

GAME DAMAGE TENDENCIES BY KAPOSVÁR FORESTRY - FROM 1998 TO 2017

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ABSTRACT

In Hungary, most of the game damage is located in a few counties. 75-80% of the agricultural game damage originates from 5 counties, but those take only 24% of Hungary's area. During the hunting season of 2016-17, the amount of agricultural game damage almost reached 2.6 billion HUF and a quarter of it was paid in Somogy County. SEFAG is the largest game management company in Somogy that manages half of the county's forests. The investigated Kaposvár Forestry is one of the eight forestries of SEFAG and it has 7 600 hectares hunting area. Our research shows that game damage is decreasing and it is centralized around a few settlements in this area. Also, we found a significant change in the structure of crops affected by game damage.

Keywords: Game damage, SEFAG, Kaposvár Forestry, Somogy county, corn, vineyard

INTRODUCTION

There are many noticeable forms of human–wildlife conflicts. One of the greatest problems is the game damage that negatively affects the agricultural management. The amount of it varies in space and time. Not only the species cause the damage differing from continent to continent but the responsible official body, too. In Europe, game damage is mainly caused by wild boar and red deer. In most cases, the bearer of the hunting right has to pay the compensation, but there are countries, where there is no legal regulation for compensating (Bleier, 2014).

The Hungarian Parliament has realized the importance and actuality of this topic and created the Act LV of 1996 on conservation of the game, game management and hunting to ensure the protection of nature and reasonable game management. The law contains the rules of game damage prevention and compensation. Chapter 5 lays down that the owner of the hunting right has to pay compensation to the affected party. It states that 90% of the damage caused in forests and agricultures by wild boar, mouflon, roe deer, fallow deer or red deer and 90% of the damage caused in vineyards, fruit gardens, nurseries, and arable lands by hare, roe deer or pheasant are considered as game damage. The 10% is considered as the farmers' private financial participation.

Since 2015, the game managers have been obligated to set up a game damage fund to cover the compensation for damages in a separate account. For that reason, prevention of game damage is an important task for both farmers and game mana-

gers and there are several different methods available. Farmers can protect their crops in various ways starting from the obvious (fence or guarding) to modern methods (electric fence, ultrasonic alarm or game repellent). Even though these modern methods are expensive, they are effective. *Kovács et al.* (2014) studied the effects of three types of game repellent (namely: Vadóc K, Vadóc V, Forester) in oat culture and found that all three products had sufficient repellent effects. In the area sprayed with Forester, there was no chewing damage and the trampling damage was irrelevant.

Hunters may carry out an alert, can hunt against game damage and can cultivate so-called wildlands for the game to prevent game damage. The prevention of game damage is in the interest and responsibility of both parties, so they often act together to achieve the goal.

Former research showed that the amount of agricultural game damage was very variable within the country. Only a few counties face most of the game damage and in other counties there is almost no game damage. 75-80% of the agricultural game damage originates from 5 counties, but those take only 24% of Hungary's area.

During the hunting season of 2016-17, the largest amount of agricultural game damage was paid in Somogy County, Hungary. It reached 657 028 thousand HUF (*OVA*, 2017). Because of the paid game damage, game management is unprofitable almost every year. SEFAG is the largest game management company in the county. It currently manages half of the forests of Somogy County on nearly 80 000 hectares of forested areas, and in addition more than 6 000 hectares of arable land, lawn and other fields. The green part of *Figure 1* shows the areas managed by SEFAG Zrt.

The forests provide varied habitats for pheasants, hare, wild boar, mouflon, roe deer, fallow deer and the world-famous red deer. The management is carried out by eight forestries: Barcs Forestry, Iharos Forestry, Kaposvár Forestry, Lábod Hunting Forestry, Marcali Forestry, Nagybjom Forestry, Szántód Forestry and Zselic Forestry (*SEFAG*, 2019).

The hunting area of the investigated Kaposvár Forestry is 7.618 hectares. In this region, most of the game damage is caused by red deer and wild boar and corn, wheat, grape and sunflower are mostly affected by it. Arable lands are likely enclaved into the forests. There are no big, continuous fields; and the distances among forests are not greater than one km (*Barna et al.*, 2007).

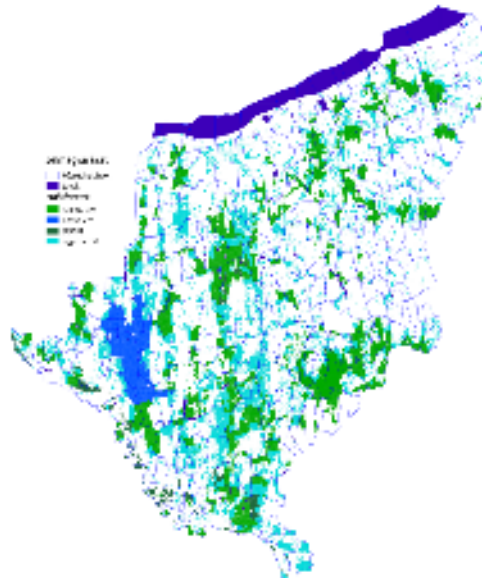
Drăgan and Cocean (2017) suggest organic production and traditional products for highlands with similar characteristics to this area. In our opinion, the agroforestry system could be a good alternative at Kaposvár Forestry. Agroforestry is a land use management system in which trees or shrubs are mixed with crops or with livestock farming (*Vityi et al.*, 2018). Agroforestry systems can be economically, socially, and ecologically advantageous over conventional agricultural and forest production methods. In 1 hectare agroforestry system, we can reach the same yield as in 0.8 hectare arable land and 0.6 hectare forest altogether in conventional production (*Honfy et al.*, 2016).

In their research, *Elblinger et al.* (2006) and *Barna* (2005) highlighted the connection of the local damaging with numerous characteristics of the land. *Barna* (2005) in

his dissertation found a significant connection between the size of the forests and the game damage in Southern Transdanubia region. Also, he found that red deer caused more damage than wild boar. Former research showed that not only the forest, but the settlements also had a border effect in the area of Kaposvár Forestry (*Barna et al.*, 2007). Games occur more and more times in inner areas and cause damage there.

Figure 1

State-owned areas managed by SEFAG Zrt. and Kaszó Zrt.



Source: SEFAG Zrt.

MATERIAL AND METHODS

The examined data are coming from the records of Kaposvár Forestry, which were originally on paper and we had to digitalize them. It means entirely 1154 records in the period from 1988 to 2017.

Through the data processing, we have recorded the following data:

- date of record,
- date of damage,
- date of report,
- game damage prevention actions.
- damage causing species,
- type of damage,
- place of damage (name of the settlement and lot number.),
- damaged area (ha),
- damaged crop,
- loss of income (HUF),
- costs that are not incurred due to the damage (HUF),
- amount of game damage (HUF),
- amount of farmer's financial participation (HUF),
- deduction due to non-adequate preventing (HUF),
- amount of paid game damage/ game damage compensation (HUF).

In the course of data processing, we faced several problems and we had to find solutions for them. Records have different form and content, depending on the recorder of it and the recording date. Some data (such as type of damage or deduction due to non-adequate preventing) have only been available on a certain type of record since 2011. In some cases, the amount of paid game damage is not equal to the amount of the real damage because of an agreement between the farmer and the game manager. For example, the game manager builds an electric fence around the arable land and the farmer relinquishes the half of the game damage compensations for the next 10 years. There was a case where a farmer had game damage on arable lands located in different settlements and the compensation was documented on one record in total. The calculation was not available for us, so we divided the amount of paid game damage between the settlements proportionally.

We made the above mentioned corrections on the data and then transformed them from current value to real value to eliminate the inflation's effect on it.

In our study, we characterized the time series of game damage with a trend (deterministic time series analysis), where we examined the extent of game damage paid in relation to the period of occurrence of the game damage (1 and 2).

$$y_i = a + b * t_i + \varepsilon, \quad (1)$$

$$y_i = b_0 + b_1 * t_i + b_2 * t_i^2 + \varepsilon \quad (2)$$

where:

y_i : expected degree of game damage in i th period

b 's: linear coefficients of the OLS model

t_i : i -th period of time

ε : error

Former investigations have shown that the amount of game damage varies depending on several factors (such as the number and the composition of the species, the size of the continuous living space, the amount of the available feed, etc.). Data was limited for us to investigate this in detail (what and how has an impact on the amount of the game damage), but we could prove the statement in general. The regression was proved to be not significant between the frequency of the game damage and the average compensation. We defined Pearson's r and R square (3).

Pearson's r formula:

$$r = \frac{[\text{cov}]_{(x,y)}}{\sqrt{([\text{SQ}]_x [\text{SQ}]_y)}} \quad (3)$$

We have shown the distribution of the settlement by descriptive statistics (ratio) and we illustrated the time series of the composition of the agricultural crops by a cumulative bar chart.

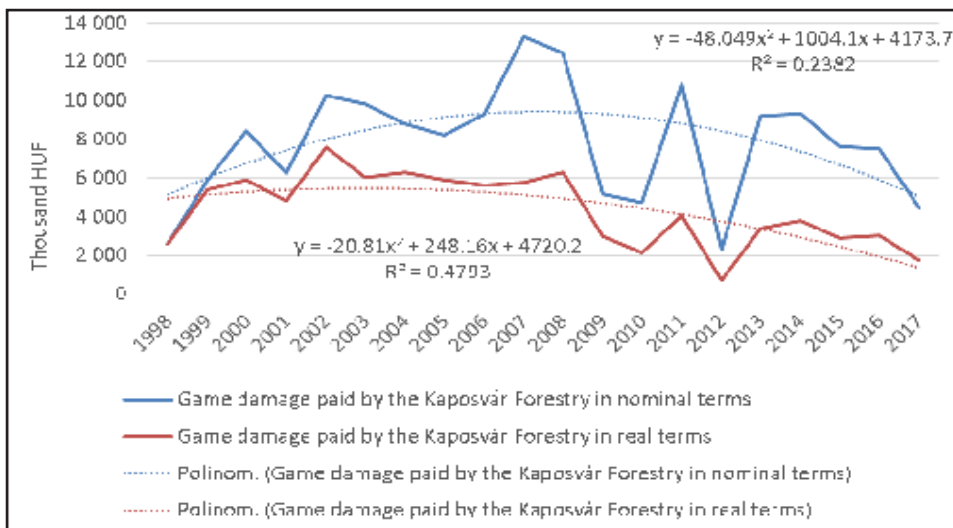
The statistical analysis was made in MS Office Excel.

RESULTS

Firstly we compared the development of the agricultural game damage paid by Kaposvár Forestry both in nominal and real terms (*Figure 2*).

Figure 2

The development of nominal and real agricultural game damage paid by Kaposvár Forestry between 1998 and 2007



The chart clearly shows that inflation greatly affects the value of game damage paid. Fitting a trendline to the data, it can be observed that at nominal value the game damage shows an increasing trend until 2007, and then it decreased. Examining the data in real terms, the upward trend can be observed until 2003.

In nominal terms, the progress of the years determines the trend by 23% while in real terms by 48% but but for both data sets, the heclicity of the data degraded the accuracy of the fit. Comparing the two data sets, it can be seen that that data at face value is characterized by stronger volatility.

Next, we examined the development of the paid agricultural game damage in real terms at Kaposvár Forestry, in Somogy County and country level (*Figure 3*).

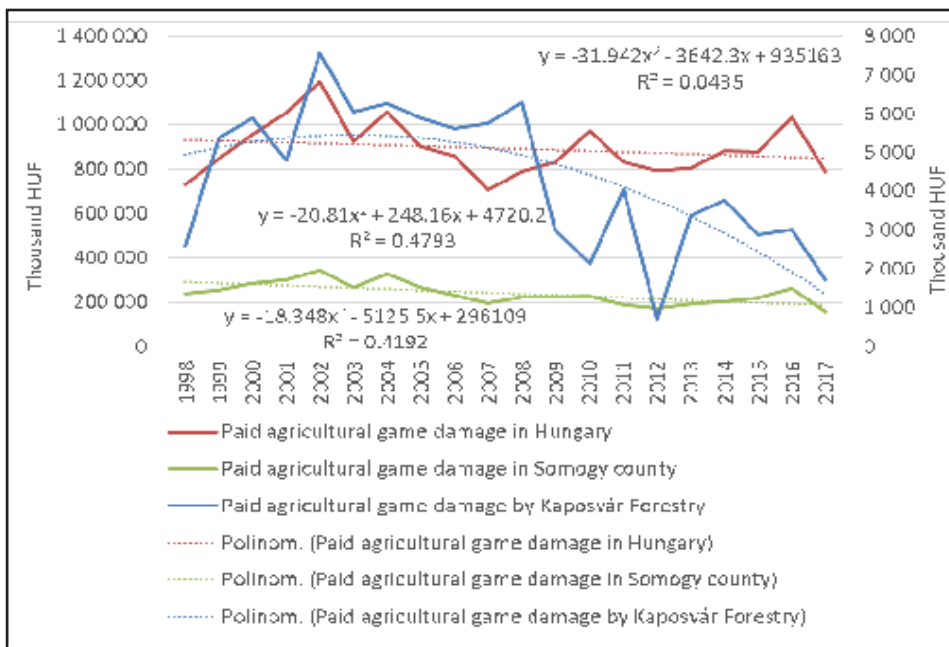
The value of game damage paid at Kaposvár Forestry (blue solid line) is insignificant compared to Somogy county and to the national values, so it was plotted on the secondary axis to ensure the comparability of trends. Plotting the data on the primary axis would result in a constant straight line image.

The value of agricultural game damage paid at Kaposvár Forestry showed a hectic but definite increase until 2003. It showed a decreasing amount afterwards. The progress of the years has determined this trend by 48% however, the goodness of fit was low. The periods 2000-2003 and 2008-2013 were characterized by strong volatility.

The data for 2009-2010 and 2012 deviated significantly from the expected value in a negative direction. However, the discrepancy does not necessarily indicate a drastic reduction in game damage. During these years, SEFAG Zrt. lost its hunting rights in certain areas, therefore according to the law, it was not liable for the compensation of game damage.

Figure 3

Paid agricultural game damage in real terms at Kaposvár Forestry, Somogy county and Hungary



The value of agricultural game damage paid nationally and in Somogy county is also hectic and shows a decreasing trend in real terms in the period under review. The agricultural game damage paid in Somogy county follows the nationally paid agricultural game damage but national values are characterized by stronger volatility. In the case of national data, the progress of the years determined the trend in 4% and in the case of Somogy county in 42%.

Figure 2 indicates that the paid agricultural game damage in real terms shows a negative trend at Kaposvár Forestry, Somogy County and nationally, but in the case of Kaposvár Forestry this decline is faster than in Somogy county or nationwide.

As the next step of our study, we looked for correlations between the average paid game damage compensation in real terms and the number of game damage events. They were first plotted as a line diagram illustrated in Figure 4.

Both data sets are hectic, and inverse proportionality can be assumed between them based on the figure. In the years when the number of game damage events deviates positively from the trend line, the average game damage compensation paid in real terms is below the trend line.

Subsequently, the average paid game damage compensation in real terms and the number of game damage events were illustrated (Figure 5).

Figure 4

Average real game damage paid in real terms and the number of game damage events between 1998 and 2017

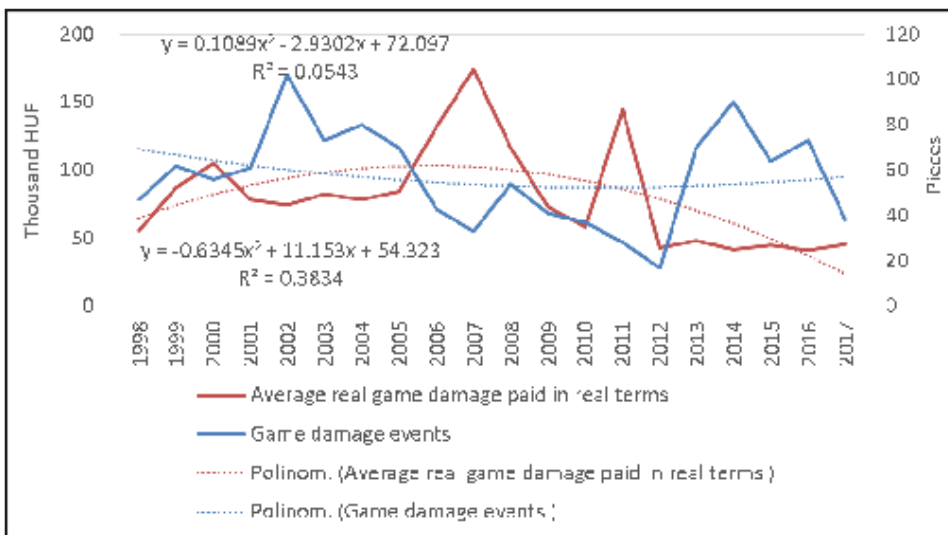


Figure 5

Scatterplot of average paid game damage compensation in real terms and the number of game damage events

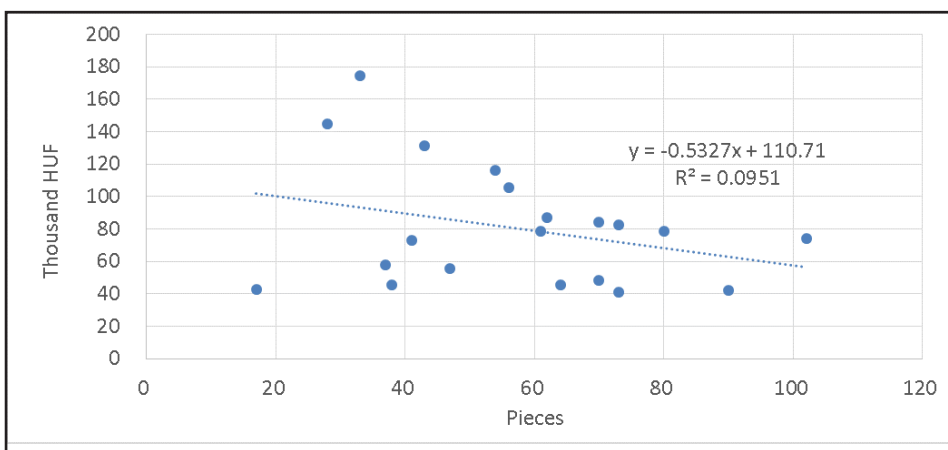


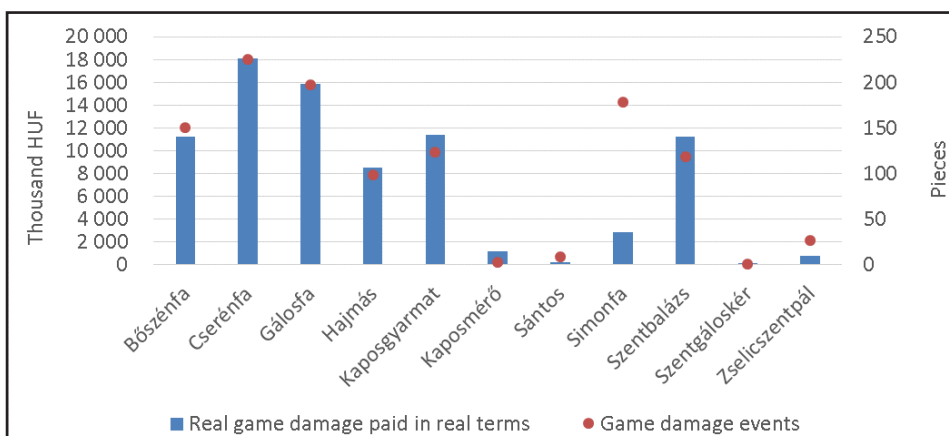
Figure 5 shows that the regression line has a negative slope, which confirms the previously assumed inverse proportionality. The points are scattered, away from the line, indicating a weak correlation between the variables. The value of the coefficient of determination can be read from the figure ($r^2=0.0951$), according to which 10%

of variation of average game compensation paid in real terms can be explained by the number of game events.

In the following, it was examined how the game damage was distributed among the settlements of Kaposvár Forestry, and whether any centralization could be observed. *Figure 6* shows the distribution of the game damage paid in real terms and the number of game events by settlement.

Figure 6

Compensation for game damage paid in real terms and the distribution of the number of game events by settlement between 1998 and 2017



In the examined period, most of the game damage occurred in Cserénfa according to both the number of events and the amount paid, followed by Gálosfa in the second place. Regarding the paid game compensation, Kaposgyarmat is the third in line, while in terms of the number of game damage events, Simonfa is the third one.

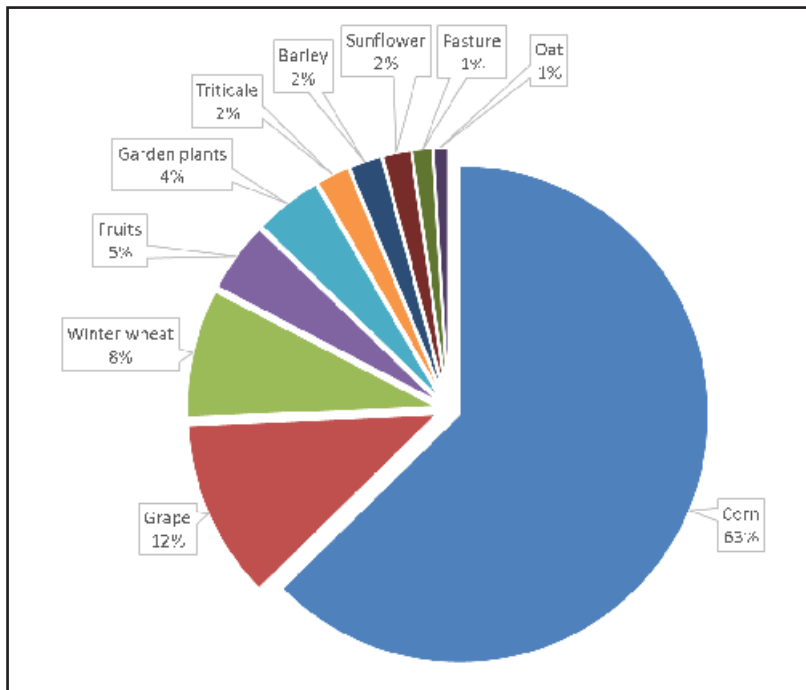
In most settlements, the amount of game damage paid and the number of game events move together, but in the case of Kaposgyarmat, Kaposmérő and Szentbalázs, it can be observed that relatively fewer claims receive more compensation. In the case of Simonfa and Zselicszentpál there is an extreme difference between the number of game damage events and the game compensation paid, while for Simonfa 178 compensations totalling HUF 2.8 million were paid in real terms, in the latter case a total of slightly more than HUF 750,000 was paid in 27 cases.

Examining the game damages paid in real terms, it can be observed that 93% of the payments were made in the territory of six settlements (Cserénfa, Gálosfa, Kaposgyarmat, Bőszénfa, Szentbalázs, Hajmás). Examining the number of game damage events, the five most game-damaged settlements (Cserénfa, Gálosfa, Simonfa, Bőszénfa, Kaposgyarmat) had more than two third of all cases (77%). Kaposmérő, Sántos, Szentgáloskér and Zselicszentpál are the municipalities least affected by game damages, both in terms of the compensation paid for game damage in real terms and in terms of the number of game damage events.

As a final step of our study, game damage was examined regarding the damaged crops. *Figure 7* shows the distribution of the number of damage events per crop.

Figure 7

Distribution of the number of damage events by crop between 1998 and 2017



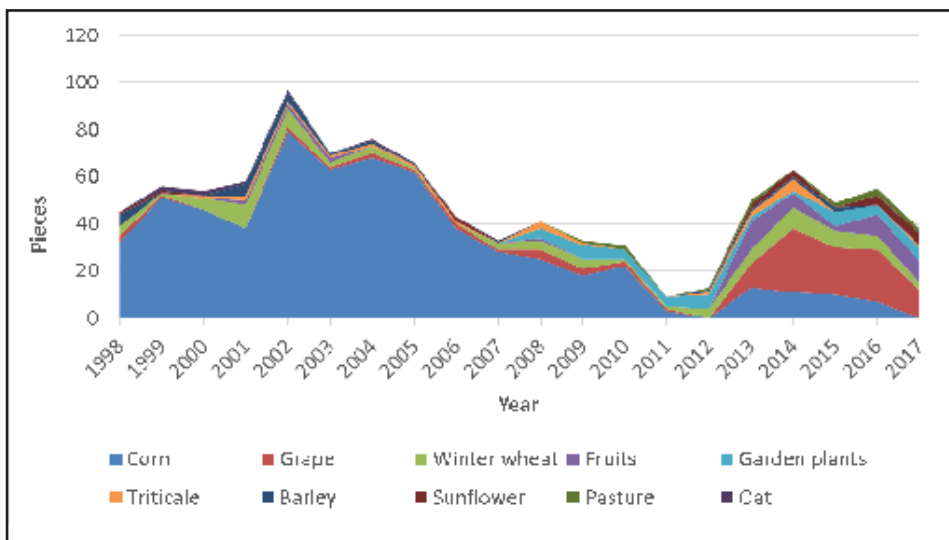
The pie chart shows that corn was the crop with the highest number of game damage during the study period, with more than 62% of all cases. In terms of game damage, grapes are in the second place with more than 11% thus, the two cultures together account for almost three-quarter of game damage incidents. Garden plants and fruit (excluding grapes) are affected by almost the same number of game damage and together account for 9% of game damage events. Together, the five most damaged crops cover 92% of the damage events.

The large number of game damage in vineyards and orchards, as well as in garden plants, confirms the impact of urbanization. The natural habitat of wild animals is constantly declining due to various habitat-narrowing effects (agricultural area payments, fencing of agricultural land, etc.), so that they make their way to the interior parts in the hope of easier forage access. The unfenced vineyards and small gardens serve as a perfect source of fodder.

To investigate further trends observed regarding agricultural crops, they were shown on a cumulative area diagram (*Figure 8*).

Figure 8

The number of damage events to the affected crops by crop and year between 1998 and 2017



The diagram shows that in the period between 1998 and 2012, corn was the most affected crop by game damage, however, from 2014, grapes became the most damaged crop. There are several possible reasons for the change in the damage structure. In addition to the previously mentioned urbanization effect and the increasing degree of protection, it may also have been affected by the declining economic situation. Farmers have become more sensitive to game damage and, even after minor game damage, report their claim to the game farmer, which they have not done before.

CONCLUSIONS

Even though the fact that similar trends (just like the border effect of the forest and settlement because of the globalization) are noticeable by Kaposvár Forestry and in Hungary, we can state that the amount of the paid game damage by Kaposvár Forestry shows bigger decrease than in Somogy or in Hungary. We suggest repeating the research in other forestries and to make the comparison of the forestries of SEFAG Zrt.

Our research has found that there is no statistical connection between the amount of paid game damage and the number of game damage at the area of Kaposvár Forestry. Former investigations have shown that the amount of game damage varies depending on several factors (such as the number and the composition of the species, the size of the continuous living space, the amount of the available feed, etc...). Unfortunately, data was limited for us to investigate this in detail, but we suggest a general OLS model on numerical and nominal factors.

We have found that game damage is restricted to a few settlements in the area of Kaposvár Forestry. We suggest investigating this with the usage of geoinformatics.

Our research showed that from among the crops, corn was the most affected by game damage during the period from 1998 to 2013, but from 2014, the most damage happened to the grapes. We suggest investigating the factors that can affect this.

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