https://doi.org/10.17221/377/2020-AGRICECON

Controversial approach to wolf management in the Czech Republic

Jana Lososová[1], Jindřiška Kouřilová[1], Nikola Soukupová[2]*

[1]Department of Accounting and Finances, Faculty of Economics, University of South Bohemia, České Budějovice, Czech Republic
[2]Department of Management, Faculty of Economics, University of South Bohemia, České Budějovice, Czech Republic

**Corresponding author: lososova@ef.jcu.cz*

Citation: Lososová J., Kouřilová J., Soukupová N. (2021): Controversial approach to wolf management in the Czech Republic. Agric. Econ. – Czech, 67: 1–10.

Abstract: Expansion of the wolf in the Czech Republic results in an increasing conflict between nature conservationists and other landscape users. In March 2020, the Ministry of the Environment of the Czech Republic issued the "Wolf Management Programme". The document provoked negative reactions from organisations of farmers, breeders, and hunters. The article deals with the key issues triggered by the conflict and the attitudes of actors involved. We want to clarify to what extent the solutions designed by individual parties help to mitigate the conflict and how the financial demands related to this issue have been evolving. The problem may seem marginal in the Czech Republic, but the wolf population density in some regions may already be close to its bearable maximum. Key problems are the identification of specific target numbers of wolves, the absence of zoning as a future option, and clear rules for dealing with direct encounters of wolves with humans. The benefit of wolf management is primarily the sum of preventive measures it aims to address, but the relationship with other main actors and the area of education and promotion is debatable as it represents a further increase in the absorption of public funds without guarantees of effectiveness.

Keywords: compensations of damage; conflict; conservation; Wolf Management Programme

From about 2014, the Czech Republic has shown a rapid expansion of wolf (*Canis lupus*), resulting in, among others, a significant increase in the amount of damage to livestock. The Ministry of the Environment (ME) tried to mitigate this growing conflict between the nature conservationists and other landscape users by issuing the "Wolf Management Programme" (Program péče o vlka obecného) through the Nature Conservation Agency of the Czech Republic (AOPK) in March 2020 (hereinafter referred to as "Programme"). It is a management plan primarily aimed at minimizing the emerging conflicts related to the damage to farm animals. It is primarily focused on implementing the well-functioning system to finance preventative measures for protecting herds, implementing the fully operational system of damage investigation

Supported by the Grant Agency of the University of South Bohemia in České Budějovice (Project No. GAJU 121/2020/S).

https://doi.org/10.17221/377/2020-AGRICECON

and compensations, a uniform wolf monitoring system as well as determining the clear steps to take when problematic individuals appear (ME 2020). Some agricultural, breeding, and hunting organisations have serious reservations about the proposed Programme. In their opinion, none of the critical comments have been reflected in the document.

The aim of this article is to identify key issues brought about by the conflict and to compare the attitudes of actors in conflict. We want to clarify to what extent the solutions proposed by individual parties help to mitigate the conflict and how the financial demands related to this issue have been evolving. The paper is arranged as follows. The following chapter lists the relevant literature about the topic in question. The reference documents and methods used are described in the third part. The fourth part presents and discusses the results (Programme objectives and key observations of opponents). The conclusion chapter summarizes the main benefits and drawbacks of the Programme.

THEORETICAL BACKGROUND

Land abandonment and village population decline in Europe led to the forest stand and scrubland spreading (Pereira and Navarro 2015), while the increasing abundance of wildlife promoted the expansion of large carnivores across the abandoned areas (Boitani and Linnell 2015), e.g. in Poland and Germany (Nowak et al. 2011; Wagner et al. 2012). If large carnivores recolonize the areas where they have not occurred for centuries and where the local inhabitants abandoned their protective methods of breeding, a very sensitive problem occurs (Linnell 2013). Such situations may result in major economic losses as well as intensive social conflicts between conservationists and farmers who feel endangered by the presence of large carnivores (Redpath et al. 2013).

Wolves generate more negative attitudes than other predators (Dressel et al. 2015), even though they are not directly related to the material damage. Attitudes are usually more strongly associated with intangible costs (Kansky and Knight 2014). Negative perceptions are stronger in the recolonized areas, whilst uninterrupted coexistence of a human being and carnivores produces higher degrees of tolerance (Kaczensky et al. 2004; Majić and Bath 2010; Lososová et al. 2019). Apart from the predation on livestock (Milner et al. 2005; Nilsen et al. 2005), the rapid wolf expansion is often considered by local inhabitants as a reduction in the quality of their lives. Protection of wolves and other carnivores is also referred to as a conflict between urban and rural communities (Skogen et al. 2013).

The term "human-wildlife conflict" (HWC) is understood as a direct fight between people and wild animals, but it is mostly a conflict between the advocates of different human activities or groups of interest (Margulies and Karanth 2018). Technical solutions may reduce impacts of the clash between people and wild animals, but they fail to tackle the conflicts between the conservation objectives and other human interests. In such a case it is difficult to find an independent arbitrator and the goals we want to accomplish need to be focused on (Redpath et al. 2015). The nature conservation manifests itself as a new party accumulating speculative capital (Büscher and Fletcher 2015) and, as such, it may have an adverse influence on not only the economic activity of people but also the protected species (Margulies and Karanth 2018).

Reduction or elimination of sheep grazing in the Czech Republic would result in further deterioration of valuable grassland and disappearance of a wide range of biotopes of rare plant and animal species of a European importance (Krahulec et al. 2001). Restoring the aesthetic landscape must be based on a more rational balance of all factors affecting its character. The sustainable harmonious landscape of value can be restored only by ensuring that the land owners permanently benefit from their soil. Reckless promotion of one factor at the expense of the others may result in totally unforeseeable impacts.

The annual compensation for large carnivore damage in Europe comprises approximately EUR 28.5 million. Between 2005 and 2012, average costs per wolf amounted to EUR 2 400 a year. To ensure mitigation of conflicts, it is necessary to evaluate efficiency of the prevention and compensation programmes on a regular basis and to adjust them upon the scores of such evaluations (Bautista et al. 2019). Especially in the context of enormous pressures on public financial resources in the current crisis period caused by the coronavirus pandemic, it is necessary to give a reasonable assessment in terms of efficiency of inputs to individual activities and to evaluate the necessity of other types of aids.

DATA AND METHODS

The paper is based especially on the initiative and needs of agricultural and regional practice. Methodically, it is comparison of clashing opinions of various groups of interest, discussions towards tackling

https://doi.org/10.17221/377/2020-AGRICECON

the problem, and effective use of public resources in the context of subsidies granted for the purposes of implementing conflicting measures. The opinions of the conservation institutions are opposed to those of breeders farming in predominantly ecologically valuable areas. Conflict management requires parties to recognize problems as shared ones, and engage with clear goals, transparent evidence base, and awareness of a compromise. Whereas the subsidies, as a rule, come from the public finances and the losses, or more exactly, their compensations, are and will be increasing, the issue will become more topical in the future. It is not only a question of financial aspects but also of certain risks stemming from changing the landscape, its value for tourism, and the impact of behaviour of entities involved in the process of promoting the spread of predators in the landscape, in particular, the direct and indirect induced costs of farms and the effects of proposed measures.

The basic document is the Wolf Management Programme (ME 2020), which is being confronted with opinions of its critics. The article is based on the data of the Czech Statistical Office (CZSO), Ministry of the Environment, Ministry of Agriculture, Ministry of Finance, The Czech and Moravian Hunting Union (CMMJ), agricultural associations, and other institutions. The study area is Broumovsko, where the representatives of breeders and municipalities have first come together and started to solve the problem at an institutional level. It compares the scientific knowledge, data available in the relevant sectors, materials and knowledge of breeders, hunters, agricultural associations and conservationists, which were obtained from printed and digital documents and statements in media or by means of free interviews conducted in person, by telephone, or electronically. We analysed the impacts of this problem on financial and non-financial indicators.

To quantify the relationship between damage caused by wolves and the number of wolves in the Czech Republic territory, a simple linear regression based on annual time series was used, in the form of:

$$y = \beta_0 + \beta_1 \times x + \varepsilon \quad (1)$$

where: y – dependent variable; β_0, β_1 – parameters of the regression equation; x – independent variable; ε – residual.

The issue applies to a number of countries which differ in their area, population, landscape type, the extent and history of wolf colonization, traditions in pastoralism, and approach to solving the conflict in question.

RESULTS AND DISCUSSION

Based on the AOPK (2020), there are about 13 wolf packs and three couples without the young, which accounts for about 70 to 80 individuals moving around the Czech Republic territory. In the same period, the results of the CZSO survey showed 334 monitored wolves [CZSO (2020); Figure 1]. One can expect that the statistical data on the number of wolves reported by hunters will be higher (due to repeated observations), but such a major difference is striking. The occurrence of approximately 10 animals had been relatively stable up to 2014. There has been a sharp increase since 2014 and this trend corresponds to the growing damage and wolf population expansion in neighbouring countries (Lososová et al. 2019).

It is a regional problem and the number of individuals makes us tempt to downplay this conflict despite the fact that the density of wolf population in some regions may already approach the maximum now. It is of utmost importance to take account of the landscape character, afforestation, amount of the wild prey, methods of agricultural land cultivation, historical experience of inhabitants, population density, and attractiveness of the region for tourism.

The Wolf Management Programme presents the wolf as a prominent species of forest ecosystems which helps to regulate the numbers of wild ungulates. According to the official policies and conservationist organisations, the role of the wolf in the landscape is indisputable and utterly positive. Wolves play an important disease control role in the ecosystem, and in the areas where they are missing, ungulates may become significantly overpopulated and, as a result, the damage to forest stands and the populations of smaller predators may increase significantly (ME 2020).

These statements are supported by many scientific studies which are, however, frequently carried out at sites little affected by human beings (Hayward and Somers 2009; Eisenberg 2013; Kuijper et al. 2016). Recolonizing the areas substantially transformed by human activities by large carnivores does not have to represent only positive impacts on the ecosystem function (Fleming et al. 2012; Flagel et al. 2017). AOPK stems from the trophic cascade hypotheses, which are often recognized as the environmental laws without convincing evidence (Allen et al. 2017). Also in the Programme, this Agency often uses the frequently referred study which was conducted in the Greater Yellowstone Ecosystem, USA, and which is an example of ignoring the details not confirming the effects of trophic

https://doi.org/10.17221/377/2020-AGRICECON

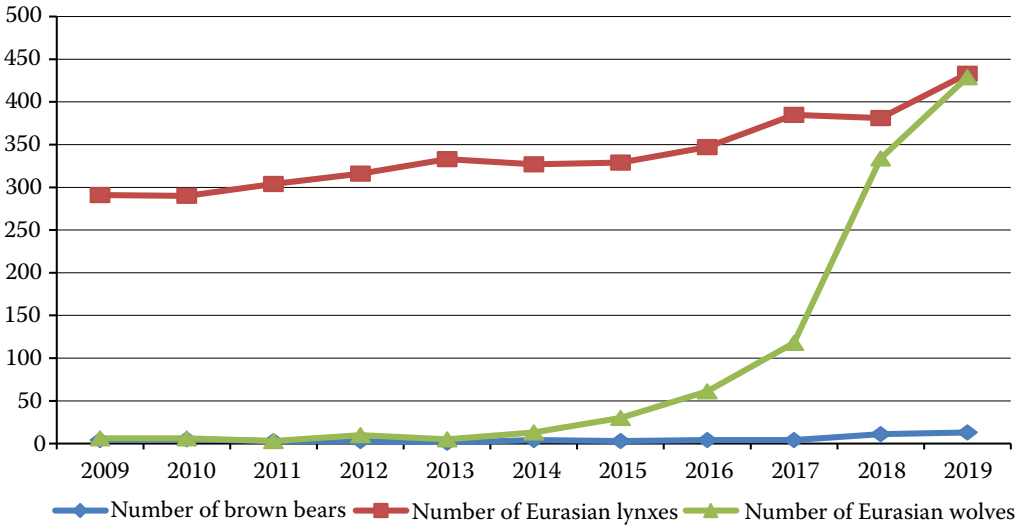

Figure 1. Trend of the incidence of large carnivores on the hunting grounds

Incidence between April 1 and March 31 in the following year
Source: CZSO (2020)

cascades (Winnie 2014). There is strong evidence that wolves themselves are not responsible for all changes attributed to them (Fortin et al. 2005; Mech 2012; Winnie and Creel 2017). Many questions regarding the impacts of large carnivores on biological diversity are yet to be answered and the positive effects within ecosystems are not universal (Allen et al. 2017). The mere return of large carnivores may be of no avail in solving many environmental problems caused as a result of their extermination (Marshall et al. 2014; Wikenros et al. 2015). The aesthetic and cultural values of wolfs are substantial. If, however, a positive role of the wolf is accepted as dogma which fails to take into consideration possible adverse impacts on other species, biodiversity and sustainability, the controversy about wolves will surely continue to swirl.

The primary aim of the Wolf Management Programme is to minimize emerging conflicts regarding the damage to livestock. According to AOPK (2020), this damage cannot be avoided in full and most herds are insufficiently protected against attacks by wolves.

Farmers were not prepared for such a rapid expansion of a predator and some of them are still lagging behind. The owners of insufficiently secured herds are, however, not entitled to compensations of the damage caused by wolf attacks. The average growth rate of these compensations between 2015 and 2019 amounts to 172% per year, which is really alarming, and the standard recommended preventative measures do not seem to be sufficient.

The Programme points to the experience gained in a number of areas where the wolf population has already established, the breeders began to employ apt preventative measures and the number of incidents of attacks on livestock has been reduced. Specific areas are not cited in the Programme, but the trends in France and Germany, for instance, do not support this statement (Figures 2–3), even though the strictly watched controlled culling has been allowed in France for a few years. Comparison with other areas may be misleading owing to different conditions, such as a different terrain, traditions, economic conditions, and deep-rooted breeding and protection practices.

The long-term aim of the Programme is to safeguard a favourable conservation status for the species, i.e. to ensure that the population of the species in its natural habitat will be viable for a long time. According to AOPK (2020), the occurrence of the wolf in the Czech Republic territory is now represented by individual population fragments on margins of the area of distribution. These separate fragments do not meet even the minimum viable population parameters. The favourable conservation status is to be declared in 2021. The implementation plan is formed by a table of individual measures along with the timing. The whole document fails to make it clear who is to carry out individual measures, who will be responsible for taking them and how these measures will be financed.

The Programme opponents were invited to comment on the document. It does not, however, mean that the comments made were understood and heard. The Programme was objected by the following:

- Czech and Moravian Hunting Union;
- Hunting Commission of the Agricultural Chamber of the Czech Republic;
- Association of Private Farming in the Czech Republic;
- Agricultural Association of the Czech Republic;
- Association of Sheep and Goat Breeders;
- Czech Beef Breeders Association;

https://doi.org/10.17221/377/2020-AGRICECON

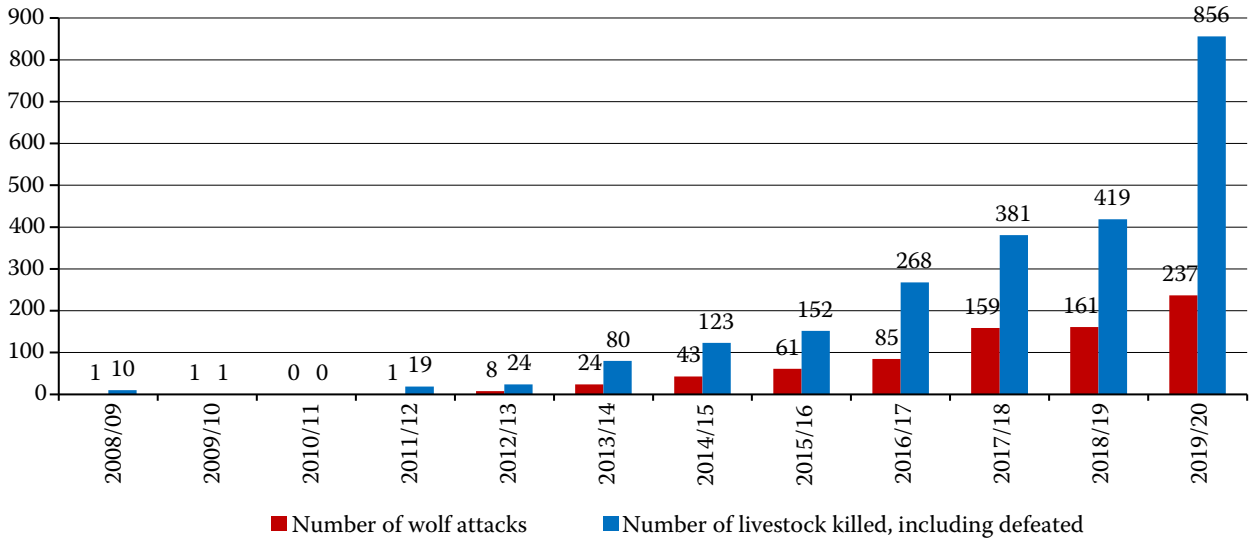

Figure 2. Trend in the number of wolf attacks on livestock in Lower Saxony

Source: NLWKN (2020)

– Czech-Moravian Association of Agricultural Entrepreneurs;
– PRO-BIO – The Association of Organic Farmers;
– Young Agrarians Society of the Czech Republic.

According to the opponents, the main drawback of the document is that the specific target numbers of wolves have not been set yet. These target numbers have not been specified in neighbouring countries, either. Declaring favourable conservation status (planned in 2021) will account for neither limit values nor the definition of outbreak, if any. In general, conservationists consider the wolf outbreak unreal, as they claim that when there is a shortage of food, the wolf restricts its reproduction or migrates to a more suitable territory.

Another key proposal of opponents is zoning or determining the sites where the wolf might live in such a way that would prevent excessive conflicts with the human being and unnecessary economic damage. This proposal is not mentioned in the document even as a future option. Although the Programme contains defining core areas as a priority, these areas will not represent any-restriction in absolute protection and the wolf will continue to be given unrestricted protection throughout the Czech Republic.

The third essential comment was establishing clear rules for addressing direct conflicts between the wolf and the man. In this case, the Programme focuses especially on monitoring the unusual behaviour of individual animals, making records on the wolves bred in captivity, and preventing hybridisation. As part of preventative measures, a network of collaborating experts and workplaces and a network of rescue

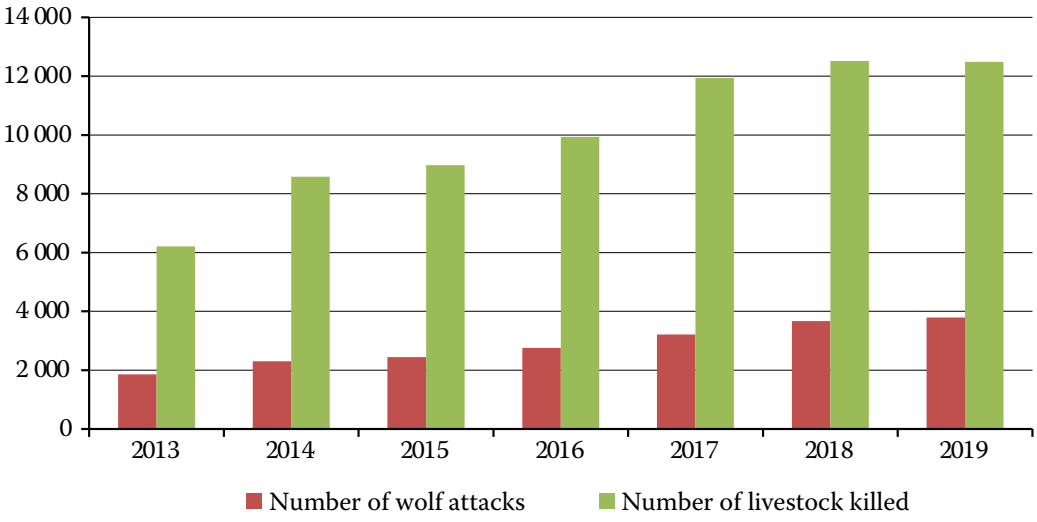

Figure 3. Trend in the number of wolf attacks and farm animals killed by wolves in France

Source: FNO (2020)

https://doi.org/10.17221/377/2020-AGRICECON

shelters where the problematic wolves captured are to be placed should be created. This is an expensive solution which, in fact, means freezing the current situation when the possibility of obtaining exemption to remove problematic animals is merely theoretical. The opponents point to the problematic development of unrestricted protection of other species. The formerly protected beavers cause material economic damage now and the zoning process has been set for them. Protected otters cause such damage that some original aquatic species, such as the grayling (*Thymallus thymallus*) are threatened with extinction. The conservation of cormorants led to such damage to fish populations that the government decided to pay out financial incentives for their culling.

According to the opponents, the Programme is based on ideological grounds: It expresses interests of only one group represented by the Large Carnivore Initiative for Europe (LCIE) and ignores those members of professional circles and the academia who disagree with this approach. The non-profit sector formerly represented by charitable organisations has transformed to a strong player affecting the politicians and having a huge influence on law-making. Every new problem entails an option of drawing money from public budgets and a possible growth of the bureaucratic machine. Using slogans such as payments for environmental services, green economy, ecosystem economy and biological diversity, the public, private, and non-governmental sectors are looking for the ways to transform intangible use of the landscape into capital which may simultaneously "save" the environment and establish long-term methods of capital accumulation (Büscher and Fletcher 2015).

Figure 4 shows the main cost streams and the arising impacts of wolf population spreading in the regions considerably affected by human activities. An unambiguous impact on the pastoral farming is the profit reduction, even in the case of a farm unaffected by a wolf attack. It is the economic situation of the farm that decides on a change or termination of farming activity, regardless of the amount of compensations. Comparison of benefits and impacts of the wolf population expansion make it clear that especially the biodiversity

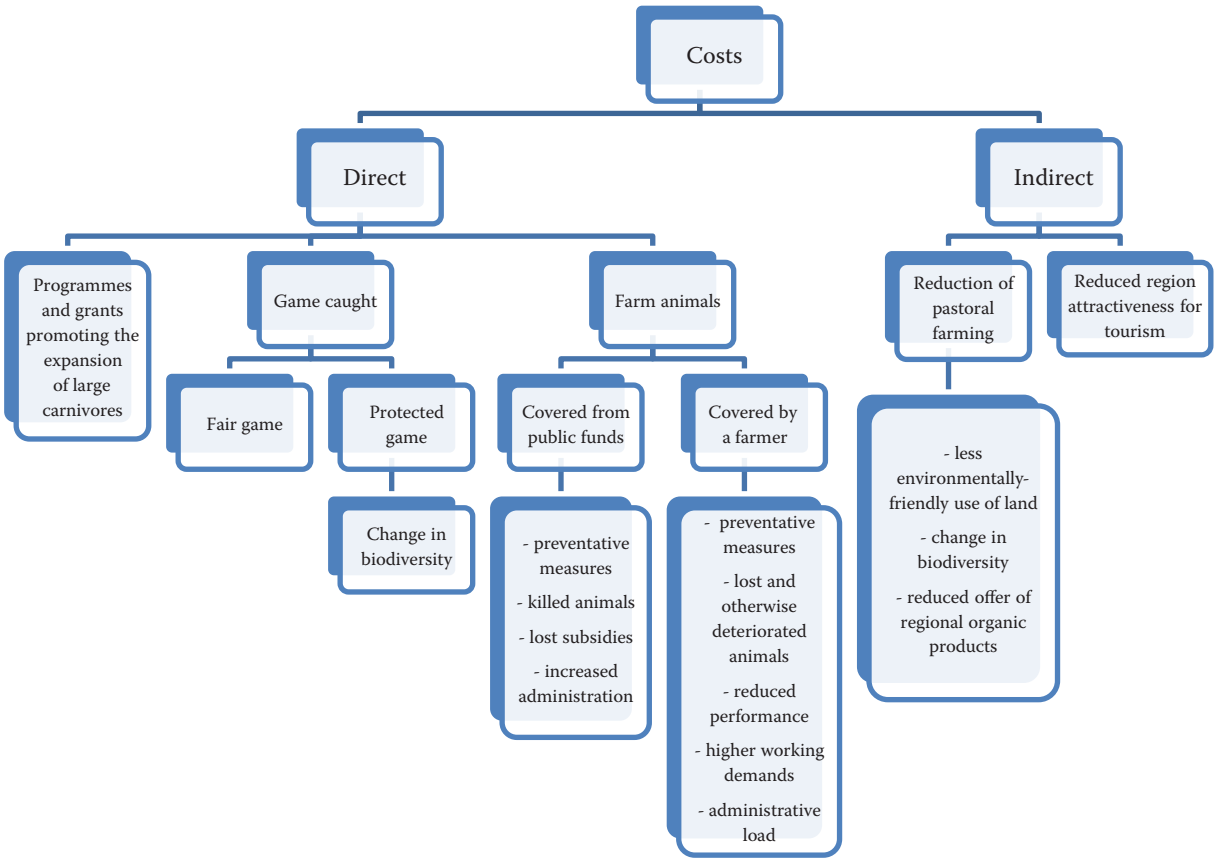

Figure 4. Diagram of wolf care costs

Source: Own processing

https://doi.org/10.17221/377/2020-AGRICECON

impacts will require further scientific studies carried out with respect to the type of landscape and the methods of farming.

AOPK states that the livestock makes up around 1% of the total consumed biomass by wolves. This indication is taken from the studies dealing with the wolf dietary composition, usually the faeces composition (Nowak et al. 2011; Wagner et al. 2012; Figueiredo et al. 2020). Hunting in the wild is a very energy intensive hunting method and wolves therefore usually do not hunt more game than they eat. In case of attacks on pastures, on the other hand, a wolf kills, injures or otherwise deteriorates much more animals than it can eat.

Normally, farm animals are not a part of the diets of wild predators; it is the behaviour the predators have learned (Much et al. 2018). The study carried out in Poland showed that dietary habits of wolf packs living in similar conditions were very different. While some wolf packs do not approach pastures at all, others are not afraid to visit human dwellings or pull a horse or calf down right in a village (Eggermann et al. 2009). A successful attack on livestock represents an increased risk of predation in the next period, i.e. up to 55 attacks in the next 12 months (Karlsson and Johansson 2010).

The regression analysis based on available data of the trend in the wolf population and the trend in the compensations of damage caused by wolves proves a high statistical dependence (r^2 = 0.993 2). An increase in the wolf population by 1 will result in the growth of compensations of damage by EUR 654 a year (Figure 5), and the predicted compensations for 2020 amount to EUR 275 442. Whereas the compensations increased in 2019, the amount of damage is likely to grow faster.

No preventative measure is 100% efficient. A combination of a number of measures taken at the same time appears to be the most efficient. All protective measures are not suitable for every breeder. They depend on the terrain type, size of grasslands, extent and structure of breeding, and other restrictions. A wolf may overcome the structures used to prevent predators from hunting. A shepherd dog is not apt for every farmer as it is expensive, and despite its demanding training it does not have to render a sufficient protection (Lososová et al. 2019). Permanent presence of a human is very efficient, but unreal for the economy of breeding in local conditions.

All of the measures employed have adverse effects on the breeding economy, change in the breeder's system and breeding practices (reduction of the animal performance, higher stress of farm animals, abortion of ewes, reduced milk yield). Protective measures also have an effect on the landscape continuity for other animal species as well as an aesthetic value of the landscape and its attractiveness for tourism. Despite these drawbacks, a majority of breeders adapt their way of farming to new conditions. It is not just about economic reasons, but also about an enormous psychological stress that the wolf presence entails. The breeders who have experienced a wolf attacking their farm describe it as the worst experience they have encountered in their practice.

The Programme reads that the foreign experience points to a possible co-existence with large carnivores. Breeder representatives, however, claim that pastoral farming and an absolute protection of wolves have not worked together anywhere and any efforts to reduce damage to livestock and decrease the conflicts between the wolf and the man just copy the practices which failed elsewhere. They think that most countries where the wolves expanded adopted regulatory measures. The authorities in the Czech Republic claim that the wolf management by means of hunting would contradict the European law. The opponents point to the recent decision of the Court of Justice of the European Union, which in response to the so-called preliminary ruling of the Finnish Supreme Administrative Court decided that the authorities in the member states may, under strictly defined conditions, authorize hunting of species protected under the Habitats Directive (No. C-674/17).

The agricultural sector as such represents an area of a considerable economic, environmental and social value. The estimates of a global carrying amount of ecosystem services expressed in monetary units are useful especially to raise awareness in regard of the size of these services as opposed to other services provided by human capital. Costanza et al. (2014) estimate that global land use changes between 1997 and 2011 led to the loss of ecosystem services in the amount of USD 4.3 trillion to USD 20.2 trillion per year. Frélichová et al. (2014) quantify the value of ecosystems in the Czech Republic in their study. For instance, pastures, natural grasslands, and wetlands are valued by them at EUR 452/ha, EUR 519/ha and EUR 13 917/ha, respectively. Pastoral farming is the most environment-friendly method of agriculture. The end of farming activity results in other additional costs and any subsequent option of pasture use is either economically or ecologically disadvantageous.

https://doi.org/10.17221/377/2020-AGRICECON

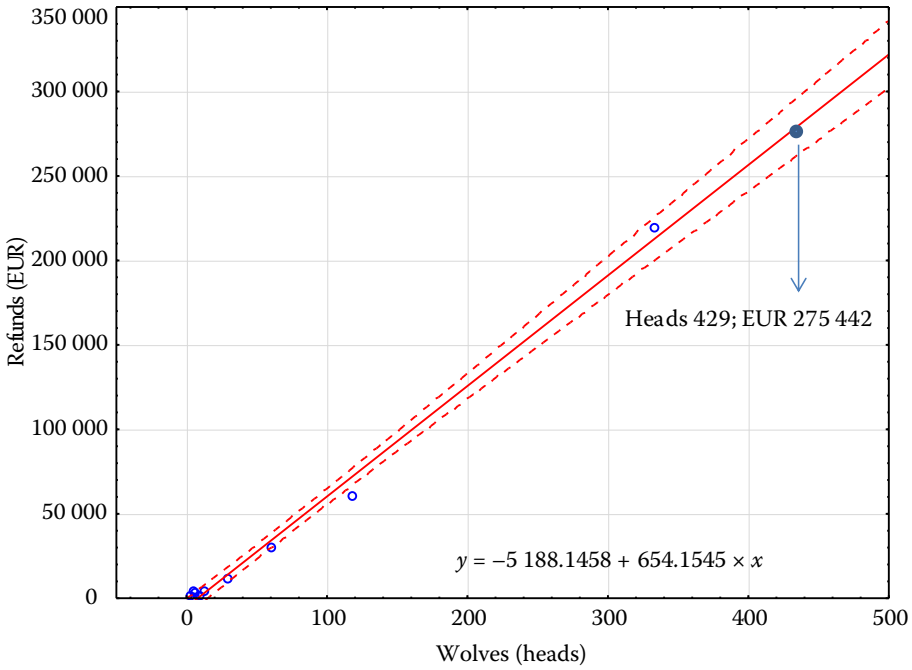

Figure 5. Relationship between the occurrence of wolves and compensations of damage caused by them (2010–2019)

Source: CZSO (2020); Ministry of Finance (2020)

The Programme is also aimed to pay attention to the impact of the grey wolf on the game and to evaluate changes which may happen in ecosystems in cooperation with hunting organisations. It is beyond doubt that all impacts of the wolf on biodiversity, especially in a densely populated landscape and in an area transformed by human activities, are not sufficiently covered and evaluated by the scientists. The same applies to how much the behaviour patterns of predators are affected by different territories. According to the CMMJ representatives, wolves can under no circumstances replace the planned culling carried out by humans. Sufficiently high numbers of wolves which would affect the amounts of game are unreal in the Czech landscape. An increased wolf predation pressure on a wild boar make the wild boars form greater groups and leave the wild open spaces to get closer to the human settlements, which is already a big problem now. The CMMJ representatives declare that the information presented in printed media on the damage caused by the hoofed game on the forest and other stands in the order of EUR millions is untrue and that such an amount of damage is a fancy figure.

The representatives believe that the exaggerated initiative aimed at the wolf protection is missing elsewhere in the nature conservation, which is affected by extraordinary media and marketing attractiveness of the wolf in contrast to common partridges and hares, which are a natural part of the current Central European cultural landscape and the numbers of which continue to decrease.

CONCLUSION

The Wolf Management Programme provides a useful comprehensive summary of problems which need to be addressed in our territory in relation to wolf population expansion. Its benefit is especially the list of preventative measures it aims to address. Promotion of preventative measures is always most efficient, not only economically. The implementation plan, however, contains only the timing of individual measures without any specific details regarding related liabilities and financing.

The relationship with other main stakeholders and the area of education and promotion, in particular, are questionable. The Programme represents a basis for further increases in drawing public money by means of subsidies and grants, but it fails to provide assurance regarding the effectiveness and real necessity of such measures.

Apart from that, the Programme is considered a mentoring tool that will educate farmers, hunters, and the public by means of individual measures and inform them "objectively" in cooperation with other pro-

https://doi.org/10.17221/377/2020-AGRICECON

tectionist organisations. In our opinion, this approach will not contribute to achieving the main aim of the Programme, i.e. mitigation of conflicts. Strengthening cooperation should especially be geared towards the actors who criticize the Programme. It is important to listen to their views and to back up another view with relevant facts. The situation where various groups of interest blame each other for dissemination of delusions and half-truths and concealment of information makes it difficult to envisage that one of such groups will contribute to providing objective information especially when it defends its own livelihood. What is more, objective information often depends on the view the given group is inclined to. A perspective and a wider context always matter. Unless there is a consensus in scientific studies in respect of all questions (the scientific studies more often bring forward new questions), answers will not be unambiguous.

Finally, it should be highlighted that this is a regional problem and the management of the wolf return cannot be approached consistently throughout the territory without considering the local context.

REFERENCES

Allen B.L., Allen L.R., Andrén H., Ballard G., Boitani L., Engeman R.M., Fleming P.J.S., Ford A.T., Haswell P.M., Kowalczyk R., Linnell J.D.C., David Mech L., Parker D.M. (2017): Can we save large carnivores without losing large carnivore science? Food Webs, 12: 64–75.

AOPK (2020): Return of the Wolves (Návrat vlků). Czech Republic, Nature Conservation Agency of the Czech Republic. Available at https://www.navratvlku.cz/o-vlkovi-historicke-a-soucasne-rozsireni/ (accessed Sept 2, 2020). (in Czech)

Bautista C., Revilla E., Naves J., Albrecht J., Fernández N., Olszańska A., Adamec M., Berezowska-Cnota T., Ciucci P., Groff C., Härkönen S., Huber D., Jerina K., Jonozovič M., Karamanlidis A.A., Palazón S., Quenette P.Y., Rigg R., Seijas J., Swenson J.E., Talvi T., Selva N. (2019): Large carnivore damage in Europe: Analysis of compensation and prevention programs. Biological Conservation, 235: 308–316.

Boitani L., Linnell J.D. (2015): Bringing large mammals back: Large carnivores in Europe. In: Pereira H.M., Navarro L.M. (eds): Rewilding European Landscapes. Cham, Springer: 67–84.

Büscher B., Fletcher R. (2015): Accumulation by conservation. New Political Economy, 20: 273–298.

Costanza R., de Groot R., Sutton P., van der Ploeg S., Anderson S.J., Kubiszewski I., Farber S., Turner R.K. (2014): Changes in the global value of ecosystem services. Global Environmental Change, 26: 152–158.

CZSO (2020): Basic Data on Hunting Grounds, Game Stock and Hunting. Available at: https://www.czso.cz/csu/czso/basic-data-on-hunting-grounds-game-stock-and-hunting-from-1-april-2019-to-31-march-2020 (accessed Sept 2, 2020).

Dressel S., Sandström C., Ericsson G. (2015): A meta-analysis of studies on attitudes toward bears and wolves across Europe 1976–2012. Conservation Biology, 29: 565–574.

Eggermann J., Gula R., Pirga B., Theuerkauf J., Tsunoda H., Brzezowska B., Rouys S., Radler S. (2009): Daily and seasonal variation in wolf activity in the Bieszczady Mountains, SE Poland. Mammalian Biology, 74: 159–163.

Eisenberg C. (2013): The Wolf's Tooth: Keystone Predators, Trophic Cascades, and Biodiversity. Washington, USA, Island Press: 1–272.

Figueiredo A.M., Valente A.M., Barros T., Carvalho J., Silva D.A., Fonseca C., Madeira de Carvalho L., Torres R.T. (2020): What does the wolf eat? Assessing the diet of the endangered Iberian wolf (*Canis lupus signatus*) in north-east Portugal. PLoS ONE, 15: e0230433.

Flagel D.G., Belovsky G.E., Cramer M.J., Beyer Jr. D.E., Robertson K.E. (2017): Fear and loathing in a Great Lakes forest: Cascading effects of competition between wolves and coyotes. Journal of Mammalogy, 98: 77–84.

Fleming P.J., Allen B.L., Ballard G.A. (2012): Seven considerations about dingoes as biodiversity engineers: The socioecological niches of dogs in Australia. Australian Mammalogy, 34: 119–131.

FNO (2020): Wolf damage: More than 12 000 victims (Dégâts du loup: Plus de 12 000 victimes). National Sheep Federation. Available at https://www.leseleveursfaceauloup.fr/etre-eleveur-face-au-loup/les-degats-du-loup/ (accessed Sept 2, 2020). (in French)

Fortin D., Beyer H.L., Boyce M.S., Smith D.W., Duchesne T., Mao J.S. (2005): Wolves influence elk movements: Behavior shapes a trophic cascade in Yellowstone National Park. Ecology, 86: 1320–1330.

Frélichová J., Vačkář D., Pártl A., Loučková B., Harmáčková Z.V., Lorencová E. (2014): Integrated assessment of ecosystem services in the Czech Republic. Ecosystem Services, 8: 110–117.

Hayward M.W., Somers M. (2009): Reintroduction of Top-Order Predators. Hoboken, New Jersey, John Wiley & Sons.

Kaczensky P., Blazic M., Gossow H. (2004): Public attitudes towards brown bears (*Ursus arctos*) in Slovenia. Biological Conservation, 118: 661–674.

Kansky R., Knight A.T. (2014): Key factors driving attitudes towards large mammals in conflict with humans. Biological Conservation, 179: 93–105.

https://doi.org/10.17221/377/2020-AGRICECON

Karlsson J., Johansson Ö. (2010): Predictability of repeated carnivore attacks on livestock favours reactive use of mitigation measures. Journal of Applied Ecology, 47: 166–171.

Krahulec F., Skálová H., Herben T., Hadincová V., Wildová R., Pecháčková S. (2001): Vegetation changes following sheep grazing in abandoned mountain meadows. Applied Vegetation Science, 4: 97–102.

Kuijper D.P.J., Sahlén E., Elmhagen B., Chamaillé-Jammes S., Sand H., Lone K., Cromsigt J.P.G.M. (2016): Paws without claws? Ecological effects of large carnivores in anthropogenic landscapes. Proceedings of the Royal Society B: Biological Sciences, 283: 20161625.

Linnell J.D.C. (2013): From conflict to coexistence: Insights from multi-disciplinary research into the relationships between people, large carnivores and institutions. Rome, Istituto di Ecologia Applicata. Available at https://ec.europa.eu/environment/nature/conservation/species/carnivores/pdf/task_4_conflict_coexistence.pdf (accessed July 9, 2020).

Lososová J., Kouřilová J., Dohnalová A. (2019): Increasing conflict between predator protection and pastoral farming in the Czech Republic. Trames, 23: 381–409.

Majić A., Bath A.J. (2010): Changes in attitudes toward wolves in Croatia. Biological Conservation, 143: 255–260.

Margulies J.D., Karanth K.K. (2018): The production of human-wildlife conflict: A political animal geography of encounter. Geoforum, 95: 153–164.

Marshall K.N., Cooper D.J., Hobbs N.T. (2014): Interactions among herbivory, climate, topography and plant age shape riparian willow dynamics in northern Yellowstone National Park, USA. Journal of Ecology, 102: 667–677.

ME (2020): Wolf Management Programme (Program péče o vlka obecného). Czech Republic, Ministry of the Environment. Available at https://www.navratvlku.cz/ke-stazeni/ (accessed June 25, 2020). (in Czech)

Mech L.D. (2012): Is science in danger of sanctifying the wolf? Biological Conservation, 150: 143–149.

Milner J.M., Nilsen E.B., Wabakken P., Storaas T. (2005): Hunting moose or keeping sheep? Producing meat in areas with carnivores. Alces, 41: 49–61.

Ministry of Finance (2020): Compensation for Damages Caused Pursuant to Act No. 115/2000 Coll (Seznam podaných žádostí). Available at mfcr.cz/cs/o-ministerstvu/sluzby-verejnosti/zadosti-o-informace-dle-zakona-106-1999/seznam-podanych-zadosti (accessed July 7, 2020).

Much R.M., Breck S.W., Lance N.J., Callahan P. (2018): An ounce of prevention: Quantifying the effects of non-lethal tools on wolf behavior. Applied Animal Behaviour Science, 203: 73–80.

Nilsen E.B., Pettersen T., Gundersen H., Milner J.M., Mysterud A., Solberg E.J., Andreassen H.P., Stenseth N.C. (2005): Moose harvesting strategies in the presence of wolves. Journal of Applied Ecology, 42: 389–399.

NLWKN (2020): Livestock Damage (Nutztierschäden). Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency. Available at: https://www.nlwkn.niedersachsen.de/wolfsburo/nutztierschaden_karten_und_tabellen/nutztierschaeden-174005.html (accessed Sept 2, 2020). (in German)

Nowak S., Mysłajek R.W., Kłosińska A., Gabryś G. (2011): Diet and prey selection of wolves (*Canis lupus*) recolonising Western and Central Poland. Mammalian Biology, 76: 709–715.

Pereira H.M., Navarro L.M. (2015): Rewilding European Landscapes. Cham, Springer Nature: 1–227.

Redpath S.M., Bhatia S., Young J. (2015): Tilting at wildlife: Reconsidering human-wildlife conflict. Oryx, 49: 222–225.

Redpath S.M., Young J., Evely A., Adams W.M., Sutherland W.J., Whitehouse A., Amar A., Lambert R.A., Linnell J.D.C., Watt A., Gutiérrez R.J. (2013): Understanding and managing conservation conflicts. Trends in Ecology & Evolution, 28: 100–109.

Skogen K., Krange O., Figari H. (2013): Wolf Conflicts: A Sociological Study (Ulvekonflikter. En osiologisk studie). Oslo, Norway, Akademika forlag. (in Norwegian)

Wagner C., Holzapfel M., Kluth G., Reinhardt I., Ansorge H. (2012): Wolf (*Canis lupus*) feeding habits during the first eight years of its occurrence in Germany. Mammalian Biology, 77: 196–203.

Wikenros C., Sand H., Bergström R., Liberg O., Chapron G. (2015): Response of moose hunters to predation following wolf return in Sweden. PLoS ONE, 10: e0119957.

Winnie J. (2014): Predation risk, elk, and aspen: Reply. Ecology, 95: 2671–2674.

Winnie Jr. J., Creel S. (2017): The many effects of carnivores on their prey and their implications for trophic cascades, and ecosystem structure and function. Food Webs, 12: 88–94.

Received: September 17, 2020
Accepted: November 20, 2020