A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfilment of the Degree of Master of Science

Local attitudes towards wolves and wolf management in and around the Bükk National Park, Hungary

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July, 2017

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Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:
Katalin TARR for the degree of Master of Science and entitled:
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Month and Year of submission: July, 2017.

Parallel to trends in Europe and North America, the population of large carnivores is slowly increasing in Hungary, including within the Bükk National Park (BNP). After almost a century of absence, the wolf (*Canis lupus*) re-entered the BNP in 2010, and human-wolf conflicts of livestock depredation and competition for wild game immediately followed. In general, wolves generate both strong positive and negative feelings in residents, and wolf tolerance is especially low in regions where the wolf has been previously extirpated. Furthermore, the wolf is often understood as a symbol for other socio-economic or cultural issues, such as rural depopulation, lack of trust in authorities, and restrictions on the use of natural resources. Local acceptance is a key factor in successful and efficient large carnivore conservation, yet no research has been conducted so far on the attitudes of local residents towards wolves and wolf management in and around BNP. The current study's aim is to assess the strength and direction of these local attitudes and the set of demographic, socio-economic, and cultural variables which shape them. A face-to-face questionnaire and semi-structured interviews were conducted among local residents of 3 villages in and around BNP - Szilvásvárad, Nagyvisnyó and Répáshuta – and several key stakeholders, and a combination of quantitative and qualitative analyses were performed to assess local attitudes. The main results are similar to global trends, namely attitudes are neutral-negative. Irrational negative emotions and fear do not influence attitudes, while most respondents attributed intrinsic or aesthetic value to wolves. Negative attitudes are centered around the concept of damage caused by wolves, and the root cause of negative attitudes towards wolves and wolf management lie in deeper socio-economic tensions.

Keywords: attitudes, Bükk National Park, Canis lupus, human-wildlife conflict, Hungary, large carnivore conservation, socio-economics of nature conservation

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Acknowledgements

I am grateful to many individuals who helped me in the completion of this thesis. First, I would like to thank my supervisor, Dr. Brandon P. Anthony for the continuous guidance, feedback and encouragement. I am also grateful to Attila Bartha from the Bükk National Park Directorate for his support, and I would like to thank all the interviewees and questionnaire respondents for taking their time to answer my questions.

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List of Abbreviations

BNP	Bükk National Park
BNPD	Bükk National Park Directorate
EUR	Euro
HUF	Hungarian Forint
IUCN	International Union for Conservation of Nature
m.a.s.l.	Metres above sea level

1. INTRODUCTION

1.1. 2010: the wolf returns to BNP

Parallel to trends in Europe and North America, the population of large carnivores is slowly increasing in the Bükk National Park (BNP) in Hungary. After almost a century of absence, the wolf has re-entered the region in 2010, and has established a breeding population. Human-wolf conflicts immediately followed, as livestock owners reported depredation on sheep, and the local forestry company complained about the loss of wild game to wolves.

At the same time, due to camera-trap images of wolf pups and a related communication campaign by BNP, BNP wolf presence received nation-wide media coverage, gaining popularity among wolf advocates and the general public.

1.2. The social context of wolf conservation

Wolves, in general evoke extreme emotions from humans, more intensely than other large carnivores. Wolf advocates and wolf haters often clash over conflict incidents as well as more symbolic tensions. Wolves which re-enter territories from where they have already disappeared are especially subjects of negative attitudes.

As human persecution is the key limiting factor to wolf abundance, understanding the local human dimension – i.e. the social context is essential in order to understand the main challenges of wolf conservation. The following pioneering study is aimed at understanding the attitudes of local residents living in the small settlements in and around BNP towards wolves and wolf management.

1.3. Research problem

This study has the purpose of assessing and understanding the attitudes of residents living in and around of BNP towards wolves and wolf management, in terms of the large carnivore's recent, spontaneous re-appearance.

The major targets of the research are: the direction and strength of attitudes, the main concepts by which attitudes are cognitively framed, and relation of attitudes to socio-demographic variables including age, gender, and education.

1.4. Thesis Structure

First, a literature review will be presented on the main elements of the conceptual framework of the research: current trends and challenges of conservation of large carnivores and wolves, the socio-psychological background of human attitudes towards large carnivores, and the characteristics of BNP and the local socio-economic context of the region.

Second, the research methodology involving quantitative and qualitative techniques, the sampling process, and the study locations will be presented. Third, the research results will be presented, using descriptive statistical tools and the presentation of qualitative findings. Finally, in the Discussion chapter, the potential backgrounds, root causes, and explanations of the results will be considered, with the aim of identifying correlations and nexus between the various emerging concepts and between the identified conceptual framework.

2. LITERATURE REVIEW

2.1. Conservation of Large Carnivores

2.1.1. The challenges

Globally, habitats of large carnivores are shrinking due to the expansion of human population and their activities, which negatively impacts carnivore populations in several ways, including habitat loss, fragmentation, and traffic kills (Linnell 2013). Because of the expansion of human activities, human-carnivore conflicts are also more frequent. Regarding large carnivores, the main source of conflicts with humans is threat of attacks on humans, depredation on livestock, and competition on prey (Anthony and Szabo 2011; Carter and Linnell 2016). Besides the material loss, other factors play an important role in the severity of human-carnivore conflicts, such as coping capacity, cultural beliefs/values, knowledge on ecology/wildlife, perception of damage, and often where poor and marginalized people come into conflict with wildlife, especially in developing countries (Anthony and Szabo 2011; Linnell 2013).

As poaching and general negative attitudes towards large carnivores increase, a major challenge of carnivore conservation is human-predator conflict management and mitigation (Van Eeden *et al.* 2017). At the same time, large carnivore conservation needs extensive and often isolated territories, which competes with human expectations (e.g. recreational activities, production of tangible products such as timber) from the management bodies of protected areas in developed countries (Primm and Clark 1996). Further difficulties of large carnivore conservation are: the difficulty of establishing coordinated actions on the large (often transboundary) territories where large carnivores roam, the intensity of conflicts raising strong emotions, symbolism and cultural value of large carnivores, trade-offs (e.g. human recreational needs in the territories isolated for carnivore protection), and misinformation (exaggeration or downplaying of

conflicts) (Linnell 2013). At the same time, under favorable carnivore management practices large carnivores can co-exist with human populations, even with high human densities, and it has been postulated that there is no direct link between carnivore extinction probability and human population density (Bruskotter and Shelby 2010; Linnell *et al.* 2001).

2.1.2. The human dimension

In order to reduce the impacts of large carnivores on human existence, several measures are being applied, such as economic compensation and incentives, information campaigns, habitat protection, technical changes to livestock husbandry, restoration of wild prey populations, limitation of the hunting of large carnivores, and lethal control (Carter and Linnell 2016; Van Eaden *et al.* 2017). The impact is, however, not always of financial nature: for example, in the case of livestock depredation, the loss is also perceived as an indirect evidence for a lack of respect from the society (usually in favor of large carnivores) towards the farmer's job, and such incidents are being either greatly exaggerated or totally down-played by various actors (Linnell 2013). Overall, coexistence strategies should be location-specific, incorporating cultural values and environmental conditions, and based on an evidence-based policy (Van Eaden *et al.* 2017).

The approach to conservation, which has been traditionally focusing exclusively on the aspects of ethology and biology, has begun to shift to the direction of the "human dimensions", i.e. embracing social, political, ethical, and cultural factors. If more relevant stakeholders are considered (and not just wildlife management professionals), the root cause behind the lack of tolerance towards large carnivores can be better understood, and large carnivore conservation efforts are likely to become more successful. Therefore, social science theories and methods, and increased dialogue and participation between diverse stakeholders are important in enhancing our understanding of issues related to large carnivore management and conservation

(Bruskotter and Shelby 2010**;** Carter and Linnell 2016; Linnell 2013; Primm and Clark 1996,**).** In general, carnivore conservation is often a surrogate for larger cultural conflicts, such as recreation-based economies versus extraction-dependent economies, urban versus rural values, top-bottom versus bottom-up decision-making, and preservation versus the use of resources (Primm and Clark 1996).

2.1.3. Tendencies in Europe

In Europe and North America, the population of large carnivores (e.g. wolf, bear) is steadily increasing, and the species re-enter into areas where they had been extirpated (Bruskotter and Shelby 2010; Linnell 2013; Mech and Boitani 2010). The increase is caused by the legal protection of carnivores, efficient practices of human-carnivore coexistence (Chapron *et al.* 2014), land use changes, rural human population shifts to cities, and changes in cultural beliefs (Anthony and Szabo 2011; Mech and Boitani 2010). As the populations of large carnivores and the habitats they occupy increase, it is likely that human-carnivore conflicts will increase as well (Bruskotter and Shelby 2010; Linnell 2013).

In the European Union, the protection of large carnivore species is defined in the "Habitat Directive", which is in effect through the designation of Natura 2000 sites and species protection provisions (Council Directive 92/43/EEC 1992). However, interpretation and implementation can be controversial and problematic in the geographically, culturally and demographically diverse EU (Trouwborst *et al.* 2016). For example, often there is insufficient law enforcement at the domestic level – e.g. the illegal killing of species protected under the Directives happens, such as wolves in southern Spain – or there is lack of clarity over the 'favorable conservation status' – e.g. whether they should be measured upwards from extinction or downwards from carrying capacity – generating controversies over the status of particular populations, such as the Scandinavian wolf population (Trouwborst *et al.* 2016).

2.2. Wolf conservation

2.2.1. Characteristics of the wolf (Canis lupus)

The wolf (*Canis lupus*) occupies a great diversity of territories with extremely different climates, topographies, vegetation, and human densities, with a wide range of relative abundances (Mech and Boitani 2010; Sillero-Zubiri *et al.* 2004). They occur primarily in remote wilderness areas, however they also adapted to the proximity of humans (Sillero-Zubiri *et al.* 2004; Szemethy *et al.* 2004). Wolves are apex carnivores, and mostly feed on ungulates (deer, moose, wild boar, etc.), but also consume smaller prey, livestock, and even garbage; their average food consumption is about 2.5-6.3 kg per day. In summer, or at low wolf density wolves hunt alone or in pairs, while in the winter and at high wolf densities they hunt in packs. They are well adapted for cursorial predation; however, they tend to select animals in weak condition (e.g. old, young, or injured, sick animals), therefore, they exercise an important top-bottom control in the food chain (Sillero-Zubiri *et al.* 2004; Szemethy *et al.* 2004). The ecological role of wolves, and their role in changing community structure among multiple trophic levels through cascades has been studied mostly in North-America, however, it cannot be generalized in all ecological and social conditions (Ripple and Breschta 2012; Linnell 2013).

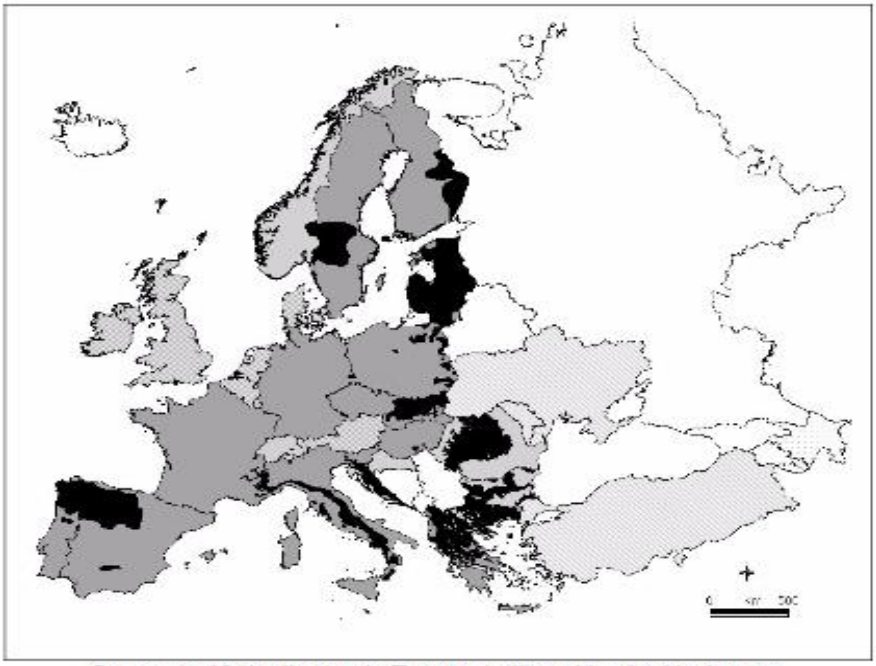
Wolves live in packs of 5-12 individuals, where only the dominant couple breeds. They occupy territories of 75-2500 km2, with densities being highest where prey biomass is highest. The territories are maintained through howling, scent-marking, and direct killing (Sillero-Zubiri *et al.* 2004; Linnell 2013). Wolves are proliferous mammals; the major natural causes of mortality are intraspecific strife and starvation (Sillero-Zubiri *et al.* 2004).

2.2.2. Conservation status

The wolf used to be the world's most widely distributed mammal, with an extensive distribution throughout the northern hemisphere. However, its world-wide range has been reduced by

approximately a third, and has been extirpated in much of Western Europe and North America, primarily because of deliberate persecution due to livestock depredation (Mech and Boitani 2010; Sillero-Zubiri *et al.* 2004). Since the 1970s, widespread wolf population declines stopped, and many populations started to grow, mostly due to legal protection, changes in land-use, rural depopulation, and in some areas of the United States, re-introduction. Also, the conservation of wolves had increasing cultural support (Marucco and MacIntire 2010; Mech and Boitani 2010; Sillero-Zubiri *et al.* 2004). In Europe and North America, although wolf populations are increasing, the major threats of wolf conservation still persist, such as competition for human livestock, exaggerated concern for human safety, and habitat fragmentation (Mech and Boitani 2010; Sillero-Zubiri *et al.* 2004). Poaching has a severe impact on population recovery, the intensity of which might be underestimated (Liberg, *et al.* 2012).

The wolf is currently categorized as "Least Concern" in the IUCN Red List of Threatened Species (Mech and Boitani 2010), however in several territories wolf populations are categorized as "Vulnerable" (e.g. Italian Peninsula), "Endangered" (e.g. Scandinavia), or "Near Threatened" (e.g. Iberia) (Large Carnivore Initiative for Europe. 2007). In Europe, wolf distribution is uneven (Figure 1). The wolf is protected in the continent based on its listing in Appendix II (strictly protected species) of the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 19.9.1979), however enforcement relies on the countries themselves, and the legal status of wolves can vary from total protection to legally controlled shooting (Salvatori and Linnell 2005; Szemethy *et al.* 2004).



Current wolf distribution in Europe, indicated by the black areas.

Legend

- Countries with recorded wolf presence, not included in the EU, that have ratified the Bern Convention.
- Countries with recorded wolf presence, included in the EU, that have ratified the Bern Convention.
- Countries with recorded wolf presence, not included in the EU, that have ratified the Bern Convention, for which a map was not available.
- Countries not included in the EU, that have ratified the Bern Convention, not included in the present report.
- EU countries where wolf is absent.
- Countries not included in the EU, and that have not ratified the Bern Convention.

Figure 1 - Current distribution of wolves in europe, marked by black areas. Source: Salvatori and Linnell 2005

2.2.3. Human-Wolf conflict

From a human-wildlife conflict point of view wolves are “problematic” animals. The main reasons are: material loss caused by depredation on livestock and competition on prey, fear from wolf attacks on humans, and deeper socio-cultural tensions, such as opposition between rural-urban communities and a lack of trust in authorities (Hojberg *et al.* 2016; Linnell 2013).

Depredation on livestock

Underprotected grazing of livestock (sheep and cattle) can become easy prey for wolves (Szemethy *et al.* 2004). Areas with the highest risk of wolf depredation are the ones with a high wolf abundance and sparsely populated by humans (Kaartinen *et al.* 2009). Wolf attacks are significantly more destructive on stray livestock, or on animals kept inside non-predator-proof enclosures, than livestock guarded by a shepherd, or by sheepdogs (Iliopoulus *et al.* 2009). In case of a high wolf density, attacks on domestic dogs can also be a significant damage, which is a major source of conflict due to the strong emotional bond between dog owners and dogs (Linnell 2013; Szemethy *et al.* 2004). At the same time, dogs can represent a direct threat for wolves through hybridization, disease transfer and competition. Wolf-dog interactions can be highly complex, with profound implications towards human understandings of the dichotomies between wild and domestic, and between nature and culture (Lescureux and Linnell 2014). Commonly, the financial compensation of damage and the provision of subsidies for active measures to protect livestock is desirable by livestock breeders, even if their major economic factor is often the low consumer demand for their products, and not the presence of wolves (Kovarik *et al.* 2014).

Competition on wild game

Regarding competition for wild game, the extent to which the competition is real or only perceived varies widely with context, but carnivores can lead to reduced hunting bags. It is more suspectible though, that the conflict is caused by the fact that the presence of predators influences behavior of wild ungulates, making hunting more time consuming, and reducing the high densities of wild game at feeding sites (Linnell 2013). According to several studies, the population growth of e.g. deer is not reversed even under relatively strong predation pressure (Sver *et al.* 2016; Szemethy *et al.* 2004), however more research is needed to document the impact of wolves on large ungulate numbers (Linnell 2013).

Fear of attacks on humans

Although the objective risk of a wolf attacking humans causing death or injury is extremely low, there have been documented lethal wolf attacks, and wolves are documented to be highly aggressive when infected with rabies (Linnell 2013). Commonly, the perceived fear and risk is high, especially in areas where the wolf re-appeared after a long period of absence (Linnell 2013).

Social context

Due to the high adaptability of wolves, the only limiting factor to their existence is human persecution, therefore, wolf conservation is less of an ecological issue, but rather a social one. This poses a challenge in wolf management and conservation especially in the context of transboundary territories (Salvatori and Linnell 2005). The lack of tolerance appears to be a greater concern in areas where the species return after long periods of absence, and in areas where protection is imposed on previously hunted populations (Linnell 2013).

Wolves have been recently expanding to landscapes dominated by humans, especially territories highly fragmented by residential areas and human infrastructure (Kojola *et al.* 2016; Linnell 2013; Mech 2017). Some studies imply that wolves are still able to roam large areas despite high densities of roads and a dense human population, thus existing anthropogenic infrastructure does not restrict wolf dispersal (Gula *et al.* 2008). Besides population and pack sizes, understanding spatio-temporal dynamics of packs and identifying corridors and barriers are essential in preventing livestock predation and implementing efficient wolf management practices in highly human-dominated landscapes (Marucco and MacIntire 2010). According to Imbert *et al.* (2016), the presence of stable packs instead of dispersing wolves (dispersing individuals having greater livestock consumption), the adoption of prevention measures on

pastures, wild game abundance, and the percentage of deciduous woods, all reduce predation on livestock.

In order to prevent wolf attacks the most important steps are: the combat of rabies, the restoration and efficient management of their habitat and prey species, and keeping wolves wild – i.e. not letting them associate humans with food – (Linnell *et al.* 2002). Zoning is also an important strategy – i.e. applying several types of management in different zones – ranging from total protection in national parks, where conflict with humans is minimal, to elimination, where conflict is too great (Mech 2017). Finally, the fact-based inclusion of divergent viewpoints of wolf advocates, game managers and hunters, and other stakeholders is necessary, considering social structure and ecosystem objectives (Smith *et al.* 2016).

2.2.4. The wolf in Hungary

From extirpation to protection

In Hungary, similarly to many European regions, the wolf population radically decreased by the end of the 19th century, and it was extirpated from almost all its territory. During the 20th century, the occasional appearance of wolves was reported in north-east Hungary, in the Aggtelek region and the Zemplén-Mountains, and on the southern border, between the Duna and Tisza Rivers. However, the data on wolf observations is scarce, unsystematic, and often contradictory. Until the end of the 1990s, the wolf was considered to be extinct, and since it was not listed as a protected animal, the shooting of lone individuals was permitted (Szemethy *et al.* 2004). The following quotation from a book from 1967 – a preparation aid for the exam necessary to obtain a hunting license – *What is there to know about recreational hunting? Aid for the preparation to the hunting exam* reflects the untolerated status of the wolf in Hungary:

> "In a well-managed hunting territory, the wolf is unacceptable, because it unselectively kills deer, roe deer, and other wild game. It is a bloodthirsty animal, and a relentless killer of wild game and of livestock as well; it causes substantial damage, especially in sheep herds. If there are more than one wolves, they form packs during winter, and chase the wild

> game weakened in the winter conditions. Therefore, the wolf's introduction and proliferation is undesirable. The wolf's presence can be recognized based on its footprint, the leftovers from its prey, and the alertness of wild game." (Szederjei and Róna, 1967)

Since the 1980s, the size of the Hungarian wolf population started a spontaneous, volatile, but growing trend (Heltai 2002; Szemethy *et al.* 2004). In 1993 the wolf was enlisted as a protected species, and in 2001 it was classified as highly protected; its monetary value is 250.000 HUF - approximately 803 EUR[1] (Szemethy *et al.* 2004). In 2004, the action plan for wolf management was accepted by the Ministry of Environment and Water, including a financial initiative for damage prevention measures (Szemethy *et al.* 2004). In the Natura 2000 Nature Protection action plan of Hungary, the wolf is indicated as a surrogate species in several terrestrial habitat types (Natura 2000, 2013)

Population size and occurrence

The wolf population is concentrated in the North-East, at the Aggtelek, Zemplén and Bükk regions, and the south of Hungary (see Figure 2). The size of the Hungarian wolf population is limited to a few individuals; there are about 10-25 single individuals of wolves present in Hungary (Kaczensky *et al.* 2012). The monitoring of wolves, and in general, large carnivores in Hungary is largely based on personal opinions and rarely on systematic scientific methods (Szemethy *et al.* 2016).

According to a study conducted in the Aggtelek National Park in Hungary, based on scat analysis and prey remains, wolves consume mostly wild living ungulates (74%), of which wild boar and red deer are the most common species (with a high population density), while the low population density mouflon and livestock have low importance in wolf diets (Lanszki *et al.* 2012). The populations of prey species preferred by wolves are currently considered as

[1] Converted by the 2016 yearly average foreign exchange rate of the Hungarian National Bank (MNB 2017)

oversized in Hungary (Szemethy *et al.* 2004). The main threats of Hungarian wolves are illegal killing, habitat fragmentation, and a possible interruption of the dispersal corridor to Serbia and Slovakia (Boitani 2000; Salvatori and Linnell 2005; Szemethy *et al.* 2004).

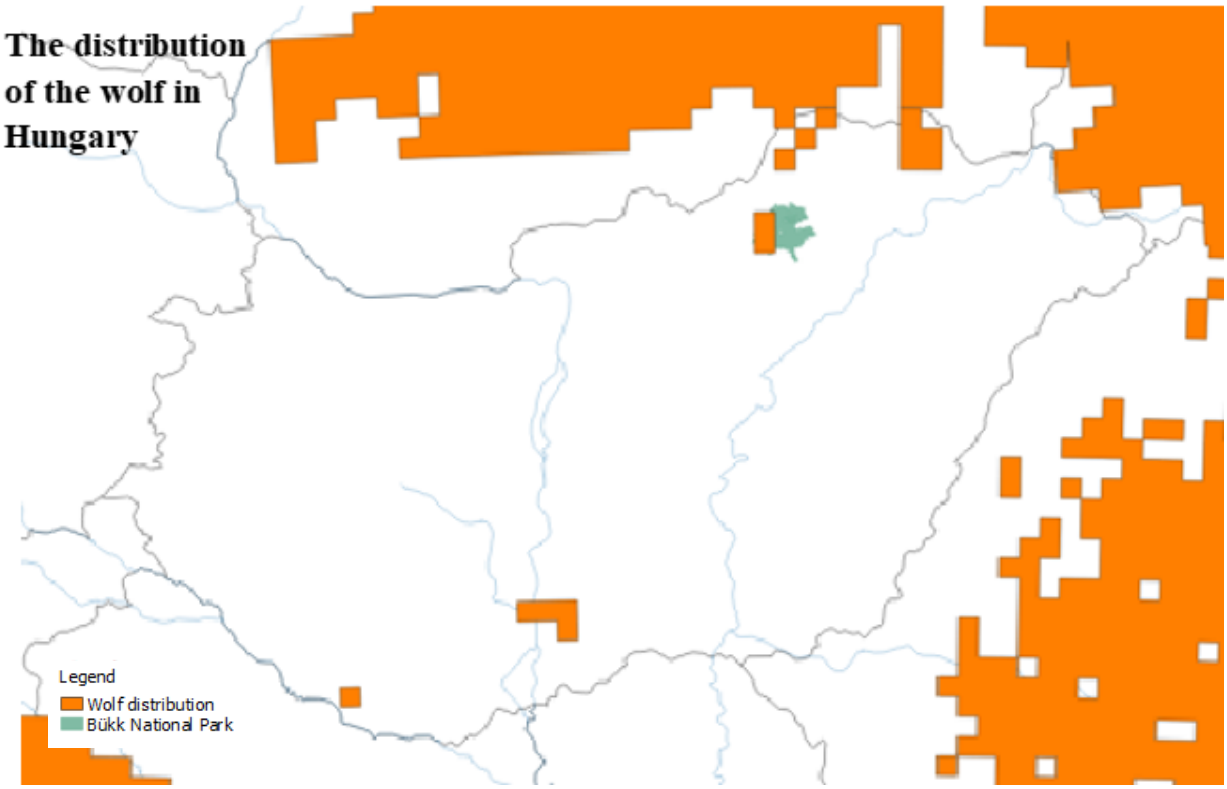


Figure 2 - The distribution range of the wolf in Hungary, marked with orange. Data source: IUCN 2010

2.3. Attitudes towards large carnivores

2.3.1. What are attitudes?

Human beings' perception of the world is filtered through a variety of cognitive-emotional constructs that are socially shaped. These constructs vary from ideologies and moral systems to values and attitudes, which differ in their level of abstraction (Hitlin and Pinkston 2013). For attitudes, the following general definition will be used: "an attitude is a psychological tendency, expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly and Chaiken 2007).

Attitudes can be explicit or implicit. Explicit attitudes can be measured by self-report instruments, relying on the assumption that individuals are telling the truth and they are able to recall them. However, self-reports of attitudes are of limited use where strong normative pressures shape responses, as internal or social sanctions augment motivation to comply with norms (Heberlein 2012). Implicit attitudes develop from previous experience and are activated without conscious awareness. Often individuals are not even aware of their implicit attitudes, therefore they have to be measured indirectly, for example, by the Implicit Association Test. They influence judgements, perceptions, and actions towards the attitude object. Overall, attitudes are developed in interaction with the world, and therefore they are potentially subject to social critique, discussion and revision (Hitlin and Pinkston 2013).

Attitudes and behavior

Attitudes contain an implicit action towards or away from the object, however attitudes are of limited use where strong normative pressures shape responses. Implicit attitudes are stronger predicators of behavior than explicit measures in situations where social desirability shapes the explicit measures. Implicit mechanisms measure deeper, spontaneous aspects of attitudes, which are more insulated from societal pressures and social desirability biases. Explicit

attitudes are correlated with behavior at a higher rate, but only across a certain class of behaviors – for socially sensitive topics (such as race or sexual preferences) they lose predictive power (Hitlin and Pinkston 2013).

Sometimes there is a failure to act consistently with one's attitudes, and there is a divide between attitude and behavior. For example, situational constraints can lead to a behavior contrary to one's attitude – e.g., an individual with positive attitudes towards the environment can demonstrate an anti-environmental behavior, such as poaching, due to poverty and unemployment (Heberlein 2012). Attitudes with limited horizontal structure (i.e. attitudes which are linked to a limited number of sets of beliefs) are easier to change, while attitudes with a more complex horizontal structure are more solid. Also, attitudes based on direct experience are better developed, and the more specific an attitude is to behavior, the better it predicts behavior (Heberlein 2012). Attitudes that are more central to an individual's sense of self become more chronically accessible, and present more stability across time and situation (Hitlin and Pinkston 2013).

Classically, attitudes are understood as having a unidimensional positive vs. negative nature, which can be moderated by relevant beliefs about the circumstances behind that attitude as well as the subjective belief about that object's relation to the social world (Hitlin and Pinkston 2013). For example, individuals tend to look for material and stimuli that confirm their attitudes, while avoiding information that contradict them (Hitlin and Pinkston 2013). Emotions have an evaluative nature and influence the formation of attitudes, while beliefs, knowledge structures, perceptual responses and thoughts constitute the cognitive component (Pohja-Mykra and Kurki 2014).

The perceived audience affects the way in which attitudes are expressed as well as how people want things to be done (Pohja-Mykra and Kurki 2014). Also, social roles influence experience, and thus also influence attitudes (Heberlein 2012).

2.3.2. Attitudes towards large carnivores

The following cognitive components of attitudes towards large carnivores will be studied: values (intrinsic and utilitarian), knowledge, emotional dispositions, fear, direct experience, and socio-economic characteristics such as age, gender, location, education.

Values

The values that individuals associate with wildlife are substantial aspects of their attitudes. One aspect is the attribution of *intrinsic value* to entities in nature. From this point of view, the attribution of intrinsic values, or in other words, morals towards nature can be categorized in the following way: anthropocentrism attributes intrinsic value only to humans; zoocentrism to some non-human animals in addition to humans; biocentrism to all living things; and ecocentrism includes ecological collectives in with intrinsic value (Lute *et al.* 2016).

Regarding large carnivores, the attributed value can mean intense, contradictory concepts (Allen *et al.* 2017). Large carnivores are often perceived as harmful, and not only because of the material damage (e.g. livestock killing, competition on wild game, attacks on humans) they cause. While the negative economic impact is a significant cause for negative attitudes, the perception of how much damage they cause often emerges as a more relevant factor than the actual damage (Anthony and Szabo 2011; Hojberg *et al.* 2016; Linnel 2013). On the other hand, the conservation of large carnivores has an increasing cultural support, mostly because of the animals' aesthetic and cultural value (Linnel, 2013).

From a cultural point of view, the wolf has a very controversial status. It was considered an enemy by most agricultural people – a threat to livestock and even to human life. At the same time, some indigenous people in North America and Central/Northern Asia respected the wolf or considered it as a sacred animal; while, in these regions the wolf is also being hunted or trapped for its fur (Salvatori and Linnell 2005; Sillero-Zubiri *et al.* 2004,). Nowadays, the conservation of wolves has increasing cultural support, and wolves are mostly valued for their aesthetic and cultural value, which can help compensate for conflicts with humans (Mech 2017). Also, their role in the ecosystem as apex predator is also being increasingly appreciated (Mech 2017). The values behind negative attitudes are, however, well-grounded. According to a study, for farmers, the wolf is a symbol of urban society's dominance, embodying alien values about the use of animals and natural resources (Heberlein 2012). This can also be explained by farmers holding strong utilitarian attitudes, and not appreciating wolves because they lack practical values (Hojberg *et al.* 2016).

Knowledge

It is an interesting question how knowledge can be associated with attitudes towards large carnivores, especially, because knowledge is usually a source of power (Linnell 2013). According to Wechselberger *et al.* (2005), a positive correlation was found between knowledge on large carnivores and level of acceptance, except among those most affected by real or perceived damage (i.e. people working in the woods). A possible explanation can be that stakeholders of higher knowledge of large carnivores are likely to have less fear about them (Johansson and Karlsson 2011). However, the level of an individual's knowledge is a complex concept. Regarding large and charismatic carnivore species, many people feel that they have valid knowledge, which might cause disagreements about questions on the number of killed livestock, the size of a carnivore population, or the origin of large carnivores in the area (Linnell 2013). This is complicated by the presence of a diversity of knowledge forms (such as scientific

knowledge, local and traditional knowledge), and the legitimacy and value of which has been widely recognized in conservation science. However there are still several practical obstacles to integrating different knowledge systems in the conservation of large carnivores. (Linnell 2013). Furthermore, a deliberate spreading of rumors and misinformation (e.g. on the level of risk the predators cause, or about their secret, illegal reintroduction) has become a central part of the politics of large carnivore conservation in Europe today (Linnell 2013). Also, the deep-rooted Euro-American historical and cultural bias towards eliminating predators probably still influences negative attitudes (Clark *et al.* 1996).

Knowledge about wolves and the level of their acceptance are positively correlated (Wechselberger *et al.* 2005). At the same time, many people with different backgrounds and interests claim that they have valid knowledge on wolves, which might create controversies about questions like how many sheep wolves kill, how many wolves exist, and from where wolves originate in the area (Linnell 2013). Misinformation and rumors that exaggerate or downplay the risks that wolves pose, or that imply that wolves have been secretly and illegally reintroduced (as opposed to have recolonized an area naturally) is common not only in society, but in higher levels of decision-making as well (Linnell 2013). For example, according to an attitude survey in Slovakia, wolves were held responsible for four to six times more damage than brown bears, even if the genetic analysis of wolf faeces proved that to be false (Rigg *et al.* 2011).

Culture – such as literature, movies, folklore art and modern mass media – have an important impact on people's knowledge about wolves. For example, recently a short video got highly popular in social media, promoting the positive impacts of decreasing plant herbivory through cascading effects of wolves reducing the number of prey (Sustainable Human 2014). However, similar media and communication products, which often used to support interventionist wildlife

management practices often disregard or devalue fundamental principles of the scientific method when communicating the reliability of current evidence for the ecological roles that wolves may play (Allen *et al.* 2017). Furthermore, relevant decisions are commonly taken in the absence of reliable population data and are driven by factors other than biological considerations (Popescu *et al.* 2016).

Emotions

Emotional dispositions, i.e. the reactions of anger or sympathy to various scenarios that may influence how individuals think wildlife should be managed, are also significant because they determine acceptability, or the cognitive assessment about whether a policy is permissible (Lute *et al.* 2016). Carnivores often trigger strong direct emotions ranging from admiration and respect to fear and hatred (Linnell *et al.* 2002; Pohja-Mykra and Kurki 2014; Primm and Clark 1996). While society's general attitude towards large carnivores is turning positive, the process started relatively recently, and it takes significant time. Especially, because the question impacts diverse stakeholders on very different levels, and also, because the concept of human-nature relations can be based on conflicting values, for example the idea of "using" nature versus "preserving" nature (Linnell 2013). Furthermore, large carnivores can become surrogates of other, general symptoms of a changing society, such as rural depopulation, the drifting apart of urban and conservative rural values, decline of traditional rural economic activities and the physical transformation of landscapes, or the new procedures (e.g. species protection and land use restrictions) and the fact that they originate from far away, from levels that many rural people feel powerless to influence (Hojberg *et al.* 2016; Linnell 2013, Pohja-Mykra and Kurki 2014; Wechselberger *et al.* 2005).

In general, wolves generate strong feelings that vary widely among different cultural groups, making passionate supporters and enemies as well (Linnell 2013; Primm and Clark 1996).

While the fear of wolves attacking humans is exaggerated, at the same time, the fear is rooted in dramatically perceived historical records on wolf attacks on humans. Nowadays, with an increasing positive attitude towards conservation and wolves in general, such feelings of fear are often ridiculed by wolf advocates, and often the language used hinders the understanding of the impact of wolf attacks. For example, the meaning of phrases such as "there are no records of an unprovoked, non-rabid wolf in North America seriously injuring a person" depend a lot on the interpretation of the used terms (such as "record" or "serious injury"), and might omit incidents which had been perceived as severe attacks (Linnell *et al.*, 2002). Other studies show that wolves are less tolerated by human populations than other large carnivores, and for example, the coverage of wolf attacks in the media can be thirty-fold higher than compared to bears (Fernandez-Gil *et al.* 2016; Linnell 2013). Therefore, wolf attitudes are highly emotional, and passionately opposing parties tend to disregard facts and use a biased, non-flexible argumentation. Despite the strong emotions about wolves, individuals mostly justify their negatives attitudes and linked behavior (e.g. illegal retaliatory killing) with reasonable arguments, often considering them as acts of justice (Pohja-Mykra and Kurki 2014).

Fear

Fear about the safety of humans and domestic animals is the most widespread emotion towards large carnivores (Hojberg *et al.* 2016; Johansson and Karlsson 2011; Pohja-Mykra and Kurki 2014; Treves *et al.* 2013; Wechselberger *et al.* 2005). According to some studies, the subjective experience of fear is primarily linked to the perceived danger or damage that the animal represents and the perceived uncontrollability of the person's own response when encountering an animal, while feelings of disgust and perceived unpredictability of the animals' movements were of less importance (Johansson and Karlsson 2011). The level of fear varies between different socio-demographic and stakeholder groups. For example, women and older people are more afraid of large carnivores, while men, younger individuals and hunters and

conservationists are less afraid of them (Johansson and Karlsson 2011). The level of fear towards large carnivore presence does not influence the overall clear support for their conservation, while the importance of having a sense of control over situations is a common factor in supporting more positive attitudes (Anthony and Szabo 2011; Linnell 2013). According to Johansson and Karlsson (2011), "the psychological experience of fear is likely to have implications for the management of brown bear and wolf, since self-reported fear has been shown to affect public interest in supporting management and conservation measures of these species".

Fear is the most common emotion towards wolves. For example, according to a survey conducted in Finland, negative attitudes towards wolves were based on anger and fear for children and domestic animals as well as frustration toward the authorities and the lack of adequate management actions (Pohja-Mykra and Kurki 2014). The exaggerated perception of wolf attacks is also widespread (Mech 2017). Often much of the fear that is expressed towards wolves are directed at the symbols that the wolf represents, rather than fear from an actual physical risk. Also, wolves often become symbolic of many other wider issues with which they are only partially connected – such as tension between rural and urban values and lifestyles, attitudes towards nature and nature conservation, or the unequal dynamics of power and influence (Linnell 2013; Linnell *et al.* 2002; Mech 2017).

Socio-demographic attributes

Quantitative surveys of the attitudes of the public and of key stakeholder groups with respect to large carnivores show that a clear majority of both rural and urban publics support the underlying principle of large carnivore conservation in Europe (Linnell 2013; Wechselberger *et al.* 2005). However, several variables (age, sex, location, occupation, education, experiences, time, etc.), diversify the attitudes towards large carnivores, and some multivariate analyses

reveal that the strongest predictor of tolerance is social group (Johansson and Karlsson 2011; Naughton-Treves *et al.* 2003).

Higher education, younger age, being male, and urban residence are predictors of more positive attitudes (Bruskotter and Shelby 2010; Naughton-Treves *et al.* 2003; Pohja-Mykra and Kurki 2014). Experience of living close to carnivores leads to more positive attitudes in some cases, whereas in other cases it leads to more negative attitudes (Linnell 2013). Wolves are associated with less positive attitudes than other large carnivore species (such as bear and lynx) (Linnell 2013; Wechselberger *et al.* 2005).

Rural citizens are generally negative toward wolves, often even if other wild species cause more damage (Agarwala *et al.* 2010; Wechselberger *et al.* 2005). Livestock owners and hunters (especially those concerned about losing valuable hounds to wolves) often have more negative attitudes than others because they experience or expect direct negative impacts of wolves on their livelihoods and activities. Also, women, older people, and people with lower educational level have more negative attitudes towards wolves (Bruskotter and Shelby 2010; Hojberg *et al.* 2016; Linnell 2013; Naughton-Treves *et al.* 2003; Pohja-Mykra and Kurki 2014; Wechselberger *et al.* 2005). There is less tolerance towards wolves in areas where the species return after long periods of absence, either via reintroduction or natural recolonization **(**Bruskotter and Shelby 2010; Chapron *et al.* 2014; Dressel *et al.* 2015; Pohja-Mykra and Kurki 2014; Linnell 2013; Wechselberger *et al.* 2005), while areas of increasing wolf abundance exhibit attitudes are more negative (Treves *et al.* 2013). Lone dispersers are particularly perceived with negative attitudes to a level, that in some areas, it has prevented or retarded wolf colonization (Mech 2017). Regarding direct encounters, some surveys found that deep-rooted social identity and occupation are more powerful predictors of tolerance of wolves than individual encounters with these large carnivores (Naughton-Treves *et al.* 2003)

The compensation for damages caused by wolves are supported by livestock owners, however attitudes are not reported or expected to be changed as a result of such programs (Agarwala *et al.* 2010, Naughton-Treves *et al.* 2003). Also, attitudes have been shown to change over time in both directions **(**Linnell 2013, Treves *et al.* 2013). The location of wolves is also an important factor: they can inhabit isolated and wild areas with little conflict with humans, but when they live outside wild lands, conflicts with humans greatly increase – especially, if people have fed wolves, habituating them and promoting attacks (Mech 2017).

Behavior

General attitudes toward large carnivores are good predictors of broad behavioral patterns; thus, attitudes toward them can be used as indicators to assess the social foundation for conservation efforts (Dressel *et al.* 2015). On the other hand, as attitudes do not always reflect behavior; the most crucial factor from a conservation point of view is that people's behavior does not have unsustainable impacts on carnivore populations, regardless of their attitudes (Linnell 2013). Overall, due to the complexity behind the attitudes of different stakeholders in carnivore conservation, besides the differences, common ground can also be identified (Mattson *et al.* 2006).

2.3.3. Conclusion

For a summary of the set of attributes which are predicators of positive or negative attitudes towards wolves, see Table 1. Overall, the tendency is that the support for large carnivores comes from a majority that is not directly affected by the damages that carnivores cause (e.g. urban population), while the costs for having carnivores are born by a small minority of the population (such as livestock breeders and hunters), who assume economic consequences. That might explain why the issue of power and influence is often central in human-carnivore conflicts. That

calls for careful considerations and compromises when evaluating the human dimension of wolf conservation and management (Linnell 2013).

Table 1- A summary of the predicators of positive and negative attitudes towards wolves identified in peer-reviewed scientific literature (source: Anthony and Szabo 2011; Bruskotter and Shelby 2010; Chapron et al. 2014; Dressel et al. 2015; Hojberg et al. 2016; Linnell 2013; Mech 2017; Pohja-Mykra and Kurki 2014; Rigg et al. 2011; Treves et al. 2013)

More positive attitudes	**More negative attitudes**
Male	Female
Younger age	Older age
More education	Less education
Residence in urban area	Residence in rural area
Sense of control over situation	Frustration toward authorities/ lack of proper management actions
Higher level of knowledge on wolves	Lower level of knowledge on wolves
Valuing conservation of nature – intrinsic value in nature	Anthropocentric/utilitarian view on nature.
Wolves located in wild areas	Wolves located in human dominated landscapes
Livelihood/ economic activities unrelated to wolf conservation	Livestock owner
	Hunter
Stable/non-increasing wolf population in the territory	Having property rights/resource use rights/economic interests and livelihoods restricted due to large carnivore conservation
	High perception of damage
	Region where wolf returned after a long period of absence
	Anger and fear for children and domestic animals
	Increasing wolf abundance in the territory

2.4. The BNP

BNP was established on January 1, 1977, as the third national park in Hungary. It is located in the Bükk Mountains – the southernmost part of the North-Western Carpathians – in the north-east of Hungary, covering 43,168.8 hectares (BNPD 2017a) (Figure 3). The territory of the Bükk Mountains has the highest average height in Hungary, with 50 peaks reaching above 900 m.a.s.l. (mean elevation of Hungary is 200 m.a.s.l.) (BNPD 2017b)

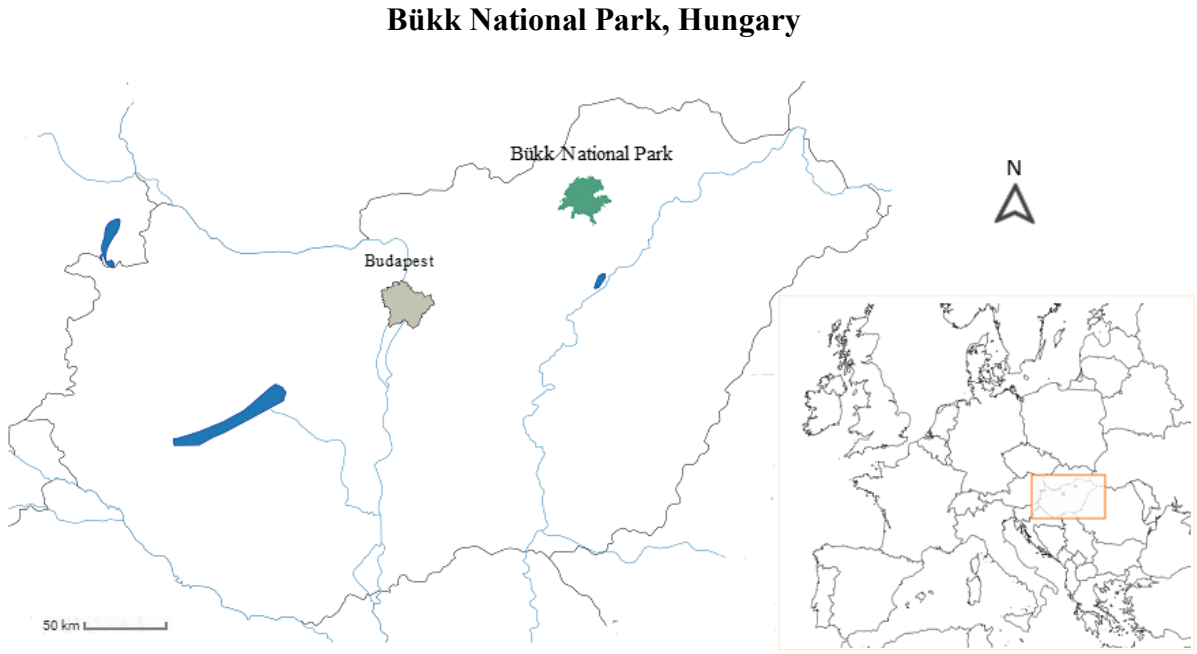


Figure 3 - Location of the Bükk National Park in Hungary. Data source: European Environment Agency 2016.

2.4.1. Climate, geography, wildlife

Within the warm continental/temperate continental climate of Hungary, the Bükk Mountains represents a cooler and more humid, mountainous region. The yearly average temperature varies between 4.5-10 °C, the yearly precipitation between 550-850 mm. Winters are long and cold, with 60-80 cm of snow cover for 40-100 days each year, while summers are short (yearly only 40-60 days of at least 25 °C of daily maximum temperature), cool and wet (BNPD 2017b).

However, there is a significant variance of microclimates in Bükk Mountains, depending on N-S orientation, elevation, morphology and bedrock. Southern slopes receive more sunlight and heat, the effect of which can be accelerated by the light-grey colored limestone, dolomite and rhyolite tuff bedrock intrusions, which reflect and diffuse the radiation. This results in microclimates with earlier springs and warmer temperatures, preferred by xerothermic plant species. On the other hand, the northern and north-facing slopes and karst caverns are colder and darker, where the light-colored bedrock absorbs less heat than the air, accelerating the cooling effect. In these areas colder, alpine microclimates have developed, with a cold-resistant vegetation. Due to the above mechanism, on some of the steeper ridges of the Bükk Mountains it is possible to locate plants within 50-100 meters, the habitats of which are normally located hundreds of kilometers apart (BNPD 2017b).

Therefore, the flora of Bükk National Park is diverse and rich, with about 1500 vascular plant species, of which 200 are protected, and 2 are endemic. The most common plant associations are the zonal, closed forests, occupying about 95% of BNP territory. The forests are dominated by beech (*Fagus sylvatica,* in Hungarian "Bükk," from where the name of the mountain range originates*),* sessile oak (*Quercus petraea*), while common hornbeam *(Carpinus betulus),* Austrian oak (*Quercus cerris*) and non-native pine species are also common (BNPD 2017c). Because of the extreme rocky habitats and diverse microclimates, there are other, rarer forest associations as well, together with open steppe-fields, rock-lawns and rocky grasslands on the warmer and drier areas, and cool ravine- and rock forests and shrubberies rich in relict plant species in the colder north-facing habitats. Due to human agricultural activities, other valuable plant associations have developed, such as montane hayfield meadows (BNPD 2017c).

The fauna of BNP is considerably rich, including several endangered and endemic species. Boreal, Boreo-Alpine, Alpine and Carpathian elements as well as Sub-Mediterranean, Balkan

and Continental elements dominate the fauna. The greatest values of BNP fauna are the diurnal birds of prey, many of which are threatened across Europe, such as endangered imperial eagle (*Aquila heliacal*), lesser spotted eagle (*Aquila pomarina),* short-tailed snake eagle (*Circaetus gallicus),* and peregrine falcon (*Falco peregrinus).* Among the mammals, the bats – representing all the Hungarian bat species – are the most remarkable, who can breed successfully in large numbers, due to the protected caves where they can survive the winters. Ungulate big game – such as red deer (*Cervus elaphus*), mouflon (*Ovis aries*) and wild boar (*Sus scrofa*) – are considered excessive, putting a remarkable burden on the vegetation. Large, protected predators, such as the wolf (*Canis lupus*) and the lynx (*Lynx lynx*) which were once extirpated in the area, are returning to BNP (BNPD 2017d).

2.4.2. Socio-economic profile

The territory of BNP has been inhabited by humans since the Paleolithic (BNPD 2017e). People in the area have always based their livelihood on the natural resources of the Bükk Mountains. Besides logging for firewood and timber, charcoal burning, lime burning, glass production, iron production, and shingle-making are the most common traditional activities. (BNPD 2017e; Veres 2003)

From the second half of the 20th century, several large industrial complexes operated in the region – e.g. one of Hungary's largest cement plant in Bélapátfalva, at the border of BNP (Bélapátfalva 2017). Following the collapse of the Communist regime, in 1989-1992 most of these industrial plants were closed, in parallel with the massive restructuring of agriculture, triggering high rates of unemployment, poverty, and the emigration of active age groups from the region to more prosperous regions of Hungary (Bélapátfalva 2017; Roaf *et al.* 2014). Rural depopulation and aging population continues to be one of the major socio-economic challenges in the region, especially in small settlements similar to the 3 target settlements of this study.

Most of BNP's protected area (65%) is located in Borsod-Abaúj-Zemplén county, and 35 percent in Heves county (BNPD 2017a). These counties are located in the socio-economically least advantageous region of Hungary. Borsod-Abaúj-Zemplén county is among the socio-economically least developed counties in Hungary, while Heves county is close to the Hungarian average, which is reflected, for example, in the unemployment rates and monthly average net income (Figures 4 and 5). As the figures show, the Hungarian average unemployment rate (4.4%) is slightly exceeded by Heves county's (4.5%), and significantly by Borsod-Abaúj-Zemplén county (6.5%), while the national average monthly net salary (HUF 175 009=EUR 561.9) is significantly higher than Heves's (158 956 HUF=510.36 EUR) and Borsod-Abaúj-Zemplén (133 906 HUF =429.93 EUR).

Unemployment rate per region, Q4 2016

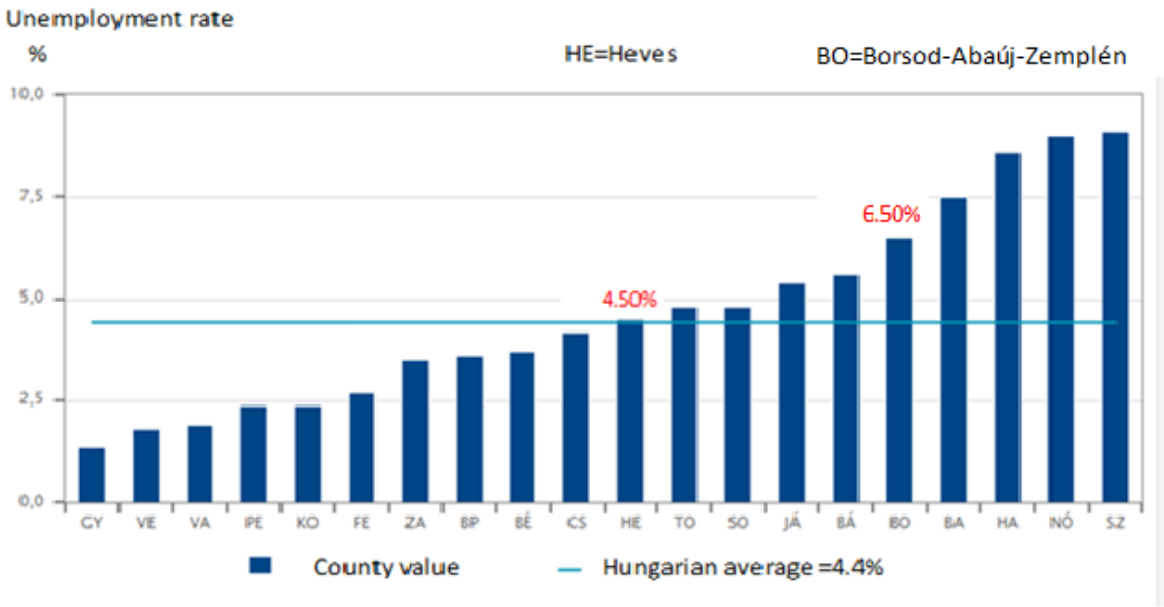


Figure 4 - Unemployment rate in Hungary per county, in Q4 2016, based on data on 15-74-year-old residents. Both Heves and Borsod-Abaúj-Zemplén counties are below the Hungarian average, and Borsod-Abaúj-Zemplén is among the regions of the highest unemployment in the country. (Source: KSH 2016, with amendments)

Average monthly net salary, 2016 Q1 – Q4

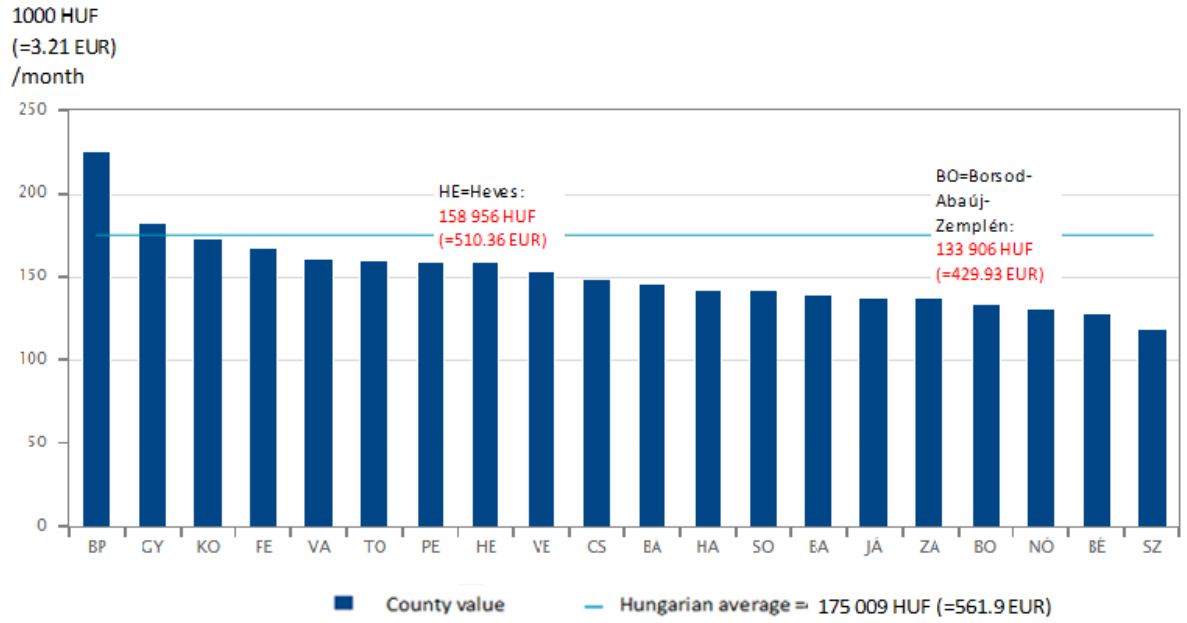


Figure 5 - Average monthly net salary, 2016 Q1 – Q4. Source: KSH 2016, with amendments.

Rural depopulation and migration to more advantageous regions of Hungary due to the lack of work opportunities is another important socio-economic characteristic of the region. Although statistical data is not available to the most critical period, following the economic crisis of 2008, it is clear even looking at the pre-crisis period between 2000-2007, that the emigration from both counties is significant, especially in the case of Borsod-Abaúj-Zemplén, where the 2007 emigration rate reached 9.3 (see Figure 6). The municipalities fully or partially overlapping the Bükk National Park can be seen on Figure 7.

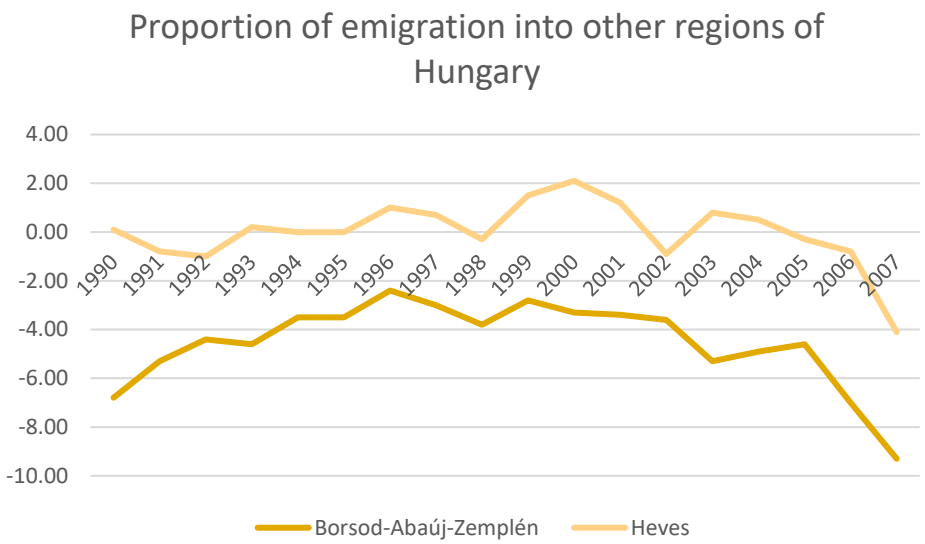


Figure 6 - Proportion of emigration of the two counties within Hungary. Negative values mean net emigration. Data source: KSH 2017a, 2017b

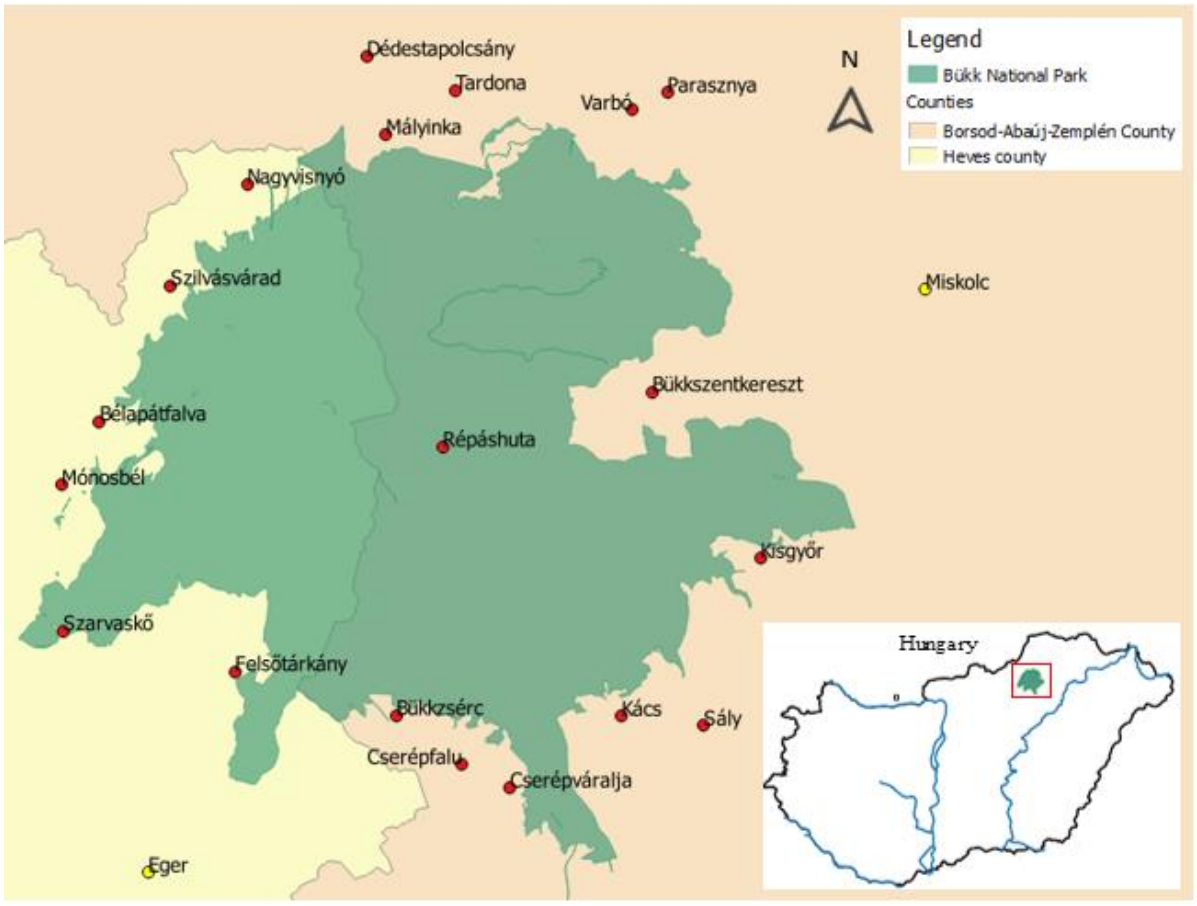


Figure 7 - Villages and towns in and around Bükk National Park. The territory is located in Heves and Borsod-Abaúj-Zemplén counties. Data source: European Environment Agency. 2016

2.4.3. BNP management: land use and conservation

Most (94.27%) of the BNP's 43,168.8 hectares of land is forest; the remaining area is grassland (meadow and pasture), arable land, vineyard and orchard (Figure 8).

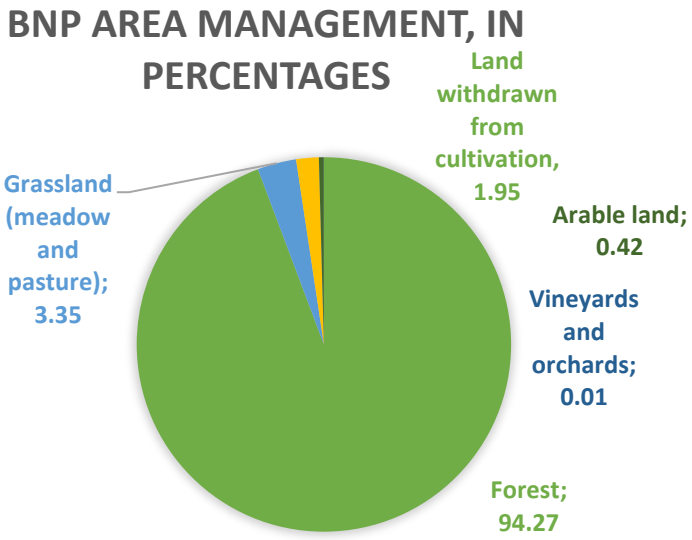


Figure 8 - BNP area management.

Since the foundation of BNP in 1976, the forest management of BNP has the main objective of protection of endangered plant and animal species and their habitats (BNPD 2017f). Most of BNP forests are not primeval forests, thus they are not self-sustaining, and need intensive, active forest management. There are only about 26 hectares of primeval forest, with trees of 200 years of age (BNPD 2017c; BNPD 2007a). Only about 2.5 percent of the forests are managed by BNP – the remaining 97.5 percent of the forests are managed by state owned forestry companies, whose yearly production plan is approved by BNP Directorate (BNPD 2017a).

Regarding wild game management, BNP Directorate implements its nature conservation policy by reviewing wild game management plans of the profit-oriented forestry companies. based on § 37 of Decree 347/2006, XII. 23. (BNPD 2007b). This policy is based on the document *Hunting and Wild Game Management Concept of Nature Protection, and Tasks of Concept Implementation* prepared by the Ministry for Environment and Water in 2003 (Ministry of

Environment and Water 2003). The main goals are the protection of protected species from the disturbances of hunting and other forestry operations, and the reduction of the number of large ungulates to a level with which the forest can sustain without the application of fences against wild game damage. (BNPD 2007b; Ministry of Environment and Water. 2003).

The central goal of BNP is the conservation of protected species and their habitats. The most endangered species are protected by special programs (rescue, active protection, introduction). Large mammals (such as red deer, roe, wild boar, and the non-native mouflon) are not protected; furthermore, their population is over-sized, and cause harm to the vegetation, therefore their hunting is permitted. Top predators, i.e. the wolf and lynx, are slowly and spontaneously re-populating the area – which is supported by the ban of their hunting and by assuring the non-disturbance of their territories (BNPD 2017f).

2.4.4. The Wolf in BNP: return and conflict

The continuous presence of the wolf in BNP has been recognized since 2010, when an injured wolf was observed. The animal depredated on livestock repeatedly; the conflicts were settled by BNP Directorate according to the annual report on their activities (BNPD 2011). It was suspected that more individuals inhabited in the territory, and their continuous presence was monitored without any active management intervention. In 2013, a wolf pack of at least 4 members was located in the central-western part of BNP. In the same year, a male individual was shot, upon which the BNP Directorate has initiated the limitation of hunting activities to prevent similar events (the limitations were not implemented). The shooter was never found, but the incident and the proof of wolf presence received large media coverage (BNPD 2014; 2015)

In 2014, proof was found of a stable, locally reproducing population of wolves in BNP. The role of wolves in controlling invasive, exotic mouflon populations was also recognized. At the

same time, Egererdő Ltd, the state-owned forestry company responsible for the wild-game management in a large part of BNP, issued a damage compensation complaint towards BNP, for the damage caused by wolves in wild game (red deer, mouflon, roe deer, wild boar), which has been rejected (BNPD 2015). In the summer of 2015, the reproduction of wolves was successfully documented by camera trap records (Figure 9) Thanks to this event, BNP directorate was able to promote in the media large carnivores and the ecological services they provide (BNPD 2016). Due to the increasing activity of large carnivores, the Directorate has started a large-scale campaign to promote information on large carnivores (the wolf and the bear): a press conference was held, information boards were placed by tourist paths, and in January 2015, the BNP Directorate organized a presentation with live wolves held by a wolf trainer. Following a wolf attack complaint, examinations took place by BNP Directorate at a livestock breeder farm, and it turned out that depredations were caused by dogs.

Figure 9 - Wolf pups recorded by a camera trap of BNP Directorate in July 2015, proving the successful reproduction of wolves in BNP. Source: BNP.hu

2.5. Conclusion

Large carnivore conservation is an increasingly challenging endeavor for several reasons: territories and habitats of large carnivores are shrinking due to the territorial expansion of human activities; human-carnivore conflicts, largely caused by depredation on livestock and competition on wild game, but also by cultural, emotional, and political connotations to large carnivores.

Attitudes towards large carnivores can be understood as good predictors of general behavior, and are important factors in the success of large carnivore management. Attitudes towards large carnivores can be understood in terms of values (economic value of lost livestock/wild game; intrinsic value), emotions (such as fear and affect), knowledge about the object of the attitude, and probably most importantly, the socio-economic profile of an individual - such as age, sex, occupation, and rural/urban residence.

Wolves are a particularly critical species as they elicit extreme attitudes – usually negative– compared to other species. In the BNP, in 2010, wolves have re-entered after a long period of absence, which is usually a predictor for more negative attitudes. BNP is located in two administrative counties, one of which is one of the most economically disadvantaged regions of Hungary. In the past 25 years, the disappearance of heavy industries, the unfortunate reorganization of agriculture, and continuous rural depopulation have shaped the region's socio-economic profile in a way, which has to be considered in connection to human-wolf relations as well.

As wolves are slowly gaining a foothold in BNP after being extirpated for close to a century, a space for both ecological and social research is nascent, particularly on how local communities respond to their presence. There has been no research carried out of this nature yet in the BNP, and this pioneering research aims at contributing to that gap.

3. METHODOLOGY

The study is primarily targeted at assessing explicit attitudes towards wolves and wolf management. Explicit attitudes are correlated with behavior at a higher rate, but only across a certain class of behaviors – for socially sensitive topics (such as race or sexual preferences) they lose predictive power (Hitlin and Pinkston 2013). We assume that wolves and wolf management are not socially sensitive topics, therefore the assessment of explicit attitudes can be considered an adequate tool for assessing attitudes towards these objects.

This study has used two research data collection techniques:

1. Face-to-face questionnaire with closed and open questions, on a random sample of households

2. Semi-structured interviews with key stakeholders

3.1. Questionnaire

The questionnaire (see Appendix I) has a total of 45 items, organized in 3 sections: 1. socio-demographic data, 2. knowledge and direct experience with wolves and wolf management, 3. Likert-scale test on attitudes towards wolves and wolf management. The 45 items were designed to address the major concepts of human-wolf relations encountered in the literature review – such as depredation on livestock, competition over game, safety of humans and domestic animals, lack of trust in authorities, direct experience, affect, and the attribution of intrinsic/aesthetic values to wolves (Carter and Linnell 2016; Chapron *et al.* 2014; Heberlein 2012; Hojberg *et al.* 2016), and to administer the most relevant factors of attitudes towards wolves identified in other studies, such as gender, age, education, and occupation (Bruskotter and Shelby 2010; Dressel *et al.* 2015; Heberlein 2012; Hojberg *et al.* 2016). Besides the results

of the literature review, personal communication with stakeholders also contributed to the final set of items. In terms of the formal planning and analysis of the questionnaire De Vaus (2014) was consulted.

The first section has closed question items on general demographic data (age, education, occupation, income). The second section has both closed and open questions on the participant's relation to the National Park, knowledge on wolves and wolf management, and the occurrence of direct experience (for example, if the respondent answered "Yes" to the question "Have you heard of someone who met a wolf?", the respondent was encouraged to tell the story). These two sections are intended to provide basic sociological data on the sampled households, and data on the households' knowledge about the research subject, with the aim of supporting the description of the social context with precise, standardized numerical data as well as more complex social roles and narratives, and to identify and test distributions and correlations (Kendall 2007). The third section is a Likert Scale on attitudes towards wolves and wolf management. The Likert Scale was chosen because its multiple indicators increase the validity of results and allows the testing of consistency (De Vaus 2014), and it is a suitable tool for assessing attitudes (Jamieson 2004). The following variables were tested in the Likert Scale: the direction and of attitudes towards wolves, and the relation of attitudes to the concepts of damage caused by wolves, fear from wolves, and affect/intrinsic value in wolves – the latter concepts were aimed at observing the extension of the attitude's horizontal structure (Heberlein 2012).

During the construction of the questionnaire one consideration was the inclusion of 'don't know' options: if they are offered, respondents may choose it out of laziness, but if they are not offered, respondents might be forced to choose an answer they do not completely agree with

(De Vaus 2014). In this questionnaire, it was omitted, however an ’other’ option was always provided, where any comments, including ’don’t know’ could be noted down.

3.1.1. Study area

Three settlements were selected from the villages located in/around BNP: Szilvásvárad, Nagyvisnyó, and Répáshuta (Figure 10).

The 3 surveyed villages: Nagyvisnyó, Répáshuta and Szilvásvárad

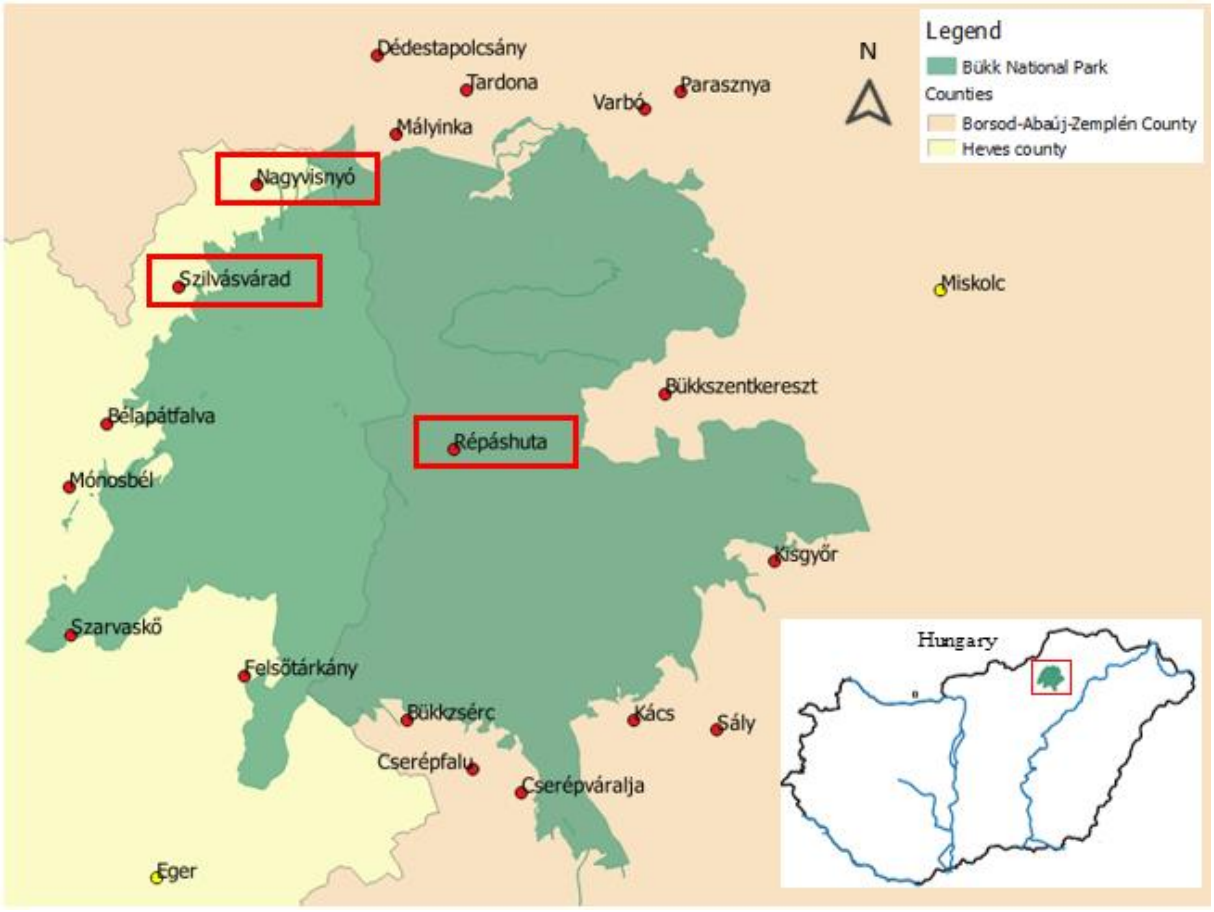


Figure 10 - Location of the three surveyed settlements, marked by a red frame: Nagyvisnyó, Répáshut and Szilvásvárad.

The selection was based on the recommendation of a BNP Directorate employee (Bartha, personal communication), and that the three villages are the most impacted by BNP wildlife, while they present somewhat different socio-economic profiles (see Table 2 in the next section “3.1.2. Sampling” for data on population of the villages).

Szilvásvárad is a touristic village, a point from where many visitors approach the BNP. There are several touristic sights and attractions in and around the village, such as the "Fátyol" waterfalls, a forest railway, the Istállóskő cave with archaeological findings originating from the stone age, trout breeding ponds, and a nationally owned, traditional herd of Lipizaner horses and an equestrian sport center (Regős 2017). There are several hotels and guesthouses in the village, while livestock breeding is not prevalent, except for the horse herd. The village is also connected by public transport to the nearby larger urban center, Eger, where some people commute to work and study. Thanks to that and tourism, Szilvásvárad has the most urban characteristic among the 3 villages.

Nagyvisnyó is a smaller settlement about 5km from Szilvásvárad. It has a rural profile, tourism is negligible, and real estate prices are about 50% lower than those in Szilvásvárad, despite the small distance between the two villages (Nagyvisnyó Önkormányzat 2017).

Finally, Répáshuta is a relatively isolated village in the middle of BNP, where population is much smaller and tourism is small-moderate. Forestry, hunting, and logging are important activities in the village; the traditional lime-burning and charcoaling activities were stopped just in the last decade (Répáshuta Önkormányzat 2017).

3.1.2. Sampling

The questionnaire was addressed to 51 randomly selected households, yielding a confidence interval of 11.5, and a confidence level of 90% - for details of the sample and the population, see Table 2. The random sampling was executed using a directory of households obtained from the municipality, assigning a serial number to each household, and then selecting the households with a random number generator tool (in Excel).

Table 2 - The population and the sample. Data source: KSH 2016a; 2016b

Village	Population	Households	Sampled households	Sampled households %
Répáshuta	445	176	12	7%
Nagyvisnyó	1001	443	14	3%
Szilvásvárad	1684	696	25	4%
Total	3130	1315	51	4%

3.1.3. Ethics

Adhering to the CEU Research Ethics Policy and Guidelines, only adult persons were surveyed, on a voluntary basis. It was emphasized to each of the respondents that their participation is voluntary, the responses are treated confidentially and anonymously, and the researcher is a student, unlinked to any administrative, governmental, or non-governmental institutions. This information was also summarized in the beginning of the questionnaire page, with the email and phone availability of the researcher.

3.2. Semi-structured interviews with stakeholders

To better understand the diversity of local socio-economic characteristics and motivations in terms of nature conservation and wolf management, several stakeholders were interviewed, including BNP employees, livestock farmers, guesthouse owners, wild game managers, and local educators. The interview questions targeted the following items:

1. The stakeholder's knowledge, opinion and attitude about wolves in general, and in BNP.

2. The stakeholder's knowledge and opinion about the impact of wolves on wildlife, human safety, livestock, and the ecosystem.

3. The stakeholder's knowledge about eventual wolf-human conflict events.

4. The stakeholder's knowledge and opinion about wolf management in BNP.

3.3. Data collection

Regarding the questionnaire, if the selected household turned out to be uninhabited (e.g. the house was empty, or it is functioning as a weekend house/ tourist guesthouse), the "left-two" rule was applied, i.e. the second house to the left side was targeted to replace the uninhabited house. The same rule was applied if the sampled household refused to undertake the questionnaire, or if nobody was at home after 2 survey attempts done on two different days. During the household research, 34 houses had to be substituted using this rule.

The questionnaires were filled out by the respondents, or by the interviewer, if she was asked specifically to do so. Data was consolidated in an Excel sheet. Interviews and answers to open questions were noted down in a notebook, and then transcribed to a Word doc file. Responses of standard questionnaires were entered an Excel sheet.

3.4. Data analysis

Both quantitative (questionnaire on random sample of households) and qualitative analyses (semi-structured interviews and content analysis) have been applied in this study. The primary aim of the quantitative method was to provide quantifiable results, and to be able to identify tendencies and correlations (Kendall 2007). The qualitative analysis has been applied in order to discover local characteristics, identify unknown and unexpected factors and causalities, and to be able to describe the situation from the point of view of the participating people (Flick *et al.* 2010). Also, qualitative analysis complemented the quantitative study through differentiation and intensification, helping the interpretation of statistical results (Flick *et al.* 2010).

3.4.1. Quantitative analysis

First, the dataset has been observed with the help of some descriptive statistical tools in Excel software – means and averages, frequencies, and correlations have been calculated and visualized in order to get a general view of the data, and to identify outliers, and correlations. A few questions of the questionnaire were omitted from the analysis because they did not give high quality results or relevant/reliable responses.

Then, the Likert scale was analyzed with the help of the calculation of attitude score, which is calculated from the value that respondents chose (integer numbers from 1-5) in the Likert test (1=Totally agree, 5=Totally disagree). If agreement with the statement (i.e. answer "1" or "2") corresponded to a positive attitude (e.g. *Wolves are important part of nature*.), the original value was considered, otherwise, if the agreement (answer "1" or "2") meant a negative attitude (e.g. *Wolves cause damage*.), the value was reversed, so that score values have a single direction as compared with direction of attitudes. Thus, a number between 1-5 was obtained, 1 meaning positive, and 5 meaning negative attitude.

Then, items of the Likert-scale were grouped into 4 groups based on a main concept, and means of the groups were taken. The Likert-scale was organized around the following 4 concepts: the general attitudes towards wolves, damage caused by wolves (referring to livestock predation and competition on wild game), fear, and emotions of affect or intrinsic value attributed to wolves. 3-5 items were grouped under each concept (for details, see *Table 12* in the section "4.3.2. The attitude score"), the means of which were used for the calculation of the score.

Finally, to have an easy-to-use score indicator, the values were subtracted from 5, thus the higher the score, the more positive the attitude. The attitude score means were examined in terms of their relation to socio-economic data of the sample.

3.4.2. Qualitative analysis

The respondents' answers to open-ended questions and their random comments were coded based on the major observed human-wolf relation concepts (such as distrust in authorities, fear, economic disadvantage due to wolf conflicts, etc.), and were used in the identification of local characteristics, and in the interpretation of quantitative data. The content of the semi-structured interviews with stakeholders were analyzed with the aim of understanding the direction of their attitudes, and the motivations and root causes of these attitudes.

3.5. Limitations

3.5.1. Sample size

First, the measured sample size was lower than originally expected. The difficulty of obtaining the originally targeted 135 households (which would have given a confidence interval of 7.1%) was a result of several unexpected difficulties. First, it turned out only on the research site that many randomly selected properties were in reality not inhabited; either they were abandoned houses, houses for sale, or guesthouses or summer vacation houses, not regularly inhabited. This required extra time and effort for the research. On the other hand, the weather was unexpectedly severe, with heavy rainfalls, unusually cold temperatures, wind, a thunderstorm, and even an ice storm during the days of household survey, because of which the survey had to be suspended for several hours, multiple times. Because of temporal and financial constraints, the researcher was not able to extend the research time.

Also, prior to the field research, on April 19, there was a large snow storm, which severely damaged the forests of BNP– the largest damage ever in BNP. For example, almost all the nestlings died in the extreme weather, and the amount of destroyed trees is still not possible to estimate. Therefore, due to the intense restoration works and nature monitoring demands

meeting with stakeholders whose work is related to BNP and the Forestry company had to be postponed. This placed a further temporal pressure to the research (BNPD 2017g).

Nonetheless, due to the homogenous, small communities a weaker confidence interval is theoretically acceptable, and the qualitative analysis of responses provides complementary information. Also, it is implied that the presence of large carnivores is perceived as negative or conflictful by a minority of the public, while the majority supports conservation, which can be tested in larger samples (Linnell 2013).

3.5.2. Questionnaire

One limitation lies within the self-reporting method, i.e. it is not possible to verify whether responses correspond to reality. For example, regarding the report of direct encounter with wolves in BNP, over-reporting cannot be excluded, and it could be the case that the encountered animal was in fact not a wolf, but a larger dog, or a golden jackal (*Canis aureus*), both of which inhabit the study area. Also, the fact that only explicit attitudes were tested is a limitation – for example, in smaller and closer communities group pressure and strong normative pressures can influence the expression of explicit attitudes (Pohja-Mykra and Kurki 2014). The perceived audience also affects the way in which attitudes are expressed (De Vaus 2014), for example, the presence of the researcher could influence the respondent.

Also, as attitudes are developed in interaction with many other factors, this study pictures just a moment, and longitudinal studies would be needed to reflect true trends and tendencies (Hitlin and Pinkston 2013).

4. RESULTS

The field research was performed between April 20th and May 9th, 2017. Ninety-eight households were approached with the questionnaire by the researcher, and altogether 51 questionnaires were completed. Table 3 summarizes the data collection results.

Table 3 - Summary of data collection results

Total households attempted:	98
Non-response:	47
Number of completed questionnaires:	51
Interviewed stakeholders:	6

4.1. Socio-demographic profile

First, the socio-economic profile of the sample was assessed based on the questionnaire, including gender, age, education, and occupation.

4.1.1. Gender

The gender distribution within the sample can be seen in Table 4. In comparison with the population's normal distribution, males are under-represented in the sample, particularly in Szilvásvárad. Because of the uneven distribution, the variable of gender and settlement will be further considered during the discussion, in relation to other variables and concepts.

Table 4- Number of respondents - gender and settlement distribution of the sample. Values in parentheses based on 2011 Census (KSH 2017a; 2017b)

Settlement	**Nagyvisnyó**		**Répáshuta**		**Szilvásvárad**		**Total**	
Female	6	43% (52%)	5	42% (54%)	21	84% (52%)	32	63%
Male	8	57% (48%)	7	58% (46%)	4	16% (48%)	19	37%
Total	14	27%	12	24%	25	49%	51	100%

4.1.2. Age

The mean age in the sample is 59.39 years, the highest mean age was presented in Szilvásvárad (61.76), and the lowest in Répáshuta (52.42) (Table 5). Comparing the distribution of age groups within the sample with that of the normal population in the 3 settlements (KSH 2017a; 2017b), the active working age group (years 30-49) are under-represented in the sample, while retired age people are over-represented. This can be explained by the time availability of the given age group, and by the fact that working age individuals are less likely to be found at home during the day when the survey was administered.

Table 5 - Age distribution of sample

Settlement	Nagyvisnyó	Répáshuta	Szilvásvárad	Total
Female mean	69.33	57.60	59.95	61.34
Male mean	55.00	48.71	71.25	56.11
Total mean	61.14	52.42	61.76	59.39
MIN	22	22	22	22
MAX	94	80	89	94
Median	64	53.5	62	62

4.1.3. Education

Most respondents' highest level of education was secondary school in all villages (n=31, 60.78%). These results reflect the age composition, as there is a significant, inverse relationship between age and level of education (Spearman's rho= - 0.394, n=51, p=.00426). The highest percentage of respondents with a bachelor's degree or higher was in Szilvásvárad (20%) and the lowest in Nagyvisnyó (7.14%), where 35.71% of respondents have only primary education (see Figure 11).

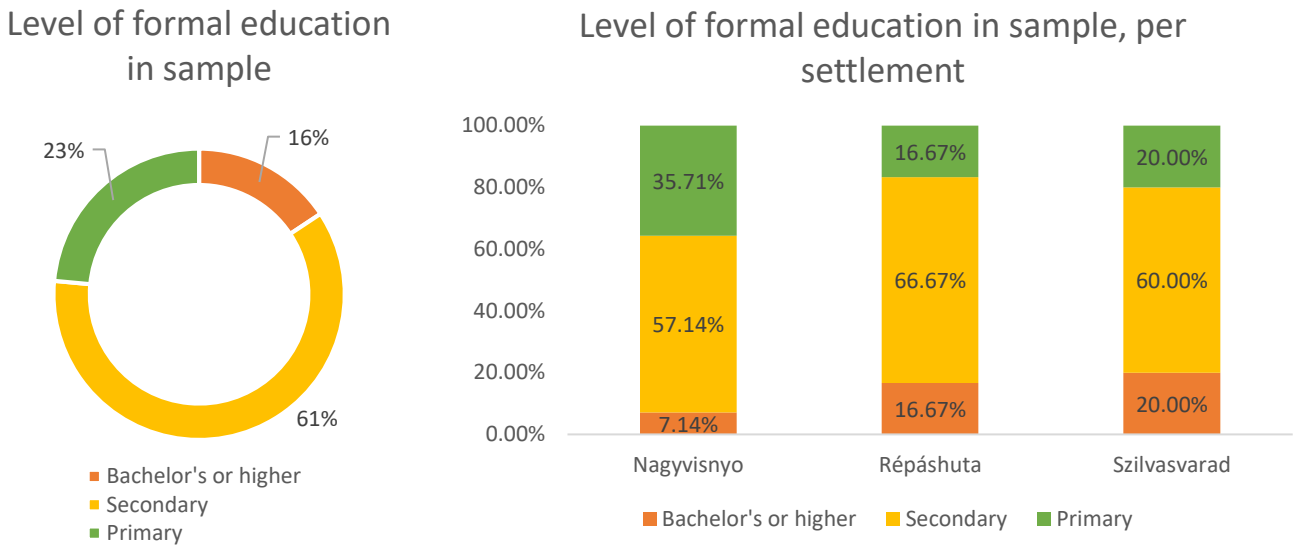


Figure 11 - Level of education in the sample. Percentage of respondents.

4.1.4. Occupation

The results on the sample's occupation are not surprising after having consulted the sample's age composition: about 51% of the sample are retired, which is higher than the normal population rate (about 30% in 2011; KSH 2017a; 2017b), and students and working age and unemployed people are underrepresented (Figure 12). The only exception is Répáshuta, where employed respondents were in majority, which can be explained by the fact that in Répáshuta the survey took place on the weekend, therefore more active, working-age people were available, while during the weekdays, in other villages retired people were more likely to be available. None of the respondents claimed to be unemployed, although a few respondents indicated they are informally employed or only employed in seasonal jobs. Only 4 respondents (7.84% of sample) reported to own livestock (Table 6).

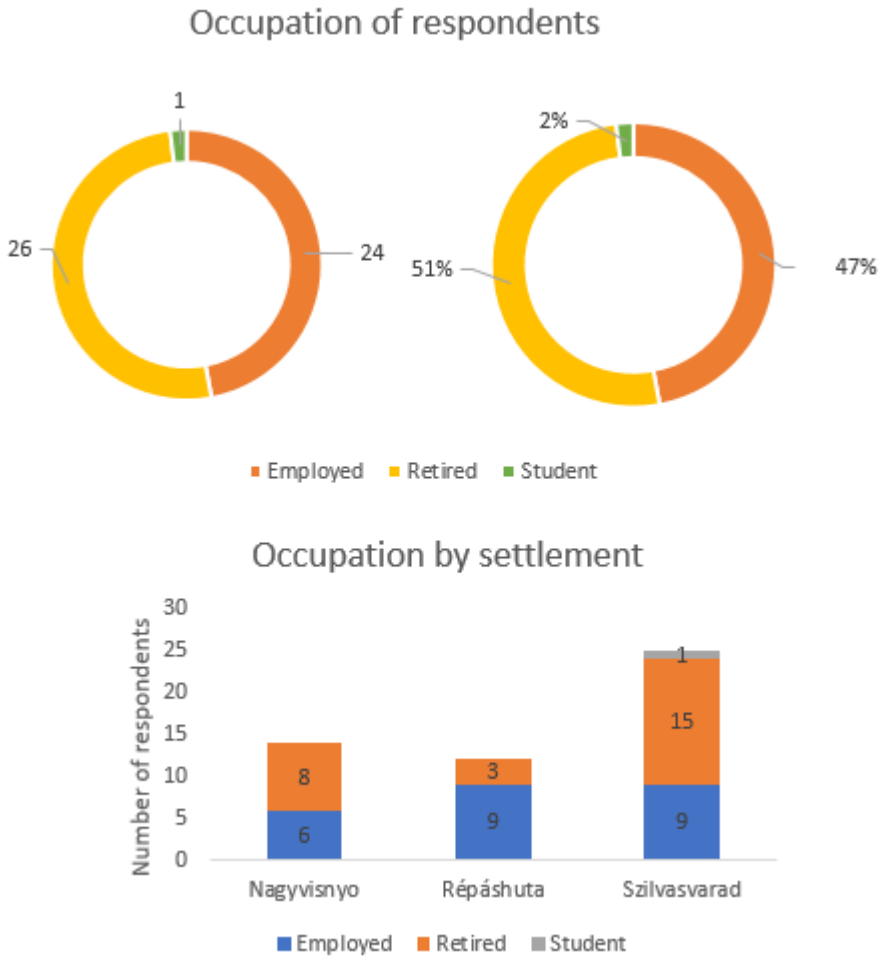


Figure 12 - Occupation of respondents

Table 6 - Livestock owned by respondents (n=4)

Settlement	Owning livestock
Szilvásvárad	horse
Répáshuta	pig
Répáshuta	pig, horse
Nagyvisnyó	pig

4.2. Knowledge and experience with wolves

In the following section the results on the sample's relationship with nature, and their knowledge and direct experience with wolves and wolf management is presented.

4.2.1. Relationship with Nature

As Table 7 shows, about 84% of the respondents have lived in the same village for more than 30 years, and only 8% moved there within the last 15 years. Looking at the frequency of visiting nature/BNP reported by the respondents, 22% never goes to the forest (many of the respondents giving this answer were elderly people), and 50% go at least once a month (Table 8). Three quarters of the Répáshuta respondents reported daily visits to the forest, and many of them commented that they already live in the forest, so the question does not make sense to them. Most respondents in Nagyvisnyó reported that they never go to the forest.

Table 7 - number of years respondent has lived in the village

	0-5 years	**6-15 years**	**16-30 years**	**>30 years**	**For several generations**
Szilvásvárad	0	2	3	9	11
Nagyvisnyó	0	0	1	6	7
Répáshuta	2	0	0	0	10
Total	2	2	4	15	28
%	4%	4%	8%	29%	55%

Table 8 - Frequency of visiting the forest/BNP

	never	**1-2 times/year**	**3-6 times/year**	**monthly**	**weekly**	**daily**
Szilvásvárad	4	8	2	3	7	1
Nagyvisnyó	6	3	1	3	0	1
Répáshuta	1	0	1	1	0	9
Total	11	11	4	7	7	11
	22%	22%	8%	14%	14%	22%

In Table 9, the purpose of visiting the forest is summarized – respondents were allowed to choose multiple options at this question. About one half (26) of the respondents mentioned excursions or hikes, and 8 reported sports, therefore recreation is the most popular purpose of visiting the forests of BNP by the surveyed locals. A significant number of respondents (n=20) reported "picking mushrooms, berries, firewood, etc." Work and hunting were selected by only 7 and 2 respondents, respectively.

Table 9 - Purpose of visiting the forest/BNP

	Excursion, hiking	picking mushroom, berries, firewood	work	hunting	sports
Szilvásvárad	9	9	1	0	3
Nagyvisnyó	5	8	0	1	1
Répáshuta	12	3	6	1	4
Total	26	20	7	2	8

Table 10 shows the number of respondents currently having a job, which is related to the forest or BNP, or in case of retired people, in the past. Altogether 9 respondents (18%) have/had such a job, most of whom are agricultural workers or loggers, and one engineer. Among the respondents of Répáshuta the percentage of forest-related jobs amounts to 50%. Regarding younger generations, in the curriculum of Szilvásvárad primary school there is a 3-week forest education program in 6th grade (anonymous personal interview).

Table 10 - Respondents having a job related to the forest/BNP

	no.	%
Szilvásvárad	2	8%
Nagyvisnyó	1	7%
Répáshuta	6	50%
Total	9	18%

Several people (n=7, 14%) gave voice in comments to their frustration about some aspects of nature conservation in BNP, which is linked to (legally justified) restriction on natural resource use – especially firewood collection, or to perceived frustrations caused by modern forestry practices. The comments of respondents are summarized below:

Restricted access to natural resources:

Because of the environmentalists we are not allowed to collect firewood anymore, although it was possible for many decades. There are too many foxes and eagles, killing the hens. It used to be different earlier.

There are no jobs because of BNP. They do not allow logging anymore. The number of wild game has decreased, hunters are disappearing. There are lots of bugs in the yard and house, because dead wood is left in the forest.

Because of bird nesting we are not allowed to pick firewood anymore. We do not dare removing dangerous trees injured in the storm because of BNP regulations.

Because of nature conservation we are not allowed to harvest firewood anymore. We have to buy it, and it is very expensive, more than 200 000 HUF/season (=643 EUR).

I do not dare to go and pick mushrooms/firewood anymore, because of the people of nature conservation - nothing is permitted anymore. The forest is now surrounded by a fence, but somehow, they left wild animals outside of the fence.

Frustration about nature protection practices:

The forest should be kept in order. For example, there are more ticks now because BNP is leaving dead wooden materials in the forest. Also, wild game cause a lot of damage in the cemetery.

I am outraged by this new style of forestry. Local people used to always do some foraging – now it is illegal to even take a bunch of convallaria [Convollaria majalis; Lily-of-the-valley]. They are not planting saplings anymore, they are just leaving everything without taking care. They only focus on protected plants, not on the common plants. The meadows are not reaped anymore, they have become wild and many plants went extinct. The forest must be kept in order.

4.2.2. Knowledge about wolves

Most respondents (37) guessed that the wolf population in BNP is between 1 and 20, which approximately corresponds to the last 5 years' data. A smaller number of respondents either over- or under-estimated the current population whilst three said they do not know (Figure 13). Several respondents added comments that wolves play an important role in the food chain, and

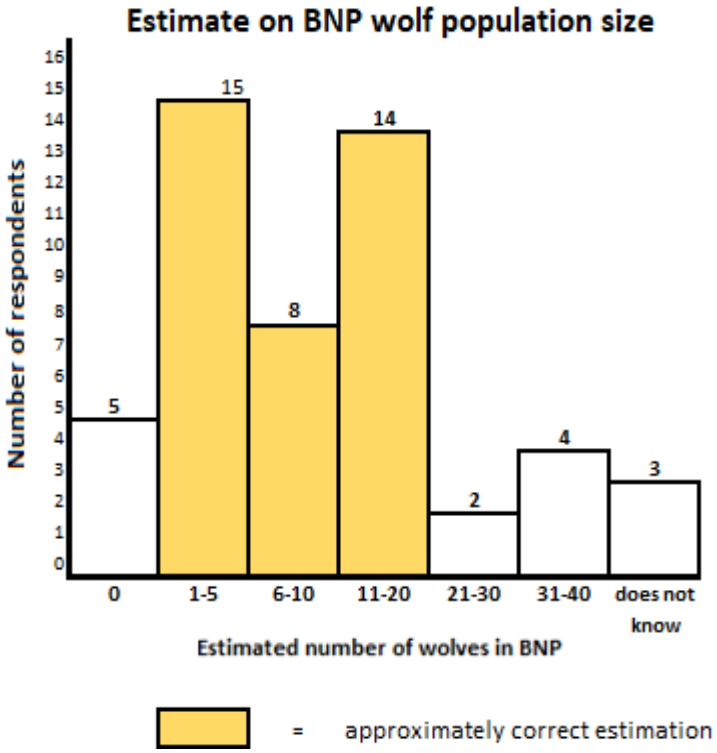


Figure 13 - Respondents' estimate on BNP wolf population. Higligted columns mean approximately correct estimation

they remove sick and weak prey animals. Others mentioned that wolves need large, wild territories, such as North American territories, and BNP is too small for them. Regarding the source of knowledge on wolves, 27 respondents reported that television is an important source of information, with several people mentioning nature documentary films specifically. About one third (16) of the respondents reported books and friends/family members. School, the internet and newspapers were also selected (Figure 14). Nine respondents mentioned other sources, such as movies, novels, and the presentation of a wolf trainer with live wolves in Szilvásvárad.

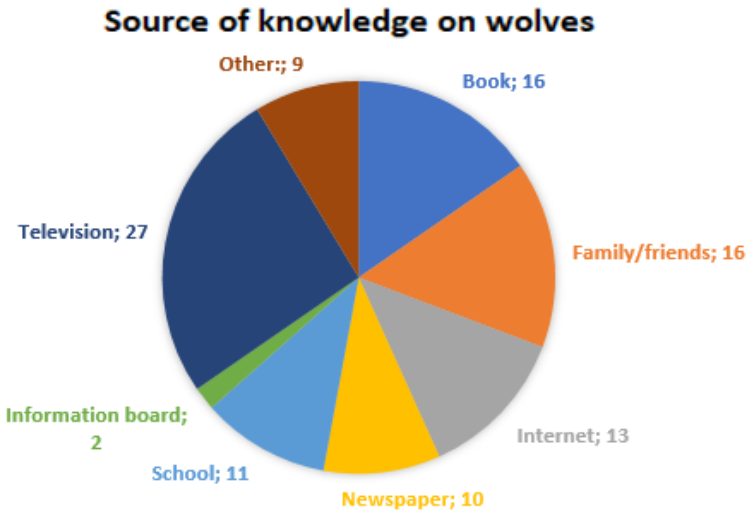


Figure 14 - Source of knowledge on wolves. Respondents were allowed to select multiple options.

4.2.3. Direct experience with wolves and human-wolf conflict

Six respondents (12%) reported that they have seen wolves in/around BNP, and 33 (65%) already talked with someone who claimed to have seen wolves. None of the questionnaire respondents suffered livestock damage by wolves, although 51% of the respondents heard of such events, including one in Répáshuta who mentioned that, based on histories of elder people, many decades ago a small child was grabbed by wolves (Table 11). Two sheep owners were interviewed as stakeholders, but were not included in the questionnaire survey, claimed to have lost several sheep because of wolf attacks. Three of the respondents met and touched living wolves at a presentation held by a wolf trainer in Szilvásvárad, 2015. The presentation was organized by BNP Directorate to educate people about wolves, as the number of wolves increased (BNPD 2016).

Table 11 - Direct experience with wolves.

	Has seen wolves in/around BNP	Heard somebody having seen wolves in/around BNP?	Had livestock damaged by wolves?	Heard of livestock being damaged by wolves in/around BNP?	Met wolves at the live wolf presentation?
Szilvásvárad	2	16	0	13	3
Nagyvisnyó	1	10	0	9	0
Répáshuta	3	7*	0	4	0
ALL	6	33	0	26	3
	12%	65%	0%	51%	6%

*comment from one respondent: 80-90 years ago, wolves grabbed a small child in the village

Description of the direct encounter with wolves:

I saw a wolf in the night from the window.

Six to eight years ago, I was collecting mushrooms. I saw wolf from a distance.

I was in the forest for work, saw a wolf running away. Also, I saw broken bones of preys left by wolves.

Up in the Bükk-Highland I saw one wolf from a vehicle, at a distance of 50 meters. It happened in 2012-13, at the Bányahegyi forestry. The wolf was standing by the road, and ran into the forest. Later in the winter I saw footprints in the snow. I followed them, and saw the same wolf.

I saw a wolf from 60-70 meters. Also, in the winter I saw footprints of 6 wolves. I already saw lynx and a bear too.

4.2.4. Wolf management

To the question "Who is responsible for wolf management?" 23 respondents answered BNP Directorate, 20 said "Forestry/Hunting company, 2 people chose "National Nature Protection Agency", and 6 said they do not know. The results show that residents are split regarding the question whether wolf management is a nature protection or a forestry/wild game management

issue. A few commented that it takes a lawyer to understand the complex legal situation around nature protection and wild game management. Five respondents (almost 10%) made a remark that wolves were deliberately introduced in BNP, including the following:

Wolves were introduced by someone, this is 100% sure. The Bükk is too small for wolves, and wolves are not indigenous here.

A BNP employee told me that wolves were introduced deliberately, 8-12 individuals, they even have chip identifiers.

Wolves were reintroduced deliberately, this was confirmed in the TV as well.

The wolf was introduced by someone. The wolf is not indigenous in Hungary, it should not be in Hungary.

Wolves were introduced deliberately, to keep the ecosystem healthier (to kill weak and sick preys) but now the wolf eats everything - I know exactly by whom they were introduced, but I am not allowed to tell it, but I know it for sure.

Several people made remarks that although there is a system of compensation for wolf damage, it is not efficient, and it is not worth initiating the procedure, because the authorities will not assign any compensation. Both interviewed livestock owners, whose animals suffered wolf attacks, expressed their disappointment in wolf management, even though one held neutral attitudes towards wolves.

Livestock owner #1 held livestock – about ten of the special, traditional breed of Racka sheep – for aesthetic purposes. He explained, that his sheep started to disappear one-by-one, so he notified BNP Directorate, who installed a camera on his property. He was instructed not to do anything, and in the course of about 1 month, all his sheep were killed, one by one. Despite the promises, his financial damage was never compensated. His disappointment is not so much about the financial loss – as the animals served hobby purposes, but rather because he had to

Figure 15 - A female sheep, which was injured on her neck in the wolf attack. Photo: courtesy of the owner.

passively wait and experience all his animals being taken, and also by the fact that despite the promises, he never received any compensation.

For livestock owner #2 sheep-breeding is his livelihood; he has hundreds of sheep. Following a wolf attack, several of his sheep were killed or injured (Figure 15), and most of his herd dispersed in the forest – it took him weeks to collect the remaining animals from the forest. He never received any compensation because his herd was not protected against wolves. Following the incident, he claimed that the provision of electric fencing was promised by BNP, however, he never received it, and he had to install the electric fencing himself. The stakeholder expressed his disappointment about wolf management and highly negative attitudes towards wolves.

Ten survey respondents reported that they heard of wolves being shot in/around BNP, but only eight provided details: two estimated the shooting to be between 3 and 8 years ago, three

referred to shootings which happened 20-25 years ago. Moreover, two respondents had the belief that shooting is the regular procedure of wolf management.

The following quotation from a retired person in Nagyvisnyó reflects that some of the wolf management questions are probably surrogates of other socio-economic root causes, such as lack of trust in authorities, or having higher budgetary priorities than nature conservation:

> *Wolf management should be the task of God only. We should spend money on hospitals, not on wolves. My daughter's dog was killed by a neighbor, but the police did nothing - but if someone kills a wolf, they will have to go to prison. This is not fair. About 20 years ago my son hit a deer on the road, but his damages were never reimbursed. Wolves should be all killed or taken away to a zoo.*

4.3. Attitudes

4.3.1. The attitude score

The internal consistency of the responses was tested using Cronbach's alpha obtaining the value of 0.88, meaning that the reliability of items is high (De Vaus 2014). In the evaluation of the Likert scale on attitudes in the questionnaire, an attitude score scale was built to provide an indicator on attitude strength between 0 and 5, 0 meaning most negative and 5 the most positive attitude. The scale was applied with the aim of getting at the complexity and the multiple indicators of the concept, and to enable greater precision in defining the strength of attitudes, avoiding the emphasis on extremes, while providing an easy-to-use, single-score indicator. A summary of the attitude items grouped based on the main concept, with the mean attitude scores is shown in Table 12. For the technical details of the Likert-scale, see the Methodology section.

Following a descriptive analysis of the attitude scores, correlations and distributions will be presented in relation to the socio-demographic characteristics of the sample.

Table 12 - A summary of the attitude items grouped based on the main concept, with the mean attitude scores (Note: 0-1=Very negative attitude; 1-2=Negative attitude; 2-3=Neutral attitude; 3-4=Positive attitude; 4-5=Very positive attitude)

Concept	Item number	Question in English	Sub-concept	Reversed?	Mean score
General attitude	30	Wolves cause damage.	Damage	y	1.57
	31	Wolves are important part of nature.	Intrinsic value	n	2.75
	33	Wolves should be protected so that future generations can get to know them.	Intrinsic value/ conservation value	n	2.43
	40	Wolves are part of the beauties and wonders of nature.	Aesthetic value/Affect	n	2.55
	42	It should not be allowed that wolves populate the Bükk Hills.	Location specific concern	y	1.31
				Total	**2.12**
Damage/ harm caused by wolves	30	Wolves cause damage.	Damage	y	1.57
	42	It should not be allowed that wolves populate the Bükk Hills.	Location specific concern	y	1.31
	37	Wolves pose a threat to livestock's' safety.	Depredation on livestock	y	1.65
	35	The wolves decimate wild game and thus cause damage.	Competition on wild game	y	1.53
				Total	**.,52**
Fear	32	Wolves are ruthless, dangerous killers.	Irrational fear, lack of control	y	2.37
	34	Wolves pose a threat to the safety of hikers.	Attack on humans	y	2.12
	38	Wolves can attack children.	Attack on humans	y	2.24
				Total	**2.24**
Affect/ Intrinsic value	31	Wolves are important part of nature.	Intrinsic value	n	2.75
	33	Wolves should be protected so that future generations can get to know them.	Intrinsic value/ conservation value	n	2.43
	40	Wolves are part of the beauties and wonders of nature.	Aesthetic value/Affect	n	2.55
				Total	**2.58**

4.3.2. General attitudes

Regarding the general direction of attitudes, Table 12 shows that the mean score is 2.12, which means a neutral-negative attitude towards wolves. The most negative attitudes were presented in relation to the concept of damage caused by wolves (mean score=1.57), especially regarding item #42, about the possible proliferation of wolves in BNP (mean score=1.31). The item about competition on wild game (item #35) yielded a lower mean score (1.53) than depredation on livestock (item #37; mean score=1.65). The most positive attitudes (mean score=2.58) emerged around the intrinsic value of wolves and affect towards wolves, which corresponds to a neutral-slightly positive value. The emotion of fear does not significantly influence negative attitudes, as the attitudes scores of items associated with fear (#32, #34, #38) are neutral-slightly negative (mean score=2.24). Irrational fear has a neutral role in shaping attitudes too (item #32, mean score=2.37). As the individual's social profile is very important in understanding attitudes towards wolves, and as the sample has an uneven distribution in terms of gender, age and geographic location, these demographic factors and their impact on attitudes will be presented below.

4.3.3. Gender and attitudes

Contrary to the expectations based on the literature review, in the sample women had slightly more positive attitudes (mean score=2.14) than men (mean score=2.09), however, according to an independent t-test on the difference between the scores of man and women, the difference is insignificant (t=0.082, df=47, P=0.47). Looking at the distribution of the attitude scores per village (Figure 16) in Répáshuta and Szilvásvárad women present more negative attitudes than men.

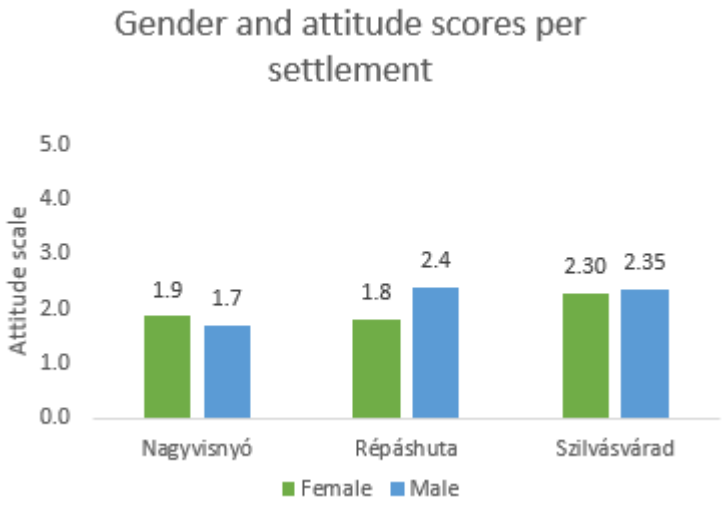


Figure 16- Gender and attitude scores per settlement

4.3.4. Age and attitudes

There is a low to moderate, negative correlation between respondent age and attitude score, but this is not significant (Pearson r= -0.216, n=51, p=0.130). Looking at the attitudes based on the damage/harm caused by wolves, however, there is a significant moderate to substantial negative correlation with age (Pearson r = -0.332, n=51, p<.05), thus older people are substantially more likely to have negative attitudes based on the belief that wolves cause damage to livestock or wild game. The correlation between age and the emotion of fear is almost significant, being low to moderate, and negative (Pearson r = -0.258, n=51, p=0.069), thus the older a respondent is, the more likely is that he/she has negative attitudes based on fear.

4.3.5. Level of education and attitudes

Respondents with at least a Bachelor's degree have the highest general mean attitude score (2.38), and respondents with a primary school education have the lowest (1.47) (Table 13). There is a low to moderate negative correlation between level of education and attitude scores, which is almost significant regarding the general attitude score (Kendall tau=-0.205, n=51, p=0.075), the concept of damage caused by wolves (Kendall tau=-0.214, n=51, p=0.0654), and

affect/intrinsic value of wolves (Kendall tau=-0.219, n=51, p=0.062), while there is no linear relationship in terms of the concept of fear (Kendall tau=-0.080, n=51, p=0.498). Thus, it seems that people with lower education base their negative attitudes on the risk of damage caused by wolves and they attribute less affect/ intrinsic values to wolves than respondents with more education; while the concept of fear is independent from the level of education.

Table 13 - Attitude score and level of education

Education	General attitude	Damage caused by wolves	Fear	Affect/In-trinsic value
Bachelor's or higher	2.38	2.06	2.33	2.13
Secondary	2.31	1.59	2.30	2.23
Primary	1.47	1.00	2.03	3.14

4.3.6. Experience and attitudes

Looking at the respondents who claimed to have seen a wolf in/around BNP, their mean attitude score (1.93) is slightly lower than the sample mean (2.12). Regarding the concept-specific scores, “damage caused by wolves” (mean score=1.29) and “affect/intrinsic value” (mean score= 2.28) are both lower than the sample means, while in terms of “fear” attitude scores are higher. However, the variance within scores is also significant (variance/standard deviation values - general attitude: 2.60/1.61, damage by wolves: 2.09/1.44, fear: 1.14/1.07 affect/intrinsic value: 3.75/1.74. In summary, direct experience seems to influence attitudes in a negative direction, however, variance between individuals is great, varying between wolf-advocates of scores near 4, and wolf-haters, with scores close to 0 (Table 14).

Table 14 - Attitude scores of respondents who have claimed to have seen a wolf

Respondent having seen a wolf	General Attitude	Damage caused by wolves	Fear	Affect/Intrinsic value
#1	3.20	1.75	1.33	4.00
#2	0.60	0.75	2.67	0.33
#3	1.00	0.50	2.00	1.33
#4	0.00	0.00	2.67	0.00
#5	4.00	4.00	4.00	4.00
#6	2.80	0.75	4.00	4.00
Sub-sample Mean	**1.93**	**1.29**	**2.78**	**2.28**
Sample Mean	**2.12**	**1.52**	**2.24**	**2.58**

Respondents who have/had a forest-related job have more negative mean attitude scores (1.93) than the sample (2.12), with a high variance (variance/standard deviation values: general attitude: 1.91/1.38, damage by wolves: 2.03/1.43, fear: 1.61/1.27, affect/intrinsic value: 2.00/1.42) - Table 15. Thus, direct experience with wolves and having a forest-related job can prompt extreme attitudes in both directions.

Table 15 - Attitude scores of people with forest-related jobs

Job/profession connected to nature?	Direction of Attitude	"Damage/ harm caused by wolves"	Fear	Affect/Intrinsic value
#1	3.60	3.25	3.00	4.00
#2	1.20	0.50	1.33	2.00
#3	1.00	0.50	2.00	1.33
#4	4.00	4.00	4.00	4.00
#5	1.40	1.25	2.67	1.67
#6	2.20	0.25	2.00	3.33
#7	3.60	2.25	4.00	4.00
#8	0.00	0.00	0.00	0.00
#9	1.60	0.75	2.00	2.33
Sub-sample Mean	**2.07**	**1.42**	**2.33**	**2.52**
Sample Mean	**2.12**	**1.52**	**2.24**	**2.58**

4.3.7. Wolf population size

It is interesting to consider people's direction of attitudes in the light of their estimation on the size of the wolf population in BNP. For this item#22 of the questionnaire was used, which posed the question: "Would you prefer that BNP wolf population increase, decrease, or stay the same?" As Table 16 shows, most people (21) desired that the wolf population decrease, 16 of which did so even if they estimated the current wolf population to be < 20. Twenty respondents prefer that wolf population not change, of which three estimated wolves to be zero. Eight people who estimated the wolf population to be between 11-20 desires the population to not change, i.e. an ideal number of wolves for them is 11-20. This result confirms the neutral-negative attitudes demonstrated in the rest of the study.

Table 16 - Distribution of estimated wolf population size and desired wolf population tendency. Results of respondents saying" I don't know" for wolf population estimation were removed (n=47).

	Estimated wolf population						
Desired wolf population tendency	**0**	**1-5**	**6-10**	**11-20**	**21-30**	**31-40**	**Total**
decrease	2	6	3	5	1	4	21
do not change	3	6	2	8	1	0	20
increase	0	2	3	1	0	0	6
Total	5	14	8	14	2	4	47

4.4. The stakeholders

Interviews with the various stakeholders gave valuable insight into the subject as they were intimately acquainted with the local context and their specific fields/professions. Their diverse arguments and points of view helped to appreciate the research question from multiple angles, and to minimize bias and inclination from the side of the researcher.

Their comments were largely considered during the interpretation of the results, and in some cases, when the interview took place prior to the questionnaire, even to the construction and modification of the questionnaire. The arguments they mentioned were referred to at several points of the analysis. Table 17 presents a matrix with a summary of the stakeholders' position and attitudes.

Table 17 - Stakeholder matrix on attitudes towards wolves

	Short description	**Summary**
Stake-holder 1	Guesthouse owner 1	Neutral attitude towards wolves. Positive attitude towards nature. Claims to have seen a wolf. Attributes economic loss to wolf presence (decrease of guesthouse revenue due to decrease of hunting).
Stake-holder 2	Tourist guide, local knowledge expert, educator	Highly positive attitude towards nature and wolves. Passionate, spiritual admiration of wolves and nature. Met wolves 2 times. Negative opinion on forestry management and hunting.
Stake-holder 3	Guesthouse owner 2/ Livestock breeder 1	Suffered livestock damage: lost several sheep, which were kept for aesthetic purposes – (traditional, rare Hungarian "Racka" breed). Neutral/positive attitude towards wolves and nature. Negative attitude towards wolf management and frustration about the handling of his case.
Stake-holder 4	BNP Directorate employee	Wolf advocate. Wolves are perceived as scapegoats for other problems (unemployment, rural depopulation, etc.). Hunting system is another root cause (rigid system of human hunting territories, reporting is not consistent with the number of hunted game, close hunting community with a potential to disobey laws)
Stake-holder 5	Local wild game management professional	Negative attitude towards wolves in BNP. Positive attitude towards lynx. Concerned about amount of wild game killed by wolves, changing wild game behavior, and about decreasing hunting revenue and its impact on local services (hotels, restaurants, etc.). A nature lover-who admires nature, including wolves. Spends a lot of time observing wildlife, seen wolves multiple times. Referred to some dissatisfaction about current hunting culture.
Stake-holder 6	Livestock breeder 2	Livestock breeding is his main source of livelihood. Lost several sheep because of wolves. Very disappointed about wolf management and the lack of support for installing wolf protection, even if it was promised. Very negative attitudes towards wolves and wolf management

4.5. Summary

Regarding the demographic profile of the sample, females and people over 60 years of age are over-represented in the sample, however the distribution is not even within the 3 settlements. Retired people are overrepresented, while active, unemployed and students are underrepresented.

More than 84% of the sample have lived in the same village for >30 years. Respondents reported to go to forest/BNP frequently, the main purpose being recreation, however work and collection of resources (mostly firewood) is also common. A significant percentage of respondents (18%) has or had a job related to the forest.

Respondents' knowledge on wolves can be considered high; most correctly estimated the size of the BNP wolf population. The major source of knowledge is the television. Many respondents expressed disappointment about wolf management, and there is uncertainty concerning which authority is responsible for wolf management. Some respondents associate frustrating nature protection practices (e.g. restriction to access natural resources, and modern forestry practices, like leaving dead wood in the forest) with wolf management. Both interviewed livestock breeders who suffered damage caused by wolves expressed disappointment about the lack of compensation.

Based on the attitude score analysis, the mean attitude is neutral-negative. People's negative attitudes are stronger regarding the concept of damage caused by wolves, and it is more positive regarding the concept of affect and intrinsic value in wolves.

Considering socio-economic variables, the difference between attitudes of males and females is insignificant.

The older a respondent is, the more likely is that he/she has negative attitudes based on the damage/harm caused by wolves and negative attitudes based on fear. Respondents with lower education base their negative attitudes on the risk of damage caused by wolves and they attribute less affect/ intrinsic values to wolves than respondents with more education; while the concept of fear is independent from the level of education.

People who claim to have seen wolves in BNP and people with forestry/BNP related jobs have on average more negative attitudes than the sample, however, the variance of extreme attitudes in both directions is high.

In general, attitudes are more negative regarding the concept of damage caused by wolves, neutral regarding fear, and more positive regarding the intrinsic values of wolves. It seems that the respondents' attitudes are not correlated to the size of wolf population that they estimated.

The stakeholders provided relevant details and insight into the research. Several stakeholders identified current the forestry and hunting system to be incompatible with large carnivore conservation; several stakeholders expressed disappointment in wolf management, lack of trust in authorities, and cascading economic effects of wolf competition on wild game.

5. DISCUSSION

5.1. Expectations and results

Most of the results found are aligned with other studies focusing on human-wolf relationships in rural settings. In a rural area where a once extirpated large carnivore re-enters, local attitudes are generally negative. At the same time, most randomly selected residents gave no-response because of their lack of interest in the issue, thus wolf presence is not among the most substantial local issues in and around BNP. The intense, contradictory concepts that wolves usually evoke (Allen *et al.* 2017), are not presented by residents in/around BNP, which might be explained by the small size of the wolf population and the relatively short time frame – less than 7 years - since their appearance.

5.2. Values, emotions, knowledge

Respondents presented largely rational explanations and reasoning regarding their negative attitudes, which were concentrated around the concept of material damage caused by wolves, and not by fear. At the same time, this result assumes that the perception of the risk of damage that wolves cause might be greater than the actual damage, which often happens in terms of human-wolf conflicts (Anthony and Szabo 2011; Hojberg *et al.* 2016; Linnell 2013). The negligible role of fear is somewhat contrary to the expectations based on the general phenomenon that fear of wolves attacking humans is exaggerated, especially in areas where the wolf re-appeared after a long period of absence (Linnell 2013; Linnell *et al.*, 2002).

Many respondents, even those with the lowest wolf-tolerance presented more positive attitudes regarding the concept of attributing intrinsic or aesthetic value to wolves. Based on this, it can be assumed that in terms of values, anthropocentrism is not common in/around BNP, and most resident's values are closer to zoocentrism, biocentrism, or even ecocentrism (Lute *et al.* 2016).

Thus, most residents value wolves per se; their concern is the territory of BNP being inadequate (to small, too close to human activities/settlements) for wolf populations. Therefore, residents are likely to be unaware about the fact that at high biomass density, wolves can adapt to relatively small territories, in the proximity of humans (Kojola *et al.* 2016; Sillero-Zubiri *et al.* 2004).

The fact that recreation is the most frequent purpose for local residents to visit BNP also suggests that non-utilitarian values regarding nature is substantial in/around BNP, i.e. local residents value their natural environment for its potential to provide aesthetic/recreational services. In addition, several respondents commented their awareness about wolves' role in the ecosystem in terms of controlling prey population – although this was not quantitatively assessed – which is also a common trend in human-wolf relations (Mech 2017).

In summary, extremely negative and irrational feelings and fear is uncommon among BNP residents, and local wolf conservation has sufficient moral foundations within local residents – in parallel with European and North American tendencies of increasing cultural support of large carnivore conservation (Linnel, 2013).

5.3. Socio-economic variables

Females, older people, and people with lower level of education – who were expected to demonstrate more negative attitudes (Bruskotter and Shelby 2010; Hojberg *et al.* 2016; Linnell 2013; Naughton-Treves *et al.* 2003; Pohja-Mykra and Kurki 2014; Wechselberger *et al.* 2005) – did not have significantly more negative attitudes than males, younger people, and people with higher education. These groups show more particular tendencies in terms of the specific concepts around which their attitudes are centered: older respondents are more likely to base their negative attitudes on the risk of damage/harm caused by wolves and, and on fear. Respondents with lower education also base their negative attitudes on the risk of damage

caused by wolves, however, they also attribute less affect/ intrinsic values to wolves than respondents with more education; while the concept of fear is independent from the level of education. Therefore, for older people safety is a more salient concern; while less educated people acknowledge the inherent values of nature to a smaller extent – which demonstrates that education is a crucial factor in shaping people's values about nature conservation. The fact that positive correlation was found between knowledge on large carnivores and level of acceptance (Wechselberger *et al.* 2005), can confirm the relation between education and attitudes, if we assume that the level of formal education and knowledge about wildlife can be associated. The mandatory 3-week forest education that 6 graders of Szilvásvárad receive can be an important factor in more positive attitudes of young generations.

Several respondents signaled that their knowledge about wolves derives primarily from television, but other media and communication products – e.g. films, literature, social media – were also mentioned by many. Therefore, the research in/around BNP confirms that the responsibility of media is high in shaping people's knowledge and attitudes towards large carnivores, and wildlife in general (Allen *et al.* 2017). The common phenomenon of misinformation and rumors regarding large carnivores and the risks and damage they pose (Linnell 2013) happens in/around BNP too, as confirmed by the common belief among respondents that wolves were deliberately introduced in the region. The diverse estimations in BNP about wild game population sizes and the amount of wild game consumed by wolves (e.g. BNP documents about over-sized ungulate populations including the invasive alien mouflons vs. the wolf damage pictured as serious loss by the forestry company) underlines the general phenomenon that different stakeholders with different backgrounds and interests claim that they have valid knowledge on wolves, leading to controversies and non-fact based argumentation (Linnell 2013). This is especially significant in the light of the common phenomenon that

wolves are held responsible for much more damage than what they actually cause (Rigg *et al.* 2011).

Direct experience and professions linked to BNP/forestry triggered more negative attitudes than the sample on average, however, the variance of extreme attitudes in both directions is high. The intensity of extreme attitudes can be probably explained by the fact that the people whose lives are more exposed to the negative impacts (e.g. economic impacts, material damage) while they also experience nature and its values (e.g. aesthetic values, good air quality, etc.) more directly. Overall the result confirms that attitudes based on direct experience are better developed (Heberlein 2012).

While both interviewed livestock breeders had very negative attitudes towards wolf management, only one – whose livelihood depends on livestock breeding – had negative attitudes towards wolves. Therefore, besides the material damage, disappointment is focused on the lack of compensation and unkept promises of authorities, provoking a lack of trust towards them. In general, compensation for damages caused by wolves is supported by livestock owners, even it is not likely to change their attitudes (Agarwala *et al.* 2010; Naughton-Treves *et al.* 2003).

5.4. Origins of human-wolf conflict in BNP

The root causes of human-wolf conflict in BNP are rather found in socio-economic and cultural tensions, parallel to the common phenomenon that wolves are often referred to as symbols for several other problems (Linnell 2013; Linnell *et al.*, 2002; Mech 2017). Both questionnaire respondents and stakeholders expressed their concern about the economic effects of the decrease in hunting revenues, and the decrease in the demand of related services (seasonal jobs at hunts, accommodation and catering). However, it has not been proven that wolves directly cause a significant decrease in wild game populations, in fact some research has demonstrated

that even under strong predation pressure deer populations have remained stable (Lanszki *et al.* 2011), and it is probably the alteration of wild game behavior that the presence of wolves cause (Linnell 2013).

Thus, wolves might alter the behavior of wild game, which can challenge existing hunting practices. For example, according to the current practice, prior to a planned hunt (which is a major income generating activity in forestry), wild game managers regularly place food (e.g. corn) to the planned hunting location, to attract animals to the territory, and to ensure a successful hunt. Wolves however, roaming across large territories can disturb wild game and chase them to distant locations, because of which the planned hunt can fail, and the forestry company has to recognize the loss of organization costs and temporary worker wages (anonymous personal communication). Also, currently the lands are divided between hunting territories, and hunters have permission to hunt only on specific territories that they purchased a hunting license for. Because of the wolves, wild game can be forced to migrate from a given hunting territory, which may cause hunters to cease to pay the license fees for the territory, placing a risk to an important local source of revenue (anonymous personal communication). Therefore, the territorial organization of current hunting practice is designed for a human-controlled ecosystem, and negative attitudes towards wolves are not likely to cease among hunting related stakeholders (and any economically connected activities) until the current system is revised and adjusted to large carnivore presence.

Furthermore, within the hunting community anti-wolf traditions still thrive, as wolf shooting was a standard, desired act just a few decades ago (Szederjei and Róna 1967). The negative attitudes are intensified by the tendency of strong group pressure within the hunting community. As hunting is an expensive activity, attracting politically or economically influential people,

the participation of hunters as key stakeholders in wolf conservation is desirable community (Pohja-Mykra and Kurki 2014).

Frustrations about nature conservation practices and its economic and psychological consequences are also important factors in the development of negative attitudes towards wolves and wolf management, symbolizing local residents' feelings of powerlessness and exposure towards a centrally controlled authority (Linnell 2013; Lute *et al.* 2016). Respondents expressed their dissatisfaction about these items in relation with the wolf issue spontaneously, even if in the questionnaire did not contain this concept at all. In the Bükk region, historically, the extraction of natural resources (firewood, timber, charcoal, limestone, etc.) were major sources of local economy (Veres 2003). In the last couple of decades, due to national and EU policies and decisions – reflecting the general public's increasingly pro-conservation attitudes – nature conservation and protected area management has transformed, and obtained a higher priority (Linnell 2013; Natura 2000). The introduction and expansion of modern, sustainable forestry practices (e.g. leaving dead wood material in the forest, logging selected trees instead of clear-cutting whole territories) (BNPD 2017c) can cause disappointment in local residents, who were socialized with the idea of human control and extensive cultivation of the forest. Also, the ban of collecting firewood and other resources from protected areas, or entering BNP by car, was not strictly enforced until the last 10-15 years (anonymous personal communication). With stricter rules and enforcement, people could have the perception that they lost control against outside authorities, and they are deprived of precious resources they believed to be legal (e.g. collecting firewood). This disappointment can influence attitudes towards wolves, especially if the appearance of wolves roughly corresponds to the beginning of novel nature conservation practices or the stricter enforcement of nature protection laws. The stubborn belief among several respondents, that the wolf was deliberately introduced by BNP is further evidence for this tension with authorities. The disappointment of the two interviewed

livestock breeders about wolf management and the lack of trust towards authorities that they reported are further examples of this aspect.

Also, as a consequence of nature protection laws, the time periods of forestry works are limited – e.g. logging can only be started after the nestling season of birds has terminated (BNPD 2017c). Consequently, seasonally employed forestry workers can associate nature protection and conservation as a further pressure on the limited job opportunities in the region. Instead of the unfair employment conditions offered by the forestry company, the National Park's activities – including wolf conservation efforts – are being blamed. The extremely negative wolf-attitudes of three respondents who are seasonal forestry workers (#2, #3, #8 in Table 15) can justify this conclusion.

In the past 25 years, job opportunities are decreasing in the region, and depopulation is significant (KSH 2017a, 2017b). The desperation on experiencing a declining economy and a shrinking community can be a reason behind negative wolf attitudes too, because of the perception of receiving less attention and financial resources than wildlife, i.e. being under-prioritized with respect to nature conservation – and its symbolic species, the wolf. Some respondents mentioned in a bitter tone, that wolves and nature protection seem to be more important than humans.

Finally, the fact that the state-owned, but profit oriented forestry companies manage 97.5% of BNP forests – including wild game management and hunting – (BNPD 2017f) can be another root cause of negative attitudes towards wolves and wolf management. The ways how economic interests of the forestry companies – such as the efforts to reach yearly-set resource extraction and hunting targets seem to oppose the long-term conservation efforts has been discussed earlier. Additionally, the simultaneous activities of forestry management and wildlife conservation management also reflects a dual system of often clashing values. The production

of tangible and marketable goods in the Bükk Mountains, which can be locally recognized and consumed is not easily comparable with the more abstract value of biodiversity conservation benefitting society on a less local level. Also, the yearly repeated harvest of tangible goods can be hardly balanced with the long-term results of the ecosystem services provided by a stable wolf population, and the abstract concept of a richer biodiversity. In this dichotomy, a deeper clash of values emerges: the divide between anthropocentrism vs. ecocentrism, utilitarian values vs. intrinsic values, and natural resource use vs. conservation.

5.5. Future research

Based on the findings of this study, the following questions constitute interesting and relevant research topics for an enhanced understanding of the challenges of wolf conservation and its socio-economic and cultural background in BNP:

1. A representative quantitative research on local attitudes, representing social groups equally, and focusing on the particularities of single villages; assessing attitudes towards wolves in comparison with attitudes towards other carnivores (bear, lynx, birds of prey, etc.).

2. Calculation of the exact local economic impact of hunting and livestock breeding: what sectors are impacted and what is the amount of cross-sectoral input/output? How many residents are impacted? What is the amount of generated income, and what percentage of total income does it constitute? How much is the damage compared to other damage caused by wild game (e.g. destroying crops by wild boar and deer)?

3. Comparison of the wild game monitoring and reporting practices of BNP and the forestry companies, including protocols, methodology and evaluation, and determine the exact impact of wolves on wild game populations and behavior.

4. Monitor and analyze the alteration of wild game behavior due to wolf presence.

5. Modelling of sustainable wolf population in BNP and presentation of long-term wolf management plans with a multiple scenario analysis.

6. The impact of media (especially television and online social media) on attitudes towards wolves.

6. CONCLUSION

As a summary, local attitudes towards wolves and wolf management in/around BNP are neutral/negative; and wolf presence is not considered as a highly important local matter. Thus, it seems that the residents of BNP show tendencies of negative attitudes typical of regions where the wolf returned after a long absence. Yet, due to the prevalence of attributing intrinsic/aesthetic values to wolves, wolf conservation has sufficient moral foundations within local residents.

Contrary to similar research results, females, older people, and people with lower level of education do not have significantly different attitudes in the sample. Regarding the specific concepts behind attitudes, for older people, fear is a major factor, while people with less formal education are less likely to base their attitudes on intrinsic/aesthetic values of wolves. People who claimed to have seen wolves and those having a BNP related job have more extreme attitudes, in both directions. Livestock breeders, who suffered damage by wolves reported disappointment towards wolf management, mostly due to the lack of compensation and a lack of trust in authorities.

The role of media (mostly television) and rumors are important sources of information about wolves and wolf management, which can lead to misinformation, such as the common belief that wolves were introduced deliberately to BNP.

The origins of human-wolf conflicts in BNP are largely rooted in socio-economic factors, and other changes in the wider context, of which wolves are interpreted as symbols. Decreasing hunting revenue and its impact on other sectors is an important concern, even if probably only the behavior of wild game has altered, and the size of populations has not changed significantly.

Rural depopulation and the lack of permanent job opportunities can lead to the association of wolves with other nature protection practices, which restrict employment (less seasonal jobs) or natural resource use possibilities (enforcement of regulation on firewood picking). Conflicting interests of forestry companies and BNP in terms of land use and other priorities (e.g. production of tangible goods vs. biodiversity conservation) can also hinder large carnivore conservation.

As the current BNP wolf population is small and has been present for a short time period – kless than 7 years – several questions are yet unanswered, such as the exact impact of wolf depredation.

Based on the results, the following recommendations are formulated:

Active, fact-based communication by BNP: beliefs and misconceptions – such as the idea that wolves were introduced deliberately in BNP – are common among residents in/around BNP. The active communication of fact-based information on human-wolf matters – such as why BNP is an adequate wolf habitat, what is its impact on wild game populations, or what is their role in controlling of over-sized ungulate populations, which also cause damage for residents – can gain trust in the local public and improve local attitudes.

Communication enforcing the intrinsic/aesthetic values of wolves: On average, residents already attribute positive attitudes towards the intrinsic values of wolves. The reinforcement of this concept can further strengthen positive attitudes and give a stable ground for the expansion of positive attitudes towards other pro-conservation concepts.

Consistent, fair and straightforward compensation of wolf damages: Livestock owners who suffered damage expressed their disappointment about not receiving any compensation on wolf damages, even though it was promised to them by authorities. Clear rules about conditions of

compensation and their consistent enforcement is necessary in gaining trust and cooperation in the most impacted stakeholder group.

Modelling of wolf populations and their impact - and its communication: it is necessary to determine the ideal, sustainable wolf population size for BNP. The modelling of several scenarios and population sizes should be analyzed, and the related wolf-management practices developed. The preparation and communication of careful planning can improve the confidence and attitudes of residents, including other stakeholders.

Implementing a standard, shared wild game monitoring protocol: Currently BNP and the forestry companies have different interpretations on wild game populations, which leads to contradictory conclusions in terms of the impact of wolf presence. The use of a standard wild game monitoring and reporting tool – including the protocols, methodology and evaluation – could create a common ground for assessing the exact impact of wolves on wild game populations and behavior.

Reconsideration of asset management practices on protected areas: this recommendation concerns legal and economic questions at high levels, therefore it is highly theoretical, however, it incorporates one of the most important root-causes of negative attitudes towards wolves. The profit-oriented activities of the forestry companies – such as timber production or hunting – provide tangible income, which is prioritized by many, in respect to the less tangible, and more long-term benefits of biodiversity conservation. In case of conflicting situations (e.g. questions of land use) it is likely that the profit-oriented activities will be prioritized. Asset management should be regulated in a way that nature conservation never conflicts with forestry, or in case of conflicting interests, BNP should have the priority.

Revision of hunting practices: the current existence of hunting territories, and the practice of pre-organized hunts is hardly compatible with large carnivores, who roam large territories and chase wild game without respect to the limits of human hunting territories, or well-prepared

feeding places of pre-organized hunts. Hunting licenses should be assigned to larger territories, and hunting itself should be transformed to become less trophy-oriented and more adventure- and challenge-focused.

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APPENDIX I – Questionnaire translated into English

Serial number: Date: Location:

Questionnaire

Hello, my name is Katalin Tarr. I am astudent of Environmental Sciences and Policy, and I am doing a research on the nature of the relationship between people and wolves in the area of the Bukk National Park. This study is undertaken as a student research and my interest is purely scientific. I would like to emphasize that I am not affiliated to the park administration or any governmental or non-governmental institutions. Your household was selected randomly from your village. Your participation in this survey is voluntary and I/we would be grateful for your views on this subject; your responses will be treated as confidential and will never be associated with your name. This questionnaire will take approximately 20-25 minutes.
If you would like more information on this study, I can be reached at tel:_____ email _____

I. Responder

1. Gender: F ( ) N ( )
2. Age _____
3. Occupation _____
4. Highest Education: _____

II. Household

5. How many people live in the Household _____
6. Women/Man older than F ( ) N ( )
7. Child younger than 18 F ( ) N ( )
8. Net monthly income (HUF)

( ) 0-50.000
( ) 50.001-100.000
( ) 100.001-150.000
( ) 150.001-200.000
( ) 200.001-300.000
( ) >300.000

9. Since when do you live in the village?

( ) 0-5 years
( ) 6-15 years
( ) 16-30 years
( ) >30 years
( ) for several generations

10. Do you have pets? Yes / No
    if Yes: what and how many?
11. Vannak haszonállatai? Yes / No
    if Yes: what and how many?
12. With what purpose do you visit the BNP?
    (Multiple answers are allowed)

( ) excursion, hike
( ) picking mushrooms, firewood, etc.
( ) work
( ) hunting
( ) sports
( ) I do not visit the BNP
( ) other:

13. How ofthen do you visit the BNP?

( ) never
( ) 1-2x/year
( ) 3-6x/year
( ) monthy
( ) weekly
( ) daily
( ) other:

III. Knowledge and exerience on wolves

14. Have you ever seen/heared a wolf in/around BNP? If yes, please tell the details.
15. Have you ever met a wolf?
16. Has anyone told you about having seen/heard a wolf?
17. Have your livestock suffered a wolf attack? If yes, please tell details. Have you applied for /received any compensation?
18. Have you heared of wolf attaches? Please tel about it.
19. Where did you obtain your information/knowledge on wolves?

( ) book
( ) family, friends
( ) Internet
( ) printed press
( ) school
( ) information board
( ) other:

20. How big is the wolf population in BNP?

( ) 0
( ) 1-5
( ) 6-10
( ) 11-20
( ) 21-30
( ) 31-40

21. How many wolves live in a pack?

( ) 1-3
( ) 4-12
( ) 13-20
( ) 21-30

22. In your opinion, the BNP wolf population should ideally:
    ( ) Increase ( ) decrase ( ) not change
23. Have you heard from old people that a long time ago wolves used to live in thr Bükk Mountains?
24. Can a wolf and a dog have a common offspring?
25. Do you know what to do if you suffer damage caused y a wolf attack?
26. Do you know who is responsible for wolf management?

( ) forestry/hunters ( ) Flayer service
( ) BNP directorate ( ) National nature conservation
( ) National Army ( ) other:

27. Do you hunt? If yes, what species?
28. Have you heared stories about someone having shot a wolf?

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Attitudes:

1 Fully agree
2 Somewhat agree
3 Neutral
4 Somewhat disagree
5 Fully disagree

		1	2	3	4	5
29.	I would be happy if BNP wolf population would increase.	☐	☐	☐	☐	☐
30.	Wolves cause damage.	☐	☐	☐	☐	☐
31.	Wolves are important part of nature.	☐	☐	☐	☐	☐
32.	Wolves are ruthless, dangerous killers.	☐	☐	☐	☐	☐
33.	Wolves should be protected so that future generations can get to know them.	☐	☐	☐	☐	☐
34.	Wolves pose a threat to the safety of hikers.	☐	☐	☐	☐	☐
35.	The wolves decimate wild game and thus cause damage.	☐	☐	☐	☐	☐
36.	Wolf management is in the authority of local forestry/hunters.	☐	☐	☐	☐	☐
37.	Wolves pose a threat to livestocks' safety.	☐	☐	☐	☐	☐
38.	Wolves can attack children.	☐	☐	☐	☐	☐
39.	Wolf-management is the task of the nature conservation authority	☐	☐	☐	☐	☐
40.	Wolves are part of the beauties and wonders of nature.	☐	☐	☐	☐	☐
41.	Wolves pose a threat to residents'safety.	☐	☐	☐	☐	☐
42.	It should not be allowed that wolves populate the Bükk Hills.	☐	☐	☐	☐	☐
43.	Wild boar cause a lot of damage.	☐	☐	☐	☐	☐
44.	I only accept the presence of wolves if there would be some financial profit from them (e.g. fur sales)	☐	☐	☐	☐	☐
45.	Wolf management is the ocal resident's business.	☐	☐	☐	☐	☐