

University of Matej Bel Banská Bystrica

Faculty of Natural Sciences

Department of Biology and Ecology



Ing. Nuno Guimarães

**ECOLOGY AND CONSERVATION OF THE GREY WOLF
(*CANIS LUPUS* L.) IN SLOVAKIA:**

A CASE STUDY IN BANSKÁ BYSTRICA NORTHEAST REGION

Autoreferát dizertačnej práce

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PhD student: Ing. Nuno Guimarães

Department of Biology and Ecology
Faculty of Natural Sciences
Matej Bel University
Tajovského 40
974 01 Banská Bystrica

Supervisor: doc. Ing. Peter Urban, Ph.D.

Department of Biology and Ecology
Faculty of Natural Sciences
Matej Bel University
Tajovského 40
974 01 Banská Bystrica

Co-Supervisor: Francisco Álvares, Ph.D.

(Post-doctoral researcher)
CIBIO – InBIO - Porto University
Campus de Vairão - Rua Pde.
Armando Quintas, nº 7
4485-661 Vairão-Portugal

Opponents: Prof. Dr. László Róbert Szemethy, PhD.

Institute for Wildlife Conservation, Faculty of Agricultural and Environmental
Sciences, Szent István University, Gödöllő,
Hungary

Doc. Dr. Duško Ćirović, PhD.

Faculty of Biology, University of Belgrade, Serbia

Prof. Mgr. Ivan Baláž, PhD.

Katedra ekológie a environmentalistiky, Faculty of Natural Sciences,
Constantine the Philosopher University, Nitra

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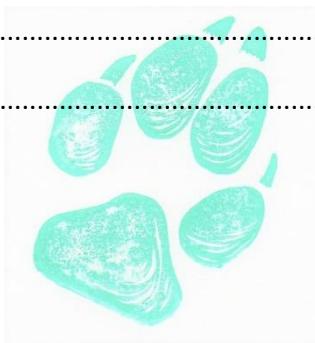
Fakulta Prírodných vied
Univerzita Mateja Bela
Tajovského 40
974 01 Banská Bystrica

Predseda spoločnej odborovej komisie:

prof. RNDr. Peter Bitušík, CSc.
Fakulta Prírodných vied
Univerzita Mateja Bela, Banská Bystrica

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ABSTRAKT

Vlk je jedným z najviac študovaných živočíšnych druhov na svete. Patrí medzi najznámejšie voľne žijúce živočíchy Karpát. Vždy bol prítomný v slovenských lesoch a je významnou súčasťou ich ekosystému. V ňom zohráva jedinečnú a zásadnú úlohu. Rešpektovaný a chránený, prenasledovaný a nenávidený existuje mnoho súčasných postojov k tomuto zvieraťu, a to nielen na Slovensku, ale aj celosvetovo. Na Slovensku sa uskutočnilo mnoho štúdií zameraných na vlka, ale veľmi málo ich výsledkov sa skutočne aplikovalo a zdieľalo. Cieľom tejto práce je analyzovať súčasnú situáciu vlka na Slovensku, zamerané na dve priestorové škály. Po prvé som sa zamerala na konflikty a zdravotný stav vlka na národnej úrovni. Na základe analýzy dostupných oficiálnych databáz môžem konštatovať, že dopad škôd spôsobených vlkom nie je zásadný a neprináša výrazné ekonomické straty. Najmä ak ich porovnáam so škodami spôsobenými inými voľne žijúcimi druhmi živočíchov –kopytníkmi. Výsledky z obdobia ostatných 10 rokov preukázali, že voľne žijúce kopytníky produkujú 17-krát väčšie škody poškodením mladých stromov a poľnohospodárskych plodín. V rámci analýzy zdravotného stavu populácie vlkov sme sa venovali identifikácii prítomnosti ich parazitov na Slovensku. Z 15 identifikovaných parazitov boli dva zaznamenané prvýkrát na Slovensku, ale žiadny zo zistených parazitov nie je pre vlka život ohrozujúci. Druhá časť práce sa týkala ekologického prístupu na regionálnej úrovni. Išlo o tri oblasti Banskobystrického kraja: NP Muránska planina, CHKO Poľana a Veporské vrchy, pričom sme sa zamerali najmä na metódy výskumu prítomnosti a abundancie vlkov, potravnú ekológiu a vývoj androidovej aplikácie. Cieľom bolo vyhodnotiť efektívnosť výskumných metód s výskytom snehu a bez neho. Za týmto účelom som uskutočnil systematický zber pobytových znakov v rámci vopred vytvorenej siete transektov, ktorý som zrealizoval počas štyroch monitoringov. Dva monitoringy som uskutočnil v období bez snehu na jeseň a dva so snehom v zime. Monitorovacie metódy na snehu boli zjavne účinnejšie a zahŕňali 78% zozbieraných dát. Hoci percento zaznamenaných dôkazov bez snehu bolo nižšie, výsledky majú mnoho užitočných výstupov pre presnejšie odhady populácie vlka so zameraním na reprodukčné svorky. V analýzach potravy som použil 248 neinvazívnych vzoriek (trus). Výsledky ukázali, že vlk loví svoju prirodzenú korisť (kopytníky), ktoré zahŕňajú 98,6 % konzumovanej biomasy. Najvyššia frekvencia konzumácie zodpovedá jeleňovi, po ktorom nasledoval diviak a srnec. Prítomnosť hospodárskych zvierat v potrave vlka bola irelevantná, čo naznačuje, že útoky vlkov na hospodárske zvieratá sú príležitostné a väčšinou oportunistické. Táto štúdia ukazuje, že použitie niekoľkých neinvazívnych metód umožňuje zber veľkého množstva údajov s cieľom vedecky podložiť rozhodnutia o manažmente vlka.

Kľúčové slová: ekológia vlkov, prieskumné metódy, konflikty, potrava, parazity.

ABSTRACT

The Grey Wolf (*Canis lupus*) has always been present in Slovakia and is an important part of the ecosystem because of its unique key role within the habitats they occur. Wolves are among the most emblematic wild species that inhabit the Carpathian Mountains. Respected and protected, persecuted and hated, they generate many different attitudes in humans, not only in Slovakia but also within their worldwide range. In Slovakia, many studies on wolf ecology have been conducted, but very few results were actually applied or widely available. With this work, I aimed to analyse the current ecological knowledge on wolves in Slovakia, focusing two different spatial scales. First, I targeted an approach at a national level focusing on conflicts with humans and wolf health status. Based on the analysis of available official databases, I can conclude that the conflicts generated by the damages attributed to wolves do not correspond to a high impact and relevant economic losses. Wolf damages related to predation on livestock and wild prey as well as to traffic collisions were more irrelevant, especially when compared with the damages caused by other wild species, such as wild ungulates. In fact, results from the 10 year period showed that paid compensations from damages on forest and agriculture crops caused by wild ungulates are 17 times higher than damages attributed to wolves on predation of livestock and game species. Health analysis of the wolf population in Slovakia, allowed the identification of 15 species of gastrointestinal parasites, two of them recorded for the first time in Slovakia, but none of the parasites found are threatening for the species survival. Second, I conducted an ecological approach at a regional level, focusing on wolf survey methods including the development of an android application and wolf trophic ecology. Study area was located in Banská Bystrica region and comprised Muránska Planina NP, Pofana PLA and Vepor Mountains. My aim regarding wolf survey methods was to evaluate its efficiency testing different substrate conditions: with and without the presence of snow. For this I used a systematic sampling design within pre-established network of transects which I covered effectively in four occasions. Two of them were conducted with the presence of snow during winter and two without snow during autumn. Survey methods with snow were considerably more effective, comprising 78% of all presence signs collected. Although the amount of evidences collected without snow was lower, these data can become fundamental for a more accurate assessment of populations estimates by targeting breeding packs. Diet analyses was based in 248 wolf scats , with results showing that wolves rely mostly on their natural prey, comprising up to 98,6% of consumed biomass. Basic prey species for wolves were red deer and wild boar, while roe deer represents a secondary prey. The presence of livestock on wolf diet was irrelevant suggesting that wolf attacks to domestic species are occasional and mostly opportunistic. This study shows that the use of several methodologies based on non-invasive sampling enables the collection of a large amount of data in order to allow scientific-based decisions on wolf management.

Key words: wolf ecology, survey methods, human-wildlife conflicts, diet, endoparasites.

INTRODUCTION

The grey wolf (*Canis lupus* L. 1758) is one of the most iconic predator, the most widespread carnivore species found worldwide and probably the most studied large carnivore (Mech & Boitani 2003, Ripple *et al.* 2014). The competition on the use of common resources between humans and wolves generate economic losses, as well as the disturbance of wolf habitat and its intensive persecution. Wolves occur where coexistence levels with humans are higher, despite most governments' worldwide targeting wolf management for eradication and/or regulation of this species as measure to decrease conflicts due to wolf damages (Boitani 1995, Messmer 2000, Treves & Karanth 2003, Marshall *et al.* 2007). Human-wildlife conflicts represent nowadays the main challenge for the conservation of ecosystems (Treves *et al.* 2006). Management of Human-wildlife conflicts is the main tool for the mitigation of these damages, especially when involving large carnivores, such as wolves, as well as other large mammals, such as ungulates, aiming to achieve a sustainable conservation of wildlife populations and their habitat in equilibrium with the human needs and interests (Messmer 2000). In Slovakia, where coexistence is recorded for many generations, involving both predators and prey, most conflicts are solved not only by a legal reduction of the population numbers, in the form of national hunting bags, but also by the illegal means of poaching (Rigg 2007).

The increasing coexistence of humans and wildlife in a shared environment can become a health problem for humans and/or for domestic animals, both livestock and pets. Therefore, as parasites can easily be transmitted, especially between wild animals and livestock that share the same space, it can consequently affect humans becoming a public health issue as contamination can easily spread (Lesniak *et al.* 2017). The occurrence of some parasites, under certain conditions, can also represent a threat to health status and conservation efforts of wildlife populations, which had already driven some species to extinction (Stringer & Linklater 2014). In this context, the health condition of wolves is of great importance for their management, survival and fitness (Mech & Boitani 2003, Sillero-Zubiri & Switzer 2004). All over the world, there are 72 parasite species identified in wolves, while in European wolves, 35 endoparasites were recorded (Craig & Craig 2005). The relevance to monitor the presence of endoparasites using non-invasive samples is a knowledge gap in studies focusing wolf health, which needs to be fulfilled (Mech 1995, Mech & Boitani 2003).

Wolves are difficult to monitor due to their elusive behaviour, low-density distribution, widespread range and their high adaptability to various landscape types as dense and inaccessible forested areas (Linnell *et al.* 1998, 2008, Mech & Boitani 2003, Galaverni *et al.* 2012, Blanco & Cortes 2012). At the same time, it is often expensive task due to wolf high mobility, pack dynamic, elusiveness and nocturnal activity of this species (Mech & Boitani 2003, Galaverni *et al.* 2012). Around the world, many different methods are used to survey wolf populations, most of them adjusted to ecological contexts, particular characteristics of landscape and climatic conditions that each area presents (Blanco & Cortes 2012). These methods of survey target the search of presence of signs from wolves mainly tracks, scats, urine and other evidences (Linnell *et al.* 2008). In countries where snow is present ground tracking survey in snow cover are the most used method for wolf monitoring (Wabakken *et al.* 2001, Jedrzejewski *et al.* 2002, Marucco *et al.* 2009, Blanco & Cortes 2012, Kaczensky 2013, Chapron *et al.* 2014). On the other hand, countries where snow is absent, ground tracking surveys are less efficient and other more adaptable methods are combined as howling surveys, scent stations, litter identification and genetic analysis in order to increase the power of the results (Blanco & Cortes 2012, Kaczensky *et al.*, 2013, Liberg *et al.* 2012, Chapron *et al.* 2014). Although surveys with the presence of snow cover are of extreme value it is always important to apply different monitoring methods in space and time, essential to achieve more robust results and to reduce each method limitation (Linnell *et al.* 1998; Blanco & Cortes 2012, Ausband 2014, Jiménez *et al.* 2016).

The diet of wolves is related with the distribution and abundance of prey and generally includes not only wild prey, their natural target, but also livestock species (Mech & Boitani 2003). Nevertheless, wolf feeding habits generates a direct competition with hunters by certain species of wild ungulates, especially those with high hunting values (e.g. red deer with large antlers) and direct impacts to livestock herders resulting in economic losses caused by predation (Wagner *et al.* 2012). In Slovakia, previous studies focusing wolf diet were conducted with the use of stomach

contents analysis and more recently with the identification of prey by the hairs from scats (Hell 1974, Brtek & Voskár 1985, 1987, Kolenka 1997, Janiga & Hrková 2002, Strnáďová 2002, Findo 2002, Rigg & Gorman 2004, Findo & Chovancová 2005). These analyses used mostly eye evaluation methods and few resorted to microscopic techniques resulting in some difficulties in prey identification, especially between Cervidae, such as *Cervus elaphus* and *Capreolus capreolus* (Rigg & Gorman 2004, Findo & Chovancová 2005).

AIMS AND METHODS

The several chapters of this dissertation are divided in two main spatial approaches: A- national level focusing all Slovakia and B- regional level focusing only Banská Bystrica region, and the main goals for each are described below:

A. Approach at national level focusing conflicts with humans and wolf health status

Chapter III - Characterize human-wolf conflicts in Slovakia

In chapter III, I want to address the following questions:

- How relevant are wolves in human-wildlife conflicts in Slovakia?
- Which are the conflicts and economic impact related to wolves, in relation to other wildlife species?

To address these questions, I analysed official data available from Slovakia governmental authorities (e.g. State Nature Conservancy S.R. and the National Forest Centre) regarding damages caused by several wildlife species and, particularly, the conflicts caused by wolves (damages on livestock and wild prey as well as traffic collisions).

Chapter IV – Endoparasites of the grey wolf in protected areas of Slovakia

In chapter IV, I want to address the following questions:

- Which is the health condition of wolves in Slovakia, by focusing on parasites?
- Are there detected parasites with potential impact in wolf survival?

To address these questions, I analyse the endoparasites composition by using mostly non-invasive samples (e.g. scats), in order to evaluate the health condition of the wolves and determine the types of parasites present in wolves in three regions from Slovakia: two national parks (Tatra NP and Muránska Planina NP) and one protected landscape area (Poľana PLA).

B. Approach at regional level focusing on wolf survey methods and diet

Chapter V - Efficiency of wolf survey methods and the influence of snow cover to assess wolf presence

In chapter V, I want to address the following questions:

- Which are the most informative presence signs for wolf monitoring?
- How snow cover conditions influence detection rates of wolf presence signs?

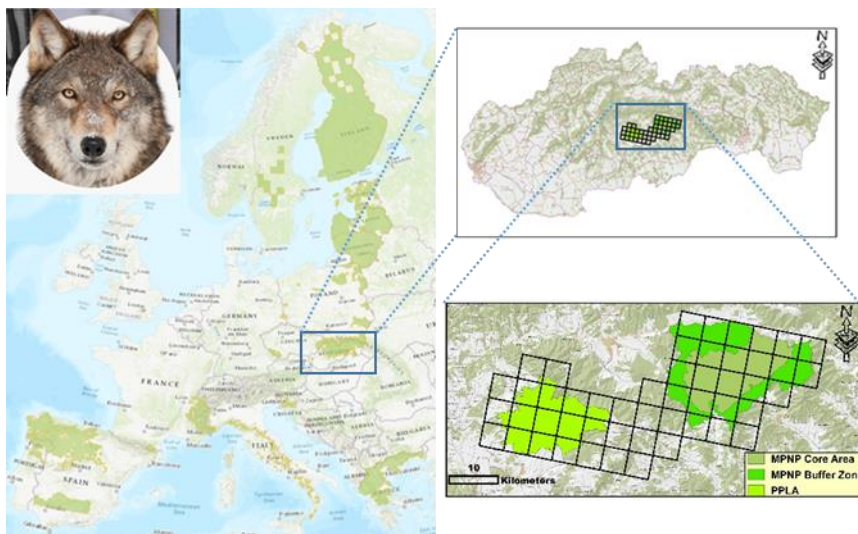
To address these questions, I analysed the efficiency and the success rates of survey by focusing non-invasive sampling, in order to detect evidences for the presence of wolves. I compare the different methods, the quantity and the quality of the evidences collected, under different climatic conditions influenced by the ground cover composition (with and without snow), in order to understand the relative importance of field surveys along different seasons.

Chapter VI - Wolf diet and impact on livestock and wild prey in Banská Bystrica region

In chapter VII, I want to address the following questions:

- Which are the main prey items for wolves?
- Which is the actual impact of wolf predation on wild ungulates and livestock?

To address these questions I assess wolf diet based on prey occurrences in scat content and the importance of the each prey found in terms of consumed biomass values. I also analysed the regional differences in prey consumption together with the availability of prey, to assess prey selection and the real impact of wolves on the most important prey species. Finally, I compared diet results with the ones from similar studies available for other locations in Slovakia.



STUDY AREA

Figure 1 – Location of Slovakia (picture up right) and the study area (picture down right) within Europe (wolf distribution in Europe green areas)

The study area at national level, focus the entire territory of the Slovak Republic, a central-European country with a total area of 49,035 km² and including two main geomorphological traits and bioclimatic regions with high biodiversity, the Pannonian lowlands and, particularly, the Carpathian mountains (Udvardy & Udvardy 1975).

The study area at regional level is located in Banská Bystrica region and comprehends a wide variety of habitats, where is included the Muránska Planina National Park (MPNP), Poľana Protected Landscape Area (PPLA) and part of the Vepor mountains (VM). The study area provides the possibility to analyse similarities and differences of landscape use, in relation to the different levels of habitat protection presented in Slovakia. These three contiguous areas represent the most common biotopes of Slovakia and the typical wolf habitat. These areas comprise 28 Natura 2000 from the network of Sites of Community Importance. Only in eight of these areas wolves have full protection status for all year, comprising 28,440.23 ha: 3 areas in Muránska Planina NP, 3 in Poľana PLA and 2 in Vepor Mts. (Anonymous 2019).

Flora is very diverse and accounts more than 1,400 species of higher plants, such as fir, beech, ash, elm, maples, limes, Norwegian spruce, sessile, turkey oaks and hornbeam, the last two restricted in the south and southwest areas (Lacika & Ondrejka 2009, Urban 2015b). Regarding fauna, the region also harbours many vertebrates and invertebrates. All the three large carnivores - wolf, lynx and brown bear -, and the three large ungulates - red deer, roe deer and wild boar - roam within this region together with many other mammals, reptiles, birds, amphibians and fish species. It is also home for the special semi-wild Hucul horse, an indigenous breed from the

Carpathians, which is considered a descendent of wild horse that has been bred in the region since 1950 (Lacika & Ondrejka 2009).

Muránska Planina National Park

Muránska Planina became a Protected Landscape Area in 1976 and earned the official status of a national park in 1997. It is located in the core of the Western Carpathians and it is considered one of the most preserved landscapes in Slovakia. With a territory of 21,700 ha including the buffer zone, forest covers 87% of the area, with old and priceless forest stands (Šmídtova 2015).

Poľana Protected Landscape Area

Poľana region was declared a Protected Landscape Area in 1981 and integrated UNESCO's Biosphere Reserve Network in 1990. It is a unique mountain mosaic landscape and an important area to analyse nature and human coexistence and interactions (Fabriciusová & Slávik 2010). Poľana PLA has 20,079 ha while the Biosphere Reserve has 20,360 ha distributed in three zones: six dispersed core areas, a buffer zone and a transition area (Urban 2015).

Vepor Mountains

Vepor Mountains is a large range of mountains with the core area located between the Muránska Planina PNP and Poľana PLA. For this study, only the area between the park and the protected area integrates the study area, corresponding to an area of 22500 ha. With similar biotopes as MPNP and PPLA, it harbours one of the most important National Nature Reserve forest areas from all Slovakia, the Dobročský Virgin Forest. It is an unique and rare pristine forest, protected since 1913, having probably some of the oldest trees of Slovakia as many beech trees age approximately 230 years old with the oldest firs exceeding 400 years old (Anonymous 2019).

RESULTS, DISCUSSION AND CONCLUSIONS

In my work, I examine the nature and relevance of the conflicts attributed to wolves in Slovakia (Chapter III). I also assessed the health status of this carnivore based on the identification of endoparasites, mostly in non-invasive samples (Chapter IV). At a regional level and with focus on the study area within Banská Bystrica region, I evaluate the possibility to increase the efficiency in wolf monitoring based on systematic field surveys under different snow cover conditions in opposition to what was done until today in Slovakia (Chapter V). Finally, also within the regional study area, I determined the trophic ecology in order to understand which prey species are the main target for wolves (Chapter VI).

In chapter III, human-wildlife conflicts are addressed by focusing in the wolves' estimates, wolves and other large carnivore's damages due depredation on livestock and predation on wild ungulates, wild ungulates damages to agriculture and forestry lands and animal vehicle collisions (AVC). The huge difference in the official population estimates from two governmental organizations on wolf population in Slovakia is a big concern as they are not coherent and they both present some possible bias (Antal 2016, anonymous 2018, Bucko & Pataki 2018). With such a different estimates values between them, it is for sure difficult to assess the real population status of wolves in Slovakia. However, according to the numbers analysed it seems that wolf population is growing between 4 to 6% per year, which is the only similarity between data presented by both organizations. The damages on livestock are the main reason for wolf culling in Slovakia. Between 2008 and 2017, the economic impact from the payed compensations from wolf damages to livestock is 8 times lower than the economic impact from the payed compensations from damages caused by wild ungulates to agriculture and forests (a total of 169,923.00€ for wolf predation on livestock and 1,390,188.00€ for damages by ungulates). In fact, compensations payed for damages caused by wild ungulates are 2.5 times higher than payments made for damages caused by all large carnivores, including wolves, over the 10 year period that was analysed. In the north part of Banská Bystrica region, wolf attacks on livestock are low and mainly opportunistic, since from 2014 until 2017, there were 60 attacks recorded, resulting in a total of 140 livestock animals killed. Regarding the damages attributed to the 3 large carnivores, wolves are the main responsible for predatory attacks with 53% of the total. However, the highest percentage of payed compensations is from damages relates to brown bears, with 52% of the total corresponding to a value of 290,000€. With the overall analyse of my results, I can conclude that wolf culling practices

are not well justified by the magnitude of their economic damages. However, in the last years, reported damages are decreasing, despite the increase of the requested values for compensations. Killing wolves to decrease the impacts of damages and the competition with humans due to predation in wild game and livestock is not well study nor realistically validated as proven in previous studies (Treves 2009, Liberg *et al.* 2010, Chapron & Treves 2016). The removal of individual wolves, which in fact were not involved in damages, is probably high and there is a great possibility of disruption of the social structure of packs, which may increase the probability of higher occurrences of livestock damages and increase conflicts (Chavez & Gese 2006, Treves 2009, Treves *et al.* 2016). In terms of traffic collisions, wolves and the other large carnivores have an insignificant value comparing to the wild ungulates. Wolves were involved in 38 AVC occurrences, bears in 107 and lynx in 27 within the 10 year period dataset. While for the same period there were 45,284 roe deer, 8,121 red deer and 5,701 wild boars killed on traffic collisions. Therefore, the number of wild ungulates killed in AVC are 3 times higher than the total number of animals which death is attributed to wolf predation (including livestock and wild ungulates). With this, it is quite clear that wolves' damages have no actual relevance in the human-wildlife conflicts and there is no significant economic impact on the damages attributed to them.

In chapter IV, the main conclusion is that the population of wolves in Slovakia is generally healthy in terms of endoparasites. Within the 15 parasitic species identified in this study, it was possible to find two new species in the parasitic fauna from wolves in Slovakia, the *Isospora spp.* and *Angiostrongylus vasorum*. However, all endoparasites that were identified cause no major harm to wolves and are not life threatening (Craig & Craig 2005). The use of non-invasive samples, such as scats, can become a useful and frequent source of information for these assessments, in opposition to previous studies based on analysis of dead wolves.

Regarding chapter V, I concluded that the collection of evidences of wolf presence, with a non-invasive approach, are not confined to the presence of snow. From the 910 evidences recorded, 78% were collected with snow cover but the 22% of data collected without snow cover showed to be of great support to produce accurate population estimates and other relevant ecological knowledge, such as detection of breeding pairs. My approach shows how important is the use of a multi-method survey allowing to detect spatial and temporal differences and the relevance of a homogeneous collection of field data with the support of the developed android application. The application outputs are of unlimited use for much analysis on wolf behaviour and territory use. The capacity of allowing many different users with many different backgrounds to collect similar field information allows also an increase of data available both systematic and opportunistic.

With the results from wolf diet analyses (chapter VI) it was possible to determine that wolf scats contained mostly one prey. In total just 13 scats presented more than one prey. Results showed that there is a higher incidence for red deer (55.7% of biomass consumed), followed by wild boar (33.0% of biomass consumed) and roe deer (9.9% of biomass consumed). With these results is important to highlight the fact that wolf feeding focuses mostly on large-size wild ungulates and only opportunistically targets other smaller prey item (2,3% frequency of occurrence and 1.4% of biomass consumed). In fact, results show a balance between the red deer and the wild boar in the overall of the study areas in terms of percentage of frequency of occurrence and biomass consumed in line with previous studies (Rigg & Gorman 2004, Findo & Chovancová 2005). However, in my study, I was able to conduct an important distinction between the two cervidae species, red deer and roe deer. The balance between the 2 main species targeted by wolves resulting from this analysis are not in line with the official data of the damages attributed to wolves. In contrast with the official data from chapter III (conflicts) that demonstrate a greater incidence in red deer and sheep, out of 248 scats analysed, only two have shown the presence of sheep hair comprising a total of 0.8% of frequency of occurrence and 0.8% of biomass consumed. With the results obtained, it was also possible to conclude that the consumption of domestic animals it is insignificant as shown in other studies (Lešová & Antal 2015).

In conclusion, I obtained information regarding the use of individuals wolves without the need of telemetry, and more important, without using invasive methods. Accurate population estimates and updated ecological knowledge to support wolf conservation has been a major challenge for many European countries. In 1975, a report published by IUCN expressed exactly the same problems concerning wolves which we are facing nowadays in Slovakia: the need for deep

ecological research on wolves in order to acquire scientific-based information (Pimlott 1975). Slovak wolf population has an important role for the conservation and expansion of this carnivore within the Western Carpathians and the recolonization to Hungary and Czech Republic. However, it is important to note that there are no standardized methods for the estimation of wolf populations neither to monitor their distribution as other carnivore species have (Linnell *et al.* 1998). Monitoring programs are the main tool to achieve an efficient wolf management plan. In this context, the use of a scientific-based multi-method approach can allow estimates that are more robust and that should be employed under different temporal and spatial scales. This study shows that the use of several methodologies based on non-invasive sampling, enables the collection of a large and wide amount of ecological data in order to allow scientific-based decisions on wolf management.

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- Guimarães N., Ďurová J., Dobříková D., Szemethy L., Patkó L. and Urban P. 2017: The importance of ecosystem regulation functions for management planning: looking back at the actions and outputs of the international seminar. *Quaestiones rerum naturalium*, 4(1): 41-50.

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Guimarães N., Álvares F., Barančeková M., Findo S. and Urban P. 2017: Wolf population survey using a multi-methodological approach: insights from Central Slovakia. In: Urban P. & Guimarães N. (eds.), Research and protection of mammals in Slovakia - book of abstracts from the 13th scientific conference with international participation, 23.-24. November 2017, Banská Bystrica: Vydavateľstvo Univerzity Mateja Bela – Belianum, 2017: 25-26.

Urban P., Bučko J., Guimarães N. and Kušík P. 2017: Šakal zlatý (*Canis aureus*): Novinky zo Slovenska [Golden jackal (*Canis aureus*): News from Slovakia]. In: Urban P. & Guimarães N. (eds.), Research and protection of mammals in Slovakia - book of abstracts from the 13th scientific conference with international participation. Banská Bystrica: Vydavateľstvo Univerzity Mateja Bela – Belianum: 46 (in Slovak).

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Guimarães N. 2016: Ecology and conservation of the grey wolf (*Canis lupus* Linnaeus, 1758) in Slovakia. Conference FJT 100 Zvolen 1. – 12. December in Zvolen Technická Univerzita Zvolen.

Barančeková M., Guimarães N., Álvares F., Findo S. and Urban P. 2017: The need of non-invasive genetics analyses for wolf conservation. In: Urban P. & Guimarães N. (eds.): Research and protection of mammals in Slovakia - book of abstracts from the 13th scientific conference with international participation. Banská Bystrica: Vydavateľstvo Univerzity Mateja Bela – Belianum: 11-12. ISBN 978-80-557-1360-1

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Urban P., Guimarães N., Bučko J., Kušík P. and Rajský R. 2018: Šakal zlatý (*Canis aureus*) na Slovensku – čo o ňom (ne)vieme [Golden Jackal (*Canis aureus*) in Slovakia – what we know about it (not)]. In: Levické poľovnícke dni – Aktuálne problémy slovenského poľovníctva: odborný seminár, Levice 27. apríla 2018. – Veľký Krtíš: Slovenská poľovnícka komora, 2018: 79-87. (in Slovak)

Urban P. Bučko J., Guimarães N. and Kušík P. 2017: Šakal zlatý (*Canis aureus*) v Európe, na Slovensku a v okrese Veľký Krtíš. [Golden Jackal (*Canis aureus*) in Europe, Slovakia and

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Guimarães N., Álvares F. and Urban P. 2017: Monitoring of the grey wolf in Slovakia year ground (with and without snow cover) for a proper management of the species. In: Kušík P., Rajský D. & Garaj P. (eds.), Šakal zlatý a ostatní reálni aj potenciálni privandrovalci zvyšujúci druhovú diverzitu prírody okresu Veľký Krtíš: zborník referátov z odborného seminára, Modrý Kameň, 8. september 2017 - Veľký Krtíš: Obvodná poľovnícka komora: 30-34.

News

Smolko P., Kubala J., Klinga P., Tám B., Ilko T., Tesák, J. and Guimarães N. 2018: Lynx monitoring in the Muránska Planina NP, Slovakia and its importance for the national and European management and conservation of species : technical report. Banská Bystrica: DIANA - Carpathian Wildlife Research, 2018: 30 - Published within the project LIFE13 NAT/DE/000755 "Lynx reintroduction in the Biosphere Reserve Palatinate Forest" with financial support of the European Commission.

Other publications and documents not included in any of the previous categories

Urban P. and Guimarães N. (eds.) 2017: Výskum a ochrana cicavcov na Slovensku: zborník abstraktov z, [Research and protection of mammals in Slovakia - Book of abstract from the conference]. 13. celoštátnej vedeckej konferencie s medzinárodnou účasťou, Banská Bystrica, 23. – 24. 11. 2017. Banská Bystrica: Vydavateľstvo Univerzity Mateja Bela – Belianum (2,85 AH): 55. ISBN 978-80-557-1360 (in Slovak)

Dobříková D. and Guimarães N. 2016: Medvedia rezervácia v Maďarsku hostila účastníkov zo Slovenska [Bear reservation in Hungary hosted participants from Slovakia]. In Spravodajca Univerzity Mateja Bela v Banskej Bystrici 22(4): 17. (in Slovak)

OTHER ACTIVITIES

Academic events in Slovakia			
Name	Location	Date	Action/activity
Seminar "Ako Učiť ochranu prírody na vysokých školách?" - ((How) Teach Nature Conservation at Universities?)	Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	6/11/2014 to 8/11/2014	Attended
Ekologické Popoludnie (Ecological afternoon)	Department of Biology and Ecology, Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	11/11/2014	Presentation - "The Iberian wolf (<i>Canis lupus signatus</i>)" + "Portuguese indigenous livestock breeds"
Seminar "Large predators, people, and prey: interactions and conflicts resolution"	Banská Bystrica	13/10/2015	Presentation - "The Iberian wolf - <i>Canis lupus signatus</i> "
Seminar "Veľká trojka" (medved, vlk, rys) na Slovensku - ("Big Three" (bear, wolf, lynx) in Slovakia)	FPV, UMB, Banská Bystrica	10/11/2015	Presentation - "The wolf in the World"
Conference "FJT100 - František Jozef Turček"	TUZVO - Zvolen	11/12/2015 to 12/12/2015	Poster - "Ecology and conservation of the grey wolf (<i>Canis lupus</i> L. 1758) in Slovakia"
Conference Zoológia 2016	Nitra	24/11/2016 to 26/11/2016	Presentation - "With or without snow? Assessing the efficiency of several non-invasive methods under different snow conditions for wolf monitoring in central Slovakia"
Seminar hunting days - "Aktuálne problémy slovenskeho poľovníctva" (Current problems of Slovak hunting)	Modrý Kameň - Veľký Krtíš	8/9/2017	Presentation - "Monitoring of the Grey Wolf in Slovakia Year round (with and without snow cover) for a proper management of the species"
Conference Muránska Planina National Park - 20 years anniversary	Zbojska	28/09/2017 to 29/09/2017	Presentation - "Ecology and Conservation of the Grey Wolf (<i>Canis lupus</i> L.1758) in Muránska Planina National Park"
Conference Výskum a ochrana cicavcov na Slovensku (Research and conservation of mammals in Slovakia)	Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	23/11/2017 to 24/11/2017	Editor of book of abstracts + presentation - "Wolf population survey using a multi-methodological approach: an insight from Central Slovakia"
Ekologické Popoludnie (Ecological afternoon)	Department of Biology and Ecology, Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	20/02/2018	Presentation - "Erasmus motilities: experiences"
Seminar hunting days - "Aktuálne problémy slovenskeho poľovníctva" (Current problems of Slovak hunting)	Levice	27/04/2018	Attended (co-author presentation "What do we know about the Golden Jackal (<i>Canis aureus</i> , L. 1758) in Slovakia?")
Workshop WWF-Slovakia - "Spolužitie veľkých šeliem s človekom" (Coexistence of large carnivores with man)	Tihányiovský kaštieľ, Central Slovak Museum, Banská Bystrica	14/08/2018	Presentation - "An analysis of wolf population using a multi-methodology approach"
Conference "Manažment ekosystémov v prizme nerovnovážnej perspektívy" (Management of ecosystems in the prism of a non-equilibrium perspective)	Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	21/11/2018 to 22/11/2018	Member of the organization team
Conference Zoológia 2018	Zvolen	22/11/2018 to 24/11/2018	Presentation - "The golden jackal in Slovakia"

International Academic events			
Name	Location	Date	Action/activity
Conference Zoologické dny 2016	České Budějovice, Czech Republic	11/02/2016 to 12/02/2016	Presentation - "With or without snow? Assessing the efficiency of several non-invasive methods under different snow conditions for wolf monitoring in central Slovakia"
Workshop "The importance of ecosystem regulation functions for management planning"	Medveothon - Veresegyház, Hungary	11/10/2016	Organization of workshop + presentation - "The Grey Wolf (<i>Canis lupus</i> L.1758) in Slovakia: Past, Present and Future"
Conference "Large Carnivores Protection in the Carpathians"	Rožnov pod Radhoštěm, the Czech Republic	18/10/2016 to 21/10/2016	Attended
Conference Zoologické dny 2017	Brno, Czech Republic	9/02/2017 to 10/02/2017	Presentation - "What do we know about the Golden Jackal (<i>Canis aureus</i> , L. 1758) in Slovakia?"
Workshop "Adaptive wildlife management strategies in forests considering the comeback of large carnivores to Austria"	Institute of Wildlife Biology and Game Management (IWJ), Univ. of Natural Resources and Life Sciences (BOKU) - Vienna, Austria	28/11/2017 to 30/11/2017	Experts meeting representing Slovakia (invited) - "Wildlife management and Large Carnivores in Austria - explore the parameters and conditions for changes in prey population in the current context in Austria."
Workshop "Golden jackal project Austria"	Institute of Wildlife Biology and Game Management (IWJ), Univ. of Natural Resources and Life Sciences (BOKU) - Vienna, Austria	27/02/2018	Presentation - "Golden jackal monitoring in Slovakia" suggestions for new systematic methodology
2nd International Jackal Symposium	Hellenic Zoological Society, Athens, Greece	31/10/2018 to 2/11/2018	Presentation - "The evolution of the presence of the golden jackal in Slovakia"
Workshop "ROAD ECOLOGY: Roadkill and wildlife-vehicle collisions on transportation infrastructure: causes, outcomes and mitigation"	CDV – Transport Research Centre, Brno, Czech Republic	15/11/2018	Presentation - "Wildlife-vehicle collisions in Slovakia"
Conference Zoologické dny 2019	Brno, Czech Republic	7/02/2019 to 8/02/2019	Presentation - "Searching for shy canid species: Wolf (<i>Canis lupus</i>) and golden jackal (<i>Canis aureus</i>) records in potential co-existence areas of Austria and Slovakia"

Funded Projects			
Name	Location	Date	Action/activity
OAED/SAIA - "Bilateral Aktion" - Project no. 2017-10 -20 -00 2	Austria and Slovakia	1/02/2018 to 31/01/2019 (postponed to 31/07/2019)	Main SK project leader - "Searching for shy canid species – wolf and golden jackal survey in potential co-existence areas of Austria and Slovakia" - Bioacoustic monitoring in pilot areas

Mobility's			
Name	Location	Date	Action/activity
Aktion Austria - Slovakia: Scholarships for short term stays OeAD-GmbH/ICM and SAIA, n.o. (on behalf of and financed by the Action Austria-Slovakia)	Institute of wildlife biology and game management, BOKU University, Vienna, Austria	21/06/2017 to 23/06/2017	Brainstorm for future cooperation, based on the study and survey of the golden jackal in Slovakia and in Austria + Field work.
Erasmus 2016 - Bear and wolf sanctuary	Medveothon - Verezegyház - Hungary	15/06/2016 to 31/08/2016	Ethology and the physiology of wolves and the study of social interactions in captivity conditions.
Erasmus 2017 - CIBIO – (Research Centre in Biodiversity and Genetic Resources) - InBIO	Faculty of Sciences, University of Porto, Portugal	10/04/2017 to 9/06/2017	Wolf ecology and conservation: non-invasive methods for monitoring an elusive carnivore.
Erasmus 2018 - CIBIO – (Research Centre in Biodiversity and Genetic Resources) - InBIO	Faculty of Sciences, University of Porto, Portugal	14/05/2018 to 27/07/2018	Wolf ecology, conservation and monitoring.

Mobility's (Hosting)			
Name	Location	Date	Action/activity
Fulbright Specialist Program - Gregg Losinski - US specialist Regional Conservation Educator for the Idaho Department of Fish & Game	Department of Biology and Ecology, Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	18/09/2016 to 28/10/2016 and 10/2017 to 11/2017	Providing support and planning activities fro the expert with students indoors and outdoors
Aktion Austria - Slovakia: Scholarships for short term stays (AT to SK) OeAD-GmbH/ICM and SAIA, n.o. on behalf of and financed by the Action Austria-Slovakia	Department of Biology and Ecology, Faculty of Natural Sciences, Matej Bel University - Banská Bystrica	09/03/2017 to 11/03/2017	Planning possibilities of synchronized monitoring of the golden jackal (<i>Canis aureus</i>). Discuss project contents and implementation of a wildlife ecology project between Austria and Slovakia.

Other activities			
Action	Location	Date	Action/activity
Workshop - Bear - Fatranský spolok	Mala Fatra National Park	24/10/2014 to 26/10/2014	Attended
Monitoring wolf and lynx in White wilderness - Slovak Wildlife Society - 2015	Liptov region (Tatra National Park, Low Tatra National Park and Velká Fatra National Park)	17/01/2015 to 30/01/2015	Snow monitoring
Monitoring Bears - Velká Fatra National Park	Velká Fatra National Park	30/04/2015	Bear counting
Monitoring Bears - Mala Fatra National Park	Mala Fatra National Park	12/06/2015 to 14/06/2015	Bear counting
Monitoring wolf and lynx - Mala Fatra National Park	Mala Fatra National Park	30/01/2016	Snow monitoring
Monitoring Bears - Poľana Protected Landscape Area	Poľana Protected Landscape Area	1/05/2015, 29/05/2015 and 27/05/2016	Bear counting
Training course - UFCS - Handling and rescuing of wildlife	France	28/10/2017 to 29/10/2017	Level 1 practical training + Presentation Large carnivores in Slovakia (UFCS - French Union of Wildlife Conservation)
Monitoring wolf and lynx	Muránska Planina National Park	2017-2018	Organizer of a week of monitoring in Muránska Planina in connection with the DIANA OZ and 20 volunteer trackers.
Monitoring Lynx	Muránska Planina NP - Vepor Mountains	2018-2019	Camera trap monitoring (installing and checking)
Conectgreen Meeting "Methodology for identification of migration corridors of large carnivores in the Carpathians"	Banská Bystrica	22/01/2019	Attended (invited)
Travel Tuesday action	Tihánylovský kaštieľ, Central Slovak Museum, Banská Bystrica	5/2/2019	Presentation - Portugal - Minho

CURRICULUM VITAE

Competencies

Enthusiastic, dedicated and communicative. PhD student with the focus on: "The Ecology and Conservation of the Wolf in Slovakia". Developing skills and expertise in the synecology area of study. Applying knowledge acquired throughout academic, professional and volunteer career. Participation in conferences, congress and workshop as the main tool for communication and education. Interest in: the relations between natural communities and habitats, their sustainability and nature ecosystem services. I am very comfortable when speaking to large audiences and I can adapt language to the public. Through my academic and professional career, I have done presentations in a variety of subjects and to a wide range of different public and in different languages.

Education and Training

2018 Erasmus CIBIO – InBio – Wolf ecology, conservation and monitoring.

2017 Erasmus CIBIO – InBio – Wolf ecology and conservation: non-invasive methods for monitoring an elusive carnivore – Faculty of Sciences from Porto University Portugal

2016 Erasmus + – White cross Animal Protection Society (volunteer internship) – wolf behaviour and public education at Medveothon (Wolf and Bear Sanctuary) – Veresegyház, Hungary

2014 (until date) PhD Student in Synecology – "The Ecology and conservation of the wolf in Slovakia" – Department of Biology and Ecology – Faculty of Natural Sciences – Matej Bel University, Slovakia

2006 Engineer degree in Environment and Rural Resources – ESAPL – IPVC - Viana do Castelo Polytechnic Institute, Portugal

2006 Specialization in Geographical Information Systems – Agrarian Development Institute, EU Program AGRO, Portugal

2006 Specialization in Classification of Satellite Photography – Agrarian Development Institute, EU Program AGRO, Portugal

2005 Honours BSc degree in International Rural Innovation and Development – CAH - Dronten Professional University, Netherlands

2005 E-business Specialization – IEFP – Braga, Portugal

2003 Certificate in Training of Trainers – SETCA (Union of Engineers and Technicians Agricultural Sciences), Portugal

2003 BSc degree in Environment and Rural Resources – ESAPL – IPVC - Viana do Castelo Polytechnic Institute, Refoios do Lima – Ponte de Lima, Portugal

1994 Certificate in Marketing Sales and International Business – Minho Industrial Association – Braga, Portugal

Employment history

2018 – (ongoing) State Nature Conservancy of the Slovak Republic, Banská Bystrica, Slovakia Wildlife researcher

- Ensuring the monitoring and mapping of large carnivores by non-invasive methods

2018 – (ongoing) Technical University of Zvolen, Slovakia

Wildlife researcher

- Monitoring of lynx camera traps, snow tracking methods and collection of genetic material integrated in connection with Life-Lynx Project.

2018 – 2019 **Integra Consulting s.r.o., Praha, Czech Republic**

Key expert in Large Carnivores

- Professional assistance in carrying out a study to ensure the migration capacity of the territory for large carnivores in connection with the construction of "D1 Turany – Hubová"

2009 – 2012 **Wolfye Dog Supplies, Dublin, Rep. of Ireland**

Self-Employed

- Manage and organise daily working duties. Develop and maintain good customer relationships.

2008 – 201 **Word Perfect Translations Ltd, Dublin, Rep. of Ireland**

Interpreter/Translator

- Providing interpretation and translation services in the Irish marketplace (Court Services, hospitals and private clinics, An Garda Síochána (Police), FAS (recruitment services), Refugee legal services, etc.).

2008 – 2009 **RGIS Inventory Specialists, Dublin, Rep. of Ireland**

Supervisor (Team Leader)

- Organising and executing inventories in different stores across Ireland. Training and supervising team members on procedures according to RGIS processes and equipment.

2007 – 2008 **Wilson's Country, Craigavon, Northern Ireland**

Quality Control Technician

- Manufacturing quality control and testing, assure internal rules, techniques and tests are correctly applied.

2007 **ETAP – Professional School, Portugal**

Teacher in Environmental Management

- Coordinate, supervise and support students, on their last professional studies research projects and final thesis;
- Facilitate self-learning experiences in the use of Geographical Information System (GIS) applied to environmental management and assessment.

2006 – 2007 **CIGESA (Geographical Information Office), Portugal**

Geographical Information System Technician

- Spatial Information data and project support officer;
- Data review and analysis and report writing;
- Data capture, editing and updating of digital cartography. Aerial Photo Interpretation and field surveys.

Volunteer Experience

2012 – 2014 **SWS - Slovak Wildlife Society – Slovak Republic**

- Participation in three White Wilderness monitoring survey, one as group leader, in monitoring wolves (*Canis lupus*) and lynx (*Lynx lynx*) and sampling for DNA and diet studies. Survey of other wild species
- Participations in two monitoring survey of Chamois (*Rupicapra rupicapra tatrica*) in the Low Tatras National Park

2008 – 2009 **ECO-UNESCO – Volunteer Environmental Education and Youth Org, Dublin**

- Managed, organized and coordinate indoor and outdoor events concerning environmental awareness (projects presentation, workshops and other educational activities) with young people, youth leaders and general public

2001 – 2002 **Students Union ESAPL – IPVC, Viana do Castelo Portugal**

President

- Management of a team of 30 students and representing 500 students
- Representing students in the Scientific and Pedagogical councils

Personal skills and competences

Languages: Native: Portuguese

Proficiency: English and Spanish

Basic: Slovak, Italian and French

Computer skills: Good working knowledge with GIS programs, Microsoft Office tools and internet

Additional information

Personal Interests: Hiking and trekking, travelling and adventure, photography, dog behaviour and training, swimming and scuba diving, DIY

Driving License: categories A and B (Full experienced with left and right (UK, ROI) driving).

References: available upon request



The report was distributed on: 10.06.2019

The dissertation defense takes place on 21st of August 2019 at 13.00h, before the commission for the defense of dissertations of the doctoral study program Evolution of Ecosystems and their Protection, in the field of study 4.3.5 Synecology at the Faculty of Natural Sciences, Matej Bel University in Banská Bystrica.

Place of defense:

Faculty of Natural Sciences
Matej Bel University
Tajovského 40
974 01 Banská Bystrica

Chairman of the Commission

prof. RNDr. Peter Bitušík, CSc.
Faculty of Natural Sciences
Matej bel University

