts on the behavior of local actors. The changing macro-conditions cause unbalanced relations between nature conservation and agriculture, which could endanger valuable close-to-nature landscapes. We conclude that the coexistence of agricultural production and nature conservation can be improved, but it will require the equal treatment and independence of sectors, comprehensive policy coordination, complex spatial planning, and paradigmatic change in support to agricultural communities and conservationists. The linkages between these two policy areas will increasingly determine sustainable land use management in the future, thus protecting natural values not just in Hungary, but in the EU and other countries too.

1. Introduction

Today, all of us can feel the significant challenges of the Anthropocene era at both global and local levels, such as climate change, biodiversity loss, overpopulation, and overconsumption. Closely related to these challenges are the land use problems arising from the increasing demand for food, industrial raw materials, and biomass for energy. The different land use needs of agriculture and nature conservation are mostly a competition for the use of a finite natural resource (Kremen and Merenlender, 2018). Some authors point out that protected areas have, since their existence, been 'arenas of social conflict' related to land use (Redpath et al., 2015; Baynham-Herd et al., 2018; Rechciński et al., 2019). The question arises as to whether agricultural production and nature conservation can be achieved at all on the same land, or agriculture can be continued in a way that is compatible with biodiversity (Gómez-Baggethun et al., 2013; Baudron and Giller, 2014). Some researchers believe that restoring close-to-nature conditions requires drastic reductions in cultivated land to preserve the biosphere and wildlife (Wilson, 2016).

Moreover, agriculture is considered by many to be one of the most environmentally damaging activities (Tanentzap et al., 2015). At the same time, some believe that these two land use types can coexist, and modern, profitable agriculture, healthy food production, and nature conservation are not mutually exclusive (Erisman et al., 2016; IDDRI, 2018). According to Kremen and Merenlender (2018), "biodiversity-based land management" can provide ecological networks where production and nature conservation can be ensured at the same time. Several authors draw attention to the importance of collaborations

* Corresponding author at: Centre for Economic and Regional Studies, Great Plain Research Department, Rákóczi str. 3., Kecskemét, 6000, Hungary.
E-mail address: farkas.jenozsolt@krtk.mta.hu (J.Z. Farkas).
[1] P.O. box: 261, Kecskemét, 6001, Hungary.

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and the integrated approach to conservation (Scherr and McNeely, 2007; Hammer et al., 2016). The cooperation between different sectors and local actors can help to optimize the use of natural resources in a way that is consistent with both environmental, social and economic interests (Hossu et al., 2017; Pérez-Soba et al., 2018).

The need for cross-sectoral cooperation is also supported by the idea of multifunctional agriculture, which recognizes the role of agriculture in rural areas alongside production (EEC, 1992; Renting et al., 2009). This partnership's visible manifestations are ecosystem-based landscape management practices in protected areas (Fedreheim and Blanco, 2017; Pretty et al., 2018).

In our opinion, several factors inhibit cross-sectoral cooperation in Europe. The European Union is committed to nature protection, but the power of agricultural advocacy organizations is well-known. Institutions responsible for protected areas and NGOs are under enormous pressure from both CAP support schemes and international trade goals, as well as biomass-based energy production and GMO policies (Henle et al., 2008). It is challenging for governments, farmers, and conservation organizations to coordinate nature conservation and agricultural land use objectives nowadays. In the EU Member States, tense opposition has been observed between land-use sectors in recent decades, not only in national parks but also in Natura 2000 areas, where conflicts of management and policy interests have also emerged (Grodzińska-Jurczak and Cent, 2011; Blicharska et al., 2016; Kubacka and Macias, 2016).

Such conflicts are particularly acute in countries with a high proportion of agricultural land. This is the case for Hungary, where agricultural areas cover 64.7 % of the country's territory (CLC by EEA, 2018). The proportion of protected areas is also significant at 22.2 %, but more than half of them are under cultivation, and this overlap is problematic for the reasons mentioned above.

It should be emphasized here that the conservation of habitats and biodiversity in Hungary became a strict principle at the end of the 20th century and is still based on firm foundations (The Fundamental Law of Hungary, 2011). Regardless of this, the role of nature conservation and the ability to assert its interests has changed over time, which was influenced by policy changes, social demands, and economic aspirations. In this respect, the change of regime (in 1989–1990) and the EU accession (in 2004) had a considerable impact, as both events brought significant differences in the relationship between the two sectors, often leading to contradictory phenomena. During the '90 s, "institutional drivers led to an increase in farmland biodiversity," but on the other hand, "land privatization and uncertain ownership led to habitat degradation, abandonment, and fragmentation." The EU membership brought some positive changes: "The establishment of the Natura 2000 network, the application of relevant EU funds and access to successful habitat restorations" but these were also overshadowed by unfavorable processes such as the "Extinction of extensive farming practices, agricultural intensification, and net habitat loss" (Mihók et al., 2017, 67).

Our work aims to provide insight into this complex issue. We examined how the interaction between nature conservation and agriculture has evolved in a study area, where the interdependence of sectors and their counter-interest are decisive due to their significant spatial overlap. For this purpose, we chose the Kiskunság National Park as a study area, which lies on the Danube-Tisza Interfluve. In these lowland areas, we can find habitats and species of international importance, but cultural landscapes have been formed by agriculture for a long time. We discuss our results over three periods, which boundaries were adapted to historical events of our country, namely change of regime and EU accession. We scrutinized the KNP because the challenges of nature conservation can be examined from a historical perspective, and the sectoral conflicts affect large territories. The establishing (in 1975) and operation of the KNP was exemplary during the socialism. At that time, the natural landscapes and habitats were in good condition in European comparison (Iványosi-Szabó, 2015). We think that land use conditions have changed, because of diminishing powers of nature protection, perpetuated land use conflicts, and limited effectiveness of the protected areas, described by others similarly in post-socialist countries (Yakusheva, 2019).

Also, we want to point out a contradiction that exists on a global level. While the problems are local-specific, the conflicts between environmental and economic interests are similar everywhere. Our case study gives an in-depth interpretation of cross-sectoral relations and presents some outcomes that can be used to improve land-use policy in other countries.

2. Study area

There are ten national parks and related directorates in Hungary under the supervision of the Ministry of Agriculture. The territory of the national park protected sites (IUCN category II) differs from the directorates' area of operation. Because of this, other types of protected areas (e.g., national monuments, nature reserves, landscape protection areas) also belong to one of the national park directorates. To answer our research questions, we have been looking for a study area where the two sectors have been living side by side for a long time, and there have been significant changes in land use over the last 30–50 years. Previous results showed that the most intensive land cover changes occurred between the Danube and Tisza rivers in Hungary (Kovács et al., 2017), which region belongs to the operation area of the Kiskunság National Park Directorate (KNPD) (Fig. 1 and Table 1).

67 % of the study area is agricultural land (see details in Table 3), which can be divided into three agrarian regions: (1) Dunavölgyi-sík, (2) Danube-Tisza Interfluve and (3) Bácska. Amongst these, Bácska has the most homogenous landscape with highly mechanized, intensive large field cereal production (mostly corn monoculture). The Dunavölgyi-sík has two faces: in the north, pastures are dominant with extensive sheep and cattle breeding, while in the south, the primary land use is arable cultivation with cereals, field vegetables, and industrial plants. The Danube-Tisza Interfluve region has a highly fragmented landscape with scattered farms, where forests, pastures, arable land, intensive fruit plantations, and vineyards alternate.

3. Materials and methods

In our analysis, both primary and secondary data were used and processed using a combination of qualitative and quantitative methods. At the beginning of the primary data collection (from September to December 2017), we conducted 30 in-depth semi-structured interviews with competent persons. In the first round, we interviewed professionals who had decades of experience, and some took us on field trips to observe the real environmental status. Based on their recommendation (with the snowball method) and other references, we identified additional interviewees. After the analysis of the first round's results, we conducted another 30 face to face interviews with additional stakeholders (from August to November 2018). We collected relevant opinions from three main groups: (1) experts of conservation and ecology (24 people), (2) agricultural professionals (24 people), and (3) local experts (12 people) from the fields of rural development, water management, and forestry. 30 % of the respondents were professionals of retired age with comprehensive knowledge (some respondents had known the area well since the 1970s). Another 50 % were over 40, and 20 % were under 40. The gender ratio was the two-thirds majority of men. The respondents were trustworthy, most of them (47 people) with higher education: including retired Deputy Minister, ex-secretary of state, the past and present head of an institution, nationally renowned agribusiness entrepreneur, local decision-makers, and farmers. We followed the basic rules of qualitative interviewing (Rubin and Rubin, 2012; Castillo-Montoya, 2016), and by preparing the interview protocol matrix, we systematized the opinions and comments expressed according to the questions. We had prepared a list of predetermined questions, but we offered the chance to the participants to pursue issues they feel essential. These questions include, but are not limited to:

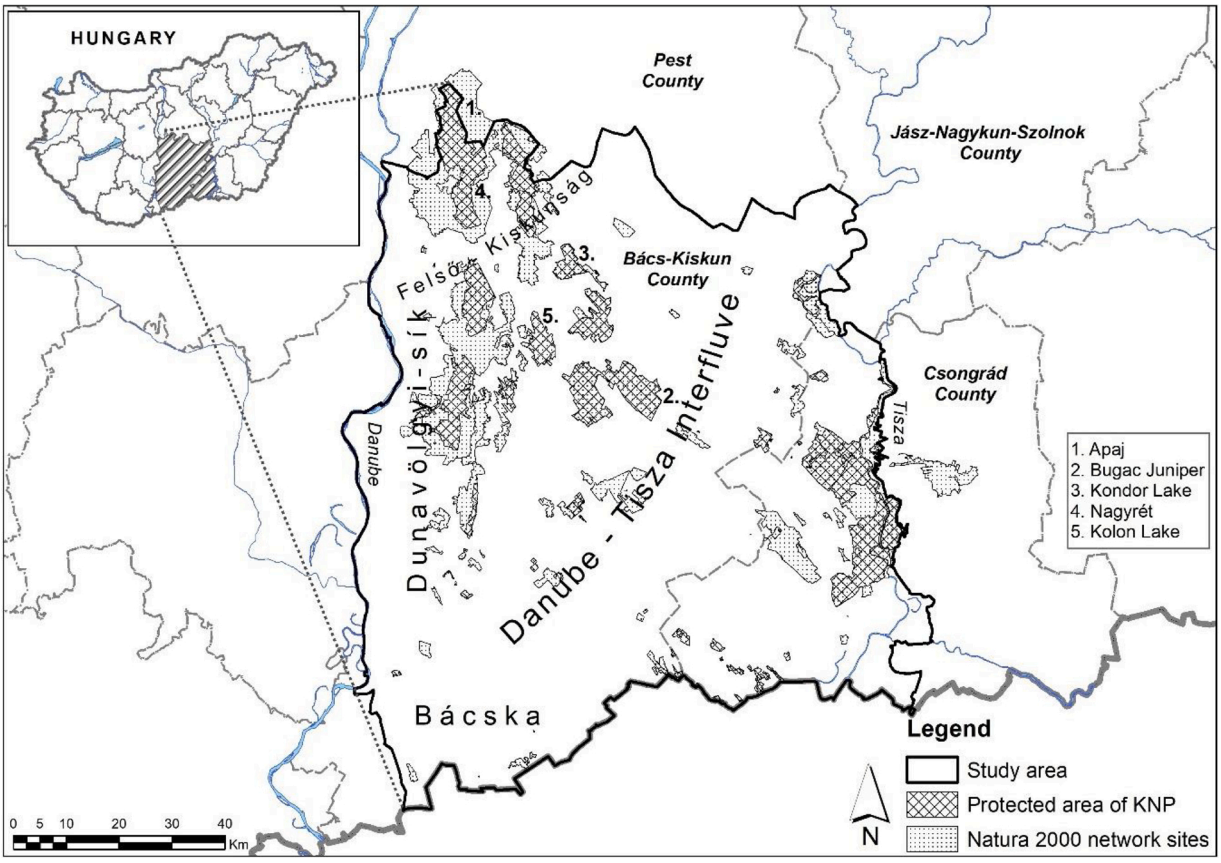

Fig. 1. Map of the study area. Data source: European Environment Agency.

Table 1
The operation area of KNP Directorate. Data source: European Environment Agency and Copernicus Land Monitoring Service.

Type of protection	Number of sites	Area in Hectares
National park (IUCN II)	9	50522
National monuments (IUCN III)	3	4
Minor nature reserves (IUCN IV)	19 (20)*	5006
Landscape protection areas (IUCN V)	3	26833
Sub-total of protected areas	34	82365
Natura 2000	45	180345
Total of nature conservation	79	262710
Total area of KNP Directorate		1005860

* The CDDA by EEA, 2019 database doesn't contain the latest changes.

- How do you assess the nature conservation, the agricultural activities, the condition of the landscapes, and the role of the national park in the area?
- What were the main conflicts between conservation and agriculture in the area concerned? How has the situation changed over the past 50 years?
- What external factors or state interventions influenced the two sectors?
- What kind of partnerships and cooperation between the two sectors were in the affected areas?

After analyzing the 60 interviews, we organized three focus groups (roundtable discussions with 4–4 former respondents from different professionals) directing the conversations with problem-oriented questions.

We used interviews equipped with a code number, with the abbreviations for the sectors concerned. Interviewees in the nature conservation are marked with 'N', the agrarian group is marked with 'A', and the other local experts with 'L'. There were cases when respondents said similar or almost the same thing in both sectors. In this case, we placed both abbreviations after the statements. The numeric code indicates how many people talked about the factor described.

In the course of our research, we performed a systematic document analysis. We reviewed annual reports of the KNPD 2002–2019 and selected the relevant laws and regulations governing the nature conservation since the 1970s. We evaluated the spatial development strategies and planning documents related to the region (4th National Environmental Protection Programme of Hungary 2015-2020 (NEPP), 2015; National Landscape Strategy (NLS), 2017; National Biodiversity Strategy, 2015).

Among the secondary data sources, we downloaded the following GIS datasets: (1) Corine Land Cover 1990, 2006 and 2018, (2) Natura 2000 sites for the reference year of 2019 (both from the webpage of Copernicus Land Monitoring Service), (3) nationally designated areas (CDDA by EEA, 2019) and (4) the KNP Directorate's area of authority from the Information System on Nature Conservation (TIR, 2020). These datasets were imported to ArcGIS to generate land cover statistics for the study area and the various types of protected and nature conservation sites.

In support of the qualitative analysis, we used agricultural statistics by the Hungarian Central Statistical Office (HCSO) and agricultural payment data (summarized to county level) from the Rural Development Department of the Bács-Kiskun County Government Office. The latter was an individual data request on EU agri-environmental and Natura 2000 subsidies from 2015 to 2020 and fruit and vineyard plantations in Bács-Kiskun County before the EU accession. In the time-series analysis of the agricultural sector, we mainly used Bács-Kiskun County data because 79.6 % of the study area belongs to this county.

4. Results

4.1. In the period of state socialism (1975–1989)

In Hungary, nature protection as an independent sector (without forest management and hunting) first appeared in 1961 in the Legislative Decree No 18, which established the National Office for Nature Conservation (OTVH) as the national authority of the sector. The 1971 law amendment allowed the creation of national parks and the existing forms of territorial protection (Iványosi-Szabó, 2015). Hortobágy National Park was the first national park in Hungary, which exists since 1972. The Kiskunság National Park followed it in 1975 and the Bükk National Park in 1976. In connection with these parks, national park directorates started their operation too. From an organizational point of view, the independent OTVH ceased to exist and was replaced by the National Agency for Environment and Nature, which in 1987 merged with the National Water Authority and continued to function as the Ministry of Environment and Water Management. The national park directorates have since acted as an independent authority and manager of protected areas within their area of competence.

When the KNP was established, the aim was to preserve the typical landscape features and habitats of the Great Plain between the Danube and Tisza rivers such as sodic lakes, salty grasslands, and sand-dunes.

> The interest and dedication of the then charismatic national and regional leaders was the starting point for establishing the KNP. So, conservationists have been able to designate protected areas with a strong political background. (Interview N 4; L 3).

More than 40 % of the 30,628 ha under protection at that time were still in cooperative ownership (Kelemen, 1996), making it necessary from the outset to consider the interests of agricultural production.

> The establishment of national parks was a crucial step in the relationship between nature conservation and farming. The creation of the KNP has provoked different reactions in various social groups similar to other areas of the country. (Interview A 5; N 11; L 3)
> At that time, some of the farmers demanded the return of the newly-managed lands by the KNP. However, others did not perceive the establishment of this new institution at all. There have been virtually no changes in the land management regime of the latter since some habitat protection requirements: e.g., great bustard (Otis tarda) protection, had to be taken into account earlier. The cooperatives and the state farms were easily handed over the newly protected areas due to reduced production ability (for example, because of the alkaline soils), so the majority of the agricultural holdings did not participate in the designation and management of the protection zones. The pastures and reeds were not used intensively, so the introduction of management rights for KNP was a smooth process. (Interview N. 2)

Since the early 1980s, the management of the KNP has gradually increased the proportion of state-owned and self-managed areas within all protected areas, which was an important step to prevent further degradation. Due to the significant cooperative ownership, close cooperation between the two sectors has made it possible to pursue nature conservation interests. Naturally, there were conflicts, as agricultural holdings were expected to get better and better financial results (e.g., higher yields) in the plan-command economy since agricultural products were one of the leading export articles of Hungary that time. It was a common practice to plow meadows periodically and dried out lakes and salty areas because these changes in cultivation did not have to be announced for two years. Thus, they achieved higher yields statistically.

The most severe disagreements with the agriculture were mainly due to the use of arable land and drainage at the time (which remains a source of concern to this day). The water authorities urged drainage to remove inland water from arable land (even today, 480 km of canal provides drainage in the Felső-Kiskunság on approx. 2000 km^2), which was in the interests of the agricultural sector. These drainage directives prevented the preservation and reconstruction of wetlands and, thus, acted against nature conservation interests.

To resolve the situation, the KNP even established a canal bypass of the Kondor lake region in the early 1980s and launched a white-headed duck (Oxyura leucocephala) reintroduction program (Kákonyi, 2010), but it was too late. Because of weather anomalies and anthropogenic effects, the area could not be prevented from drying, which caused a significant loss of biodiversity (Kovács et al., 2017). There was also a conflict of interest in agricultural crop protection, as fungicides and pesticides were used in large quantities in the industrial agricultural system.

During this period, cooperatives and state farms dealt with non-agricultural secondary activities (e.g., construction, car fitting service). These economic activities were polluting, which was also conflictual because the waste was dangerous, and in many cases inadequately managed. The most egregious example came out in 1983 when the Kiskunság State Farm buried 250 paint barrels in a protected area near Apaj (Kákonyi, 2010). The KNPD had to intervene in similar cases as the responsible authority.

However, there were also moments of partnership. "The consensus was facilitated by the existence of private farmers in state socialism, even if they were very few in numbers. These farmers' lands were wedged between cooperative lands (nationwide, 13–14 % of agricultural land was in the hands of smallholders in the 1980s). This situation overshadowed the use of large-scale agricultural technologies in some areas (e.g., helicopter crop protection), thus favoring nature conservation and the long-term preservation of the Kiskunság landscape." as a former official summarized the era.

"Although not from the agricultural side, there was a special and strong counter-interest in the land use due to the military activity in the area, which has long been a serious threat to landscape protection. The Russian Army military exercises often resulted in landscape wounds (for example, they occasionally scorched large areas, such as the Bugac ancient juniper), but this problem could not be solved until 1990. After the departure of the Russians, approx. Ten thousand hectares got into the management of the KNP," a retired expert described the situation.

4.2. From the change of regime to EU accession (1990–2004)

At the beginning of the period, the socio-economic environment of Hungarian agricultural production changed radically. With the disintegration of the Council for Mutual Economic Assistance (COMECON), the stable market has disappeared, which, together with the amortization of technical infrastructure led to a deep and lasting crisis in the sector. The new political elite (under the pressure of the Independent Smallholders Party, included in the first coalition government after the first free elections) prioritized the compensation of formerly nationalized private property and the associated land issue. The Smallholders Party achieved its objectives because in the compensation auctions, 1.5 million new landowners received land, and by 1995 48.2 % of the arable land was already in the hands of smallholders (Csáki and Lerman, 1997).

> The change of regime also brought a significant change for nature conservation. Conservationists no longer had to consult only a few cooperatives or state holdings, but thousands of individual farmers. Moreover, most of the farmers started their businesses at this time, often under challenging circumstances. This was quite a new situation. In addition to this challenge, the main real problem was the conduction of the compensation process (Interviews A 7; N 4; L 5).

During the compensation, land funds were created from the land of cooperatives and state farms. Neither compensated nor cooperative equity holders were able to obtain ownership in highly protected areas or conservation areas protected by international conventions (e.g.,

Ramsar wetlands). These were placed in a separate fund and were subsequently owned by the Hungarian state, which handed them over to the directorates of the national parks. "Unfortunately, at that time, there was no accurate cadastral register of the lands belonging to the national park, so the protected areas were often included in the compensation land fund for auctioning. In the case of non-specially protected areas with arable, garden, orchard or vine cultivation could only be allocated to private owners with the official permission of the national park. Besides, the KNP was also in need of plots that had previously been managed by the cooperatives. The park wanted to obtain them for nature conservation." as a former director of KNPD summarised the period. The disagreements settled later with the new private farmers, mainly because the state provided funds for the KNP to purchase of these lands until the mid-2000s (Law No. XCIII. of 1995 on the State Ownership Obligations for Protected Natural Areas). The Law resulted in a significant increase of public property in protected areas from 9,617 ha (1989) to 48,907 ha (2006) (Kákonyi, 2010). During the 1990s, this effort was supported by private companies, such as GlaxoSmithKline Hungary (a pharmaceutical company which supported the conservation of great bustard habitats) or Magyar Telekom (the latter employees even built a high-stand on the salt-meadow of the Felső-Kiskunság).

> In the first half of the 1990s, the KNP was not prepared to handle the increased area, in particular, the arable land, so it was leased back to the remaining cooperatives. This interdependence was mutual since the cooperatives had just lost their lands. The terms and techniques of production were precisely regulated in the contracts, so this was the first time that the two sectors relied on daily partnership (Interviews A 3; N 6; L 2).

The disintegration and crisis of agriculture favored nature conservation because the transformation suppressed industrial agriculture. The small farms created in the compensation process were poorly mechanized, lacked capital, and the use of fertilizers, pesticides, and fungicides was not profitable, which made Hungarian agricultural production greener during this period (OECD, 2008). The farmers struggled with livelihood difficulties because 904% of the new individual farms had land under 5 ha (Burger, 2006). To increase their area, producers often tried to cultivate ecologically important landscapes elements of conservation areas such as tree rows or dried-out small lake beds (which filled with inland water in rainy years, so agriculture needed more drainage like a vicious circle).

Since 1996, significant changes have been initiated, which can be linked to Hungary's 1994 application for membership of the European Union. Law No. LIII. of, 1996 on Nature Conservation also regulated the relationship between agriculture and nature conservation. It mentions the preservation of habitats in areas with handicaps related to agricultural production as a general task and prescribes to cease or regulate economic activities (farming, forestry, mining) in protected areas. The coordination of nature conservation and agriculture interests is governed by paragraphs 71–73 of the Law, which outline a very sketchy support and compensation scheme to make farmers interested in nature conservation. On this basis, the Environmentally Sensitive Area Program was launched, whereby farmers could apply for additional support in designated areas with poor fertility (e.g., Dunavölgyi-sík). The program aimed to spread environmentally friendly agricultural production practices (e.g., ecological and organic farming) already introduced in the EU countries. As an agronomist said: "In 2002, with greater territorial coverage, the agri-environmental management scheme was launched (first from the Hungarian national budget). At that time, many problems seemed to be resolved, and stakeholders agreed on several issues." By 2000 there were 471 organic farms in Hungary (Drexler and Dezsény, 2012).

The implementation of Law No. CXIV. of 1997 on the Development of the Agrarian Economy brought decisive changes in many fields. New agricultural subsidies aimed to prepare Hungarian producers for the market competition after the EU accession. In the national subsidy system, there were 118 payment titles to improve competitiveness and to increase agricultural production output. As a result, agricultural production was intensified, and the positive trends in the use of chemicals have changed since the beginning of the 2000s (Table 2) (Csatári et al., 2019).

Regarding landscape management aspects, the support of plantation investments (new or renewed vineyards, orchards, and forest plantations) had the most significant impact. According to the data (Table 3), the vineyards and fruit plantations dropped dramatically after 1990 because the plantations were abandoned. After 1997, this trend stopped, and local farmers set up new plantations or carried out plantation reconstruction on 8,900 ha. Except for afforestation, these investments rarely affected conservation areas. However, they still have a significant effect: according to many interviewees, the most severe encroachment against nature conservation was the fencing of individual plots. "Western European experts have warned of the fragmentation of landscapes in the past. In the 1970s, there were open ecological corridors here. These have become very narrowed down now. In addition to the fences, road network developments and new motorway crossings sealed the free wildlife movement in the region. All of this has resulted in a dramatic loss of diversity." said an experienced retired ecologist. The CLC data confirms the above statement because the area of transportation networks increased from 82,6 ha to 390,1 ha between 1990 and 2018.

In 1990, 31,4% of the protected areas of the national park were under agricultural cultivation, which did not change significantly by 2006 either (Table 3). Even though the share of state-owned and KNP managed land areas increased significantly. The habitat protection and reconstruction activities (e.g., arable land conversion to grassland in Nagyrét) strengthened in the second half of the 1990s, which can be seen in the 1,900 ha increase in pastures and natural grasslands. On the other hand, despite the Kolon Lake wetland reconstruction project, the overall area of wetlands decreased with nearly 700 ha, which confirms the difficulties in maintaining these habitats.

Our interviewees summarised the relationship between land use and agricultural subsidies in the following:

> Despite the strong positions of nature protection in this period, the emergence of area-based (a national form of SAPS before the EU accession) and other agricultural subsidies produced balanced power relations with the farmers. The subsidies have improved the income generation of farmers and strengthen the positions of the primary sector. Thus, there was no meaningful opportunity to reduce agricultural land use in the national park (Interview A 7; N 11; L 3).

With the improvement in profitability (of which subsidy is an essential element), the ability of farmers to assert their interests is strengthened, which does not allow them to resolve some problems beyond land use. The most important of these remains the issue of regional water management, in which both crop production and fish farming have interests. The former is due to the rapid drainage of inland waters and the latter due to the exchange of water in the ponds (in Bács-Kiskun County, their area increased with more than 1,000 ha from the 1980s) (Hoyk et al., 2013).

Besides, the national park became the most significant "landowner" at that time, further exacerbating the problems. The park leased most of its land where agricultural production was taking place. In doing so, KNP also made use of agricultural subsidies, including the National Agri-Environmental Scheme (NAKP), and after 2004 its European counterpart.

> It has become common practice that the KNPD took part in the supervision of these payments. Thus, in the 2000s, the national park found itself in a complex and difficult-to-manage role, performing conflicting activities, mainly due to the failure of policy, which was incapable of developing an appropriate regulatory and operational framework for the national parks. Later, the government measures

Table 2
Long time series indicators on the intensification of agricultural production and changes in livestock. Data source: Statistical Yearbooks of Bács Kiskun County, Agricultural Yearbooks of Hungary, Hungarian Central Statistical Office, and Eurostat Agri-environmental Indicators.

Indicators on the intensification of agricultural production*						
	1986–1990	*1991–1995*	*1996–2000*	*2001–2005*	*2006–2010*	*2011–2015*
Average yield of wheat (kg/hectare)	4833	4130	3790	3960	4230	4470
Average yield of corn (kg/hectare)	4928	4190	5640	5820	5710	5570
Average yield of grassland farming (kg/hectare)	1004	620	1025	1080	1450	1840
Area of grassland farming (hectare)	142584	142577	137245	83051	92422	88503

Agri-environmental indicators**					
	2000	*2005*	*2010*	*2015*	*2018*
Nitrogen fertilizer consumption (1000 tonnes)	257,7	260,4	281,4	338,8	348,4
Phosphorus fertiliser *consumption (1000 tonnes)*	19,6	26,5	19,9	35,1	46,7
Total sales of pesticides (1000 tonnes)	5,4	9,6	20,5	27,5	–

Changes in livestock*						
	1980	*1990*	*2000*	*2003*	*2010*	*2015*
Cattle (1000 heads)	140,6	79,4	58	56	56	70
Horse (1000 heads)	4	1,4	1	1	7	7
Sheep (1000 heads)	244,6	139,3	200	217	196	223

* Bács-Kiskun County data.
** National data.

Table 3
Land use of the study area, protected sites, and Natura 2000 areas 1990-2018. Data source: Corine Land Cover, Copernicus Land Monitoring Service, European Environment Agency.

Land use category	Study Area 1990 (Ha)	Study Area 2018 (Ha)	*Change in %*	Protected Area 1990 (Ha)	Protected Area 2006 (Ha)	*Change in %*	Natura 2k Area 2006 (Ha)	Natura 2k Area 2018 (Ha)	*Change in %*
Artificial surfaces	39524	44371	12,3	445	422	*-5,0*	573	638	11,3
Non-irrigated arable land	488302	456234	*-6,6*	20109	19103	*-5,0*	58907	52939	*-10,1*
Vineyards	44929	32070	*-28,6*	431	114	*-73,6*	359	279	*-22,3*
Fruit trees and berry plantations	9377	6976	*-25,6*	9	4	*-49,6*	73	96	32,6
Pastures	100352	106477	*6,1*	3852	4755	23,4	32194	34198	*6,2*
Other agriculture	93878	79908	*-14,9*	1472	1281	*-12,9*	3554	3359	*-5,5*
Forests, transitional woodlands	158307	208309	31,6	15033	15161	*0,8*	27095	28164	*3,9*
Natural grasslands and sparsely vegetated areas	36052	40327	11,9	28589	29574	*3,4*	35623	38587	*8,3*
Wetlands	22934	18320	*-20,1*	7873	7185	*-8,7*	13646	13715	*0,5*
Water	12204	12869	*5,5*	4554	4766	*4,7*	8322	8369	*0,6*
Total area	1005860	1005860		82365	82365		180345	180345	

that caused the weakening of nature conservation could be considered as a solution to this situation (Interviews A 1; N 4).

This situation of the KNP was further aggravated by the fact that they had conflicts with other sectors and found it difficult to cooperate with local actors and entrepreneurs. Their decisions as authority made local development difficult, which fact was acknowledged by our interviewees, who work for KNP. They tried to avoid any development projects which might have unfavorable changes for nature conservation. Thus, many local projects were delayed or canceled.

4.3. From the EU accession to nowadays (2004-)

EU membership has created a new context in the relationship between the two sectors. From this point of view, the Natura 2000 (Government Decree No. 275., 2004) and the Agri-environment Payment Schemes (APS) became the decisive regulators. In essence, APS is a continuation of the former National Programme of Environmental Protection in Agriculture but within the EU framework (Ángyán et al., 2004). It contains several payment titles that had clear positive impacts on nature conservation and the partnership between the two sectors. For example, these measures helped to achieve suitable stocking densities for grasslands, which had previously been a significant problem due to the prolonged crisis in livestock breeding (Table 2). Although there were experts in both sectors, who were critical. "Many farmers did not understand the goals of the Natura 2000 directives. People felt these measures as unnecessary restrictions, which led to a deterioration in the perception of nature conservation and affected their willingness to cooperate. Some of the farmers have even turned to resistance. The concept of the European ecological network seems to have been accepted in principle, but in practice, not only most of the agricultural sector but also many government officials opposed it at the outset. In the end, nature conservation emerged victorious in this debate." said a group of former secretaries of state at a roundtable discussion.

So the introduction of Natura 2000 in landscape management has not been very successful (at least in the beginning), and even its lack of understanding has contributed to a top-down reduction (suppression) policy, which has hit nature conservation (interviews N 11; A 7; L 5).

Many interviewees described this turn as follows:

The state leadership felt that managing and regulating the dual role of the national parks led to autarchy. This has contributed to the

withdrawal of authority form the national park directorates in 2005, which means their exclusion from local affairs and development decisions. Consequently, the strategic importance of nature conservation, its legal representation, and its ability to assert its interests have diminished (interviews N 14; A 12; L 4).

In Bács-Kiskun County, approx. three thousand producers receive APS and approx. 1,200 Natura 2000 payments on average over the last five years (for comparison, 3,700 companies and 55,100 producers are registered, who can apply for subsidies). The connected area in the case of the APS program is about 80,000 ha and 36,000 ha in Natura 2000 (total supported area of the county is 470,000 ha), according to the Rural Development Department of the Bács-Kiskun County Government Office.

Institutional reforms have also played a major role in distorting the position of the two sectors. The dissolution of the Ministry of Environment and Water in 2010, and the reorganization and staff reduction led to operational problems and unclear cooperation framework between the Ministry, the national park directorates and the agricultural sector. Although the number of employees in the KNPD increased between 2005 and 2017 (partly due to public work programs), but with significant labor turnover. According to a KNPD report from 2017, one in five jobs was a personal change during the year. The fluctuation of experienced staff creates difficulties in performing basic conservation management tasks. One of the reasons for the instability is the unpredictable career path and the declining competitiveness of public sector salaries (KNPD, 2018).

The current tensions between the sectors are caused by the structural and functional divisions and the over-bureaucratic functioning of the institutional system (Interviews N 12; A 9; L 3).

The institutional manifestation of subordination to agriculture has been clear for years. Lately, nature conservation belongs to the Ministry of Agriculture's State Secretariat for the Environment. Some have said: "The upper management has become asymmetric, and this is also being felt in the Danube-Tisza Interfluve… Once again, agricultural production interests should be considered more and more in the management decisions of conservation areas. When the conservationist, the farmer, and the local citizens were already able to shake hands, they ruined the relationships." In most of the interviews, there was a recurring thought that agricultural subsidies gave a real boost to agricultural interests. The maximized drawdown of funds and the transfer of areas managed by national parks to the National Land Fund (NLF) have exacerbated the land use conflicts. As a result, those who argued for ecological aspects were less able to assert their ideas, and it became increasingly apparent that the state and local governments did not give sufficient weight to the protection of nature values. Participants in a focus group summed up their impressions of the period as follows:

Nature conservation undoubtedly suffered a severe loss of prestige in the area. In many cases, the KNPD has acted unilaterally and only considered its sectoral interests: imposing unjustified restrictions and prohibitions. As the park's official power weakens, the controversy over protected areas has revived. Once again, forestry and hunting interests, which have always been latent, came to power, and the land property management rights of protected areas under agricultural cultivation were transferred to the NLF. In the NLF's leasing practice, nature conservation rights have been violated, and the results of previously achieved habitat and wildlife conservation programs have been compromised. Also, "there is a lack of professional roundtables that previously balanced different interests. In this way, logging could become robbery management of forests, and hunting a profitable sport. These disturbances are well visible in the landscape; for example, forests have agricultural plantation like appearance, and everything is subordinated to economic profit." said a former senior manager of conservation.

Comparison of Corine Land Cover data from 2006 and 2018 shows the transformation of 6,200 ha agricultural land in these 12 years (Table 3). Five thousand hectares converted from this to pasture and natural grasslands from more intensive cultivation forms such as arable land and vineyards. It is important to note that, on the other side, statistical data shows significant intensification in grassland farming (Table 2), which is related to the increase in livestock (Table 2). Despite all of the changes agricultural land use still dominates in Natura 2000 sites in 2018, its territorial share is above 50 %. The land use of Natura 2000 sites can be considered stable, and a minimal effect of the Natura 2000 subsidies is visible in the direction of land use conversions. So, the Natura objectives of habitat protection have met. However, not in terms of environmental awareness, as shown by some of our results above.

However, the partnership between the two sectors has some common environmental benefits, such as the region's water management, which is of common interest. The farmers questioned acknowledge that "some larger-scale nature conservation tenders will also benefit agriculture." For example, the project VEKOP-4.2.1−15-2016−00007, entitled *Removal of rice field canals, landscape wounds, and abandoned farmsteads in the operational area of the Kiskunság National Park Directorate*. The aim is to improve the water situation of the area by eliminating artificial line facilities that affect water movement. Nowadays, the farmers' viewpoint in water retention and water management get closer to nature conservation, while the water authorities are still calling for drainage. "Without water retention, water supply, nature conservation, and it, farming will be questioned… It is worrying in such an environment, where thousands of illegally drilled wells can maintain the operation of farms. The typical farms of the region may disappear. In addition to the adverse social effects (emigration, unemployment), drying of wetlands is slowly becoming an irreversible problem. There has been sharp, the professional controversy over the water supply issue for decades, and in the absence of a firm government position, the situation is hopeless." problems raised by conservationists and farmers alike.

Several interviewees believe that the complex problems of the region can be reduced by combining water management, nature conservation, and rural development favoring multifunctional agriculture (Interviews A 14; N 12; L 6).

To improve the cooperation between farmers and nature conservation, and to marketing the products produced in protected and Natura 2000 areas, the Ministry of Agriculture introduced the national park product trademark in 2010. The trademark can be obtained through a tender, carried out by the national park directorates every year. Obtaining the trademark proves that the product has been produced in environmentally friendly farming using local raw materials. According to the KNP website, 27 producers are currently participating in the program with approx. Fifty food products (different types of honey, jam, cheese, wine, and meat products) and some handicrafts. Compared to the number of Natura 2000 participants and farmers in the national park area, this is a deficient number, but it is also important to note that the share of the organic farming area is only 3.9 % from the utilized agricultural area in Hungary, while the EU average is 7.5 % based on Eurostat data.

5. Discussion

Over the past half-century, both agriculture and nature conservation has undergone a significant transformation in Hungary. These decades are characterized by distinct phenomena (Fig. 2), which we summarized in two directions. On the one hand, we have taken general and sectoral changes, and on the other hand, we have incorporated our local results about KNP.

The institutes and structure of nature conservation have national characteristics (Hellström, 2001), but KNP faced several problems which were a challenge in the post-socialist countries, in Europe or other

	The 1970s	The 1980s	The 1990s	The 2000s	The 2010s
AGRICULTURE	Industrial agriculture, technology import from western countries, outstanding agricultural export, the sector becomes a key player in „currency production";	The beginning of the agrarian crisis, lack of capital, decline in investment, market anomalies technological backlog, heavy environmental load due to pesticides and wasteful use of energy;	Total change in agricultural ownership, deep crisis of the sector, disintegration of cooperatives, loss of markets, compensation - fragmented land ownership structure, reduction of environmental pressures, emergence of ecological approach;	Preparation for EU accession, introduction of new domestic support schemes, appearance of agri-environmental management, adoption of EU CAP support system after 2004, strong technological development of the sector;	Increasing role of ecological and organic farming (although the size of agri-environmental areas is stagnant), the monoculture is getting stronger, the concentration of land ownership is increasing, sharply polarized agricultural society.
NATURE CONSERVATION	*The "golden age" of nature conservation, the establishment of the first national parks, cooperation and minor conflicts with cooperatives and state farms, biodiversity and landscape status are very good compared to Western-Europe;*	*A partnership between national parks and the cooperative sector based on local agreements, improving relations between the two sectors, intensification of environmental problems;*	*Beneficiary status of nature protection during compensation (Law LIII of 1996), development of strong authority power at national parks, state ownership of protected areas, new park roles for education and social attitudes;*	*Dualistic decade: LIFE Programs, new Green Authorities, NATURA 2000 expansion of parks and educational tourism functions, taking away powers of the National Park Directorates at the same time in 2005;*	*Weakening of the management system for nature and environment protection, leasing and auctioning of protected areas, limited results of NATURA 2000 directives, farmers' environmental awareness is stagnating.*

Fig. 2. A short overview of Hungarian agriculture and nature conservation in recent decades.

national parks of the world, such as governance and management of the environment, or cross-sectoral policy conflicts (Hossu et al., 2017; Le Billon, 2015). Changing views of nature and conservation is problematic worldwide (Mace, 2014), but especially in our case. Because of historical turning points, KNP was even less able to evolve constantly and organically. Although the designation of park areas did not cause striking counter-interests in the beginning, later a series of conflicts have emerged concerning land use, which can be summed up as follows:

- The intensification of agricultural production caused disagreements between agricultural producers and conservationists, similarly to the results of Henle et al. (2008). These debates were typical during the state socialist industrial production era, and after the 2004 EU accession, because of the increasing use of fertilizer, pesticides, and fungicides.
- The change in farm size has been a major challenge for nature conservation. Not only during the expansion of large-scale socialist enterprises but also when they ceased, and many smallholders appeared with their new territorial needs.
- Despite the conflicts between the two sectors, the land use of protected areas has fundamentally stabilized over the past 15 years. This is due to the agri-environmental and Natura 2000 programs.
- The adverse effects of agricultural development were mainly observed in the vicinity and in the buffer zones of the protected areas, which phenomenon has also been described in other regions (Palomo et al., 2013). Unfavorable and fast land use changes were manifested due to the new vineyard and orchard plantations or their revitalization before the EU accession and transport network developments. These interventions have led to habitat fragmentation and ecosystem decay, which present substantial challenges for international nature conservation too (Piekielek and Hansen, 2012).
- Regional water management is a significant and ongoing debate between the two sectors (Lemly et al., 2000; Mioduszewski et al., 2010). Drainage and, therefore, the maintenance of wetlands has been a problem since the establishment of the KNP. Climate change has brought the farmers and conservationists closer together, but the regional water authority is still not forcing the partnership.
- Organic farming activities and the national park owned brand or trademarks have significant potential for cooperation between the two sectors. These types of collaborations are still in their infancy in the case of KNP, but based on foreign examples, they provide an opportunity for the development of sectoral synergies (Grandi and Triantafyllidis, 2010).

In addition to the above direct effects, the economic motivations of agricultural subsidies are very important (Palomo et al., 2013; Ahnström et al., 2009). Subsidies have a strong influence on farmers' decisions, who most often seek to maximize their income. The agri-environmental and habitat support launched in 2002 had positive effects but has not brought a change of producers' attitude. We agree with the proposition that the benefits of eco-friendly programs should be made clear for all farmers and relevant actors to protect the natural values and improve environmental awareness (Ahnström et al., 2009; Schenk et al., 2007). Our overall experience is in line with the opinions that the EU Common Agricultural Policy (CAP) has driven the intensification of agriculture and biodiversity loss (Emmerson et al., 2016). In summary: the CAP caused inadequate land use in some cases, which also affects protected areas, including KNP.

After 1990, the management of KNP was not prepared to operate between the new social and economic environment. Their segregative approach remained, so protected areas could not be integrated into the local resource system, and the territorial ecosystem services remained incomplete. Besides, overusing its official powers, the KNPD was the limiting factor in spatial development in many cases. Thus, a negative opinion was formed among the local actors about the national park. Symptoms of this type are also known from other researches (Bonaiuto et al., 2002). Moreover, several farmers did not understand the real goals of Natura 2000, which reduced the respect of the whole sector of conservation. Since the 2000s, due to the political dominance of agricultural subsidies and the improving markets, the institutional system of Hungarian nature conservation has gradually faded into the background. A similar phenomenon has also manifested in other countries: the autonomous, area-specific decision-making has disappeared with the central administrative control of national parks (Thompson, 2005, 2008).

The current subordination of nature conservation is not favorable for any sector in the long run. Serious malfunctions can occur due to the institutional uncertainties of the parks. This jeopardizes the effectiveness of biodiversity conservation and the expansion of organic agriculture. The latter would mean a partial failure of the second pillar of the CAP as well (ECA, 2017)! That is why it would be important to strengthen the integrative and sophisticated planning approach in both sectors (Scherfose, 2016). The goals of holistic landscape management can be achieved only by the coordination and cooperation of the sectors. Further, there is a strong need to focus on training farmers and locals to understand the natural systems of their region and the necessary methods to protect them. Therefore, nature conservation has a great responsibility in presenting its interests and explaining the problems at the local level, while at the European level, it has to give new inputs and impulses to the ongoing CAP reform to help the formation of integrated policies.

Joining other authors, we support the principle of cross- and multi-sectoral policy coordination, which allows for optimal land use and ecosystem services (Runhaar et al., 2014; Pérez-Soba et al., 2018). As the case of KNP demonstrates, European eco- and agricultural policy need to be more collaborative and flexible to consider regional characteristics. For this, each Member State must pay more attention to adapting community development principles at the national and local levels.

6. Concluding remarks

With our study, we want to emphasize the more prudent governance of protected areas. The Hungarian example demonstrates the conflicting interests of agricultural production and nature conservation, which appear not only in Europe but also around the world. This paper highlights the shortcomings of the current EU's CAP in many areas, such as the lack of cross-sectoral policy coordination as well as the production-intensifying effects of agricultural subsidies. Our results also show that the two sectors' imbalances in the Hungarian public administration further caused adverse effects in both directions over the examined period. We conclude that the coexistence of agricultural production and nature conservation can be improved. However, it will require the equal treatment and independence of sectors, comprehensive policy coordination, complex spatial planning, and paradigmatic change in support to agricultural communities and conservationists. The linkages between the different policy areas will increasingly determine sustainable land use management in the future, thus protecting natural values.

Our research has focused on agriculture relations so far, but other sectors, such as tourism, also have a significant impact on nature conservation. Therefore, we would like to investigate the tourist activities in protected areas in the future, both national parks and private company-organized ones.

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CRediT authorship contribution statement

Jenő Zsolt Farkas: Conceptualization, Methodology, Formal analysis, Investigation, Visualization, Writing - original draft. **András Donát Kovács:** Methodology, Investigation, Writing - review & editing, Supervision.

Declaration of Competing Interest

The authors report no declarations of interest.

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CLC Corine Land Cover by E.E.A. 2018. retrieved from https://www.eea.europa.eu/data-and-maps/dashboards/land-cover-and-change-statistics (checked 2019-09-11).

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