

# CAN BEARS AND WOLVES COEXIST PEACEFULLY? A CASE STUDY OF A CONFRONTATION RECORD IN BOSNIA AND HERZEGOVINA

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## Abstract

The existing data indicates a steady decrease in the grey wolf (*Canis lupus*) population of Bosnia and Herzegovina (B&H), but despite this there remains no official protective legislation in place for the species. In an attempt to address the issue of protective legislation, we initiated monitoring projects on the grey wolf in B&H with the support of the Rufford Foundation. The aim of these projects was to obtain data on the presence, activity, abundance, and behavior of wolves, while continuously expanding the area of monitoring. Monitoring has been conducted via camera trapping since 2015. Cameras were set up at several localities, at one of which a confrontation between a wolf and European brown bear (*Ursus arctos*) was recorded. Since these two apex predators have recolonized common regions and habitats across Europe, resource competition and the possibility of inter-specific conflict is more likely. These conflicts may jeopardize the continued existence and future expansion of populations of both bears and wolves in these recolonized habitats. Accordingly, it is very important to study the nature of their coexistence, and the resulting data is ultimately essential for helping to create or resume conservation management plans for both species. Moreover, these data can help highlight areas for data collection and monitoring, thus providing important baseline information for survey planning.

**Key words:** bears, Bosnia and Herzegovina, camera trapping, coexistence, wolves, monitoring

## INTRODUCTION

After decades of the decrease in populations, both wolves and bears have made a significant recovery across Europe (Chapron *et al.*, 2014). This is mainly due to the introduction of national and international legislation, reforestation, the recovery of wild prey populations, and an increased social tolerance for wildlife (Boitani and Linnell, 2012). However, many of these populations remain threatened and their long-term viability relies on effective conservation efforts (Bautista *et al.* 2017).

Similar to other countries (Brown, 1993), wolves and bears have coexisted in much of the same habitat range in B&H, but details of the nature of their coexistence are poorly explored. Although interactions between these two species generally rely on mutual avoidance (Servheen, 1990), records of conflicts exist (e.g. Mech, 1995). Behavior during interactions

depends upon many variables, including age, sex, reproductive status, prey availability, hunger and aggression, numbers of individuals, and experience of previous interactions (Servheen, 1990). Most serious interactions occur around wolf dens (Peterson *et al.*, 1984). In typical occurrences, wolves often behave aggressively to juvenile, old or otherwise weakened bears (Mech, 1995). Furthermore, bears may occasionally kill wolves (Joslin, 1966; Pimlott *et al.*, 1969), but generally there are no negative trends for wolves or bears as a result of interactions (Servheen *et al.*, 1991). According to Weaver (1986), bears may even benefit from wolves by opportunistically scavenging their kills. There are plenty of other ways of interaction such as: i) wolves harassing bears, ii) wolves stealing fish from bears, iii) wolves displacing bears from a moose carcass, or iv) wolves and bears travelling together, all explained in detail in the research by Smith *et al.* (2004).

In studying wildlife behavior, camera trapping consistently represents the most convenient and cost-effective survey method (e.g. O'Connell *et al.* 2010; Rovero *et al.*, 2013). This non-invasive, harmless tool has become popular in i) identifying species inhabiting a particular area; ii) monitoring species abundance and activity, and iii) addressing a variety of ecological and conservation-related questions (e.g. O'Brien *et al.*, 2003). In recent years, the use of camera traps has considerably increased in ecological field studies (Rowcliffe *et al.*, 2008; McCallum, 2013).

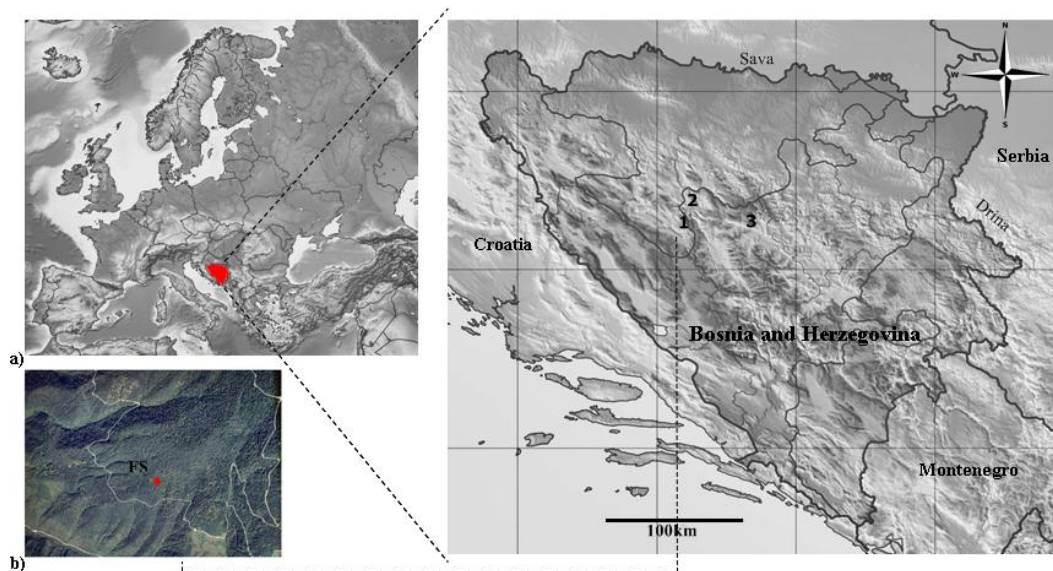
Although the biodiversity of B&H is among the most diverse in Europe, due to the country's position in the Balkan Peninsula, systematic collection and analysis of biodiversity data, and its monitoring, are notably poor (USAID report, 2016). In B&H, wolves are not legally protected (Šnjegota *et al.*, 2018), despite the fact that population is slowly decreasing (Šnjegota *et al.*, 2021). Thus, we initiated projects involving the monitoring of wolves at several localities within the country, aiming to collect enough data to enable us to suggest conservation measures and establish the legal protection for this species. During the monitoring period, we recorded a confrontation between a bear and wolves, which we aim to analyze in this case study. This case study and opportunistic sighting provide an interesting insight into the sympatric life of these two apex predators in their natural environment in B&H.

## MATERIALS AND METHOD

Projects on the monitoring of wolves in B&H have been conducted since 2015 and are ongoing, with the support of the Rufford Foundation (<https://www.rufford.org/search/?q=dragana>). A fundamental need for monitoring arose from reports on wolf population decline and potential structuring noted by several authors (Boitani, 2000; Djan *et al.*, 2014). Wolves from B&H represent the central component of the larger Dinaric-Balkan wolf population, an extremely important element for recolonizing neighboring populations (Hindrikson *et al.*, 2016; Ražen *et al.*, 2016). Despite their position within the Dinaric-Balkan population being very significant, monitoring of wolves on the wider territory across B&H has historically been negligible. This revelation consequently triggered and initiated projects on national wolf monitoring via camera trapping.

Over the past few years, fifteen trail cameras (Bushnell Trophy Cam HD, SunTec HC 300m Cam HD) were placed at several distant locations within areas marked as biodiversity hotspots in B&H (Figure 1a). Within each location cameras were set and repositioned at: i)

feeding stations (FS) which were regularly supplied with food and/or ii) established transects (T). Each FS and T is considered a sub-location within the main location. To maintain consistency, cameras were placed at each sublocation for a certain period of each season of the year. FS and T were selected with the assistance of forest rangers who provided us with information concerning animals' local activities and abundance. This method of camera placement allowed us to examine the presence, abundance and behavior of species in various situations, including i) at feeding stations with freely-available food, ii) while crossing transects during daily activities (i.e. searching for food), during different seasons. At feeding stations, cameras were placed up to 30 m from the center of the monitored area, covering all angles from which animals could approach the food. At the established transects, cameras were placed less than 20 m from the transect lines in areas with the highest levels of animal activity (ie. presence of animal trails). Cameras were set up to take photographs and record videos 24 hours per day throughout the study period.



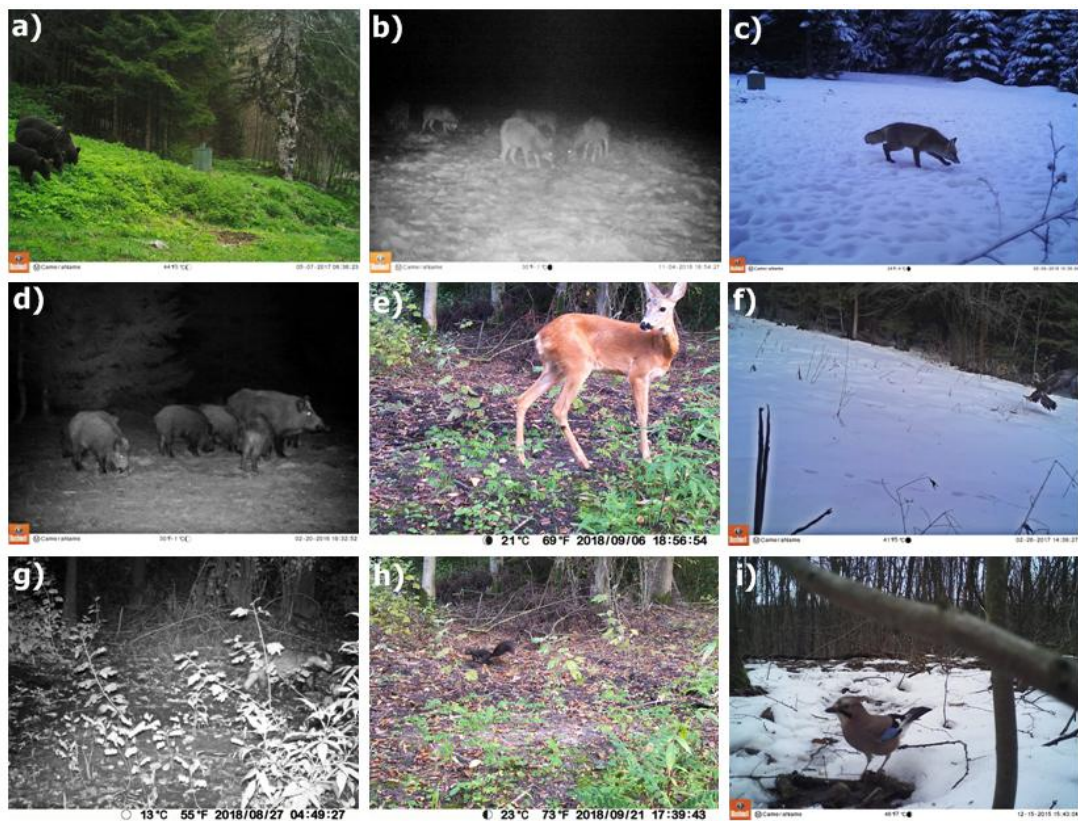
**Figure 1.** a) Map of Bosnia and Herzegovina with grey wolf (*Canis lupus*) monitoring localities: 1) Janj (44.18, 17.26) 2) Čemernica (44.58, 17.21) 3) Vlašić (44.27, 17.67) b) FS - feeding station where wolf/bear confrontation was detected.

## RESULTS

After organizing and sorting photographs from all monitored locations during five months of continuous monitoring, from May to September 2015, a variety of species were detected (Figure 2). From photographs, we noticed that wolves and bears generally overlap within the same areas but principally avoid each other. However, we managed to capture and record a single confrontation between the two species (Figure 3). The confrontation was captured at one of the feeding stations (Figure 1b) where the most likely scenario was as follows: i) bear attended the feeding station before the wolf/wolves (Figure 3a); ii) after some time an individual wolf approached the same location without any evidence of conflict with the bear (Figure 3b, 3c, 3d, 3e); iii) twenty minutes later another wolf joined the bear and wolf

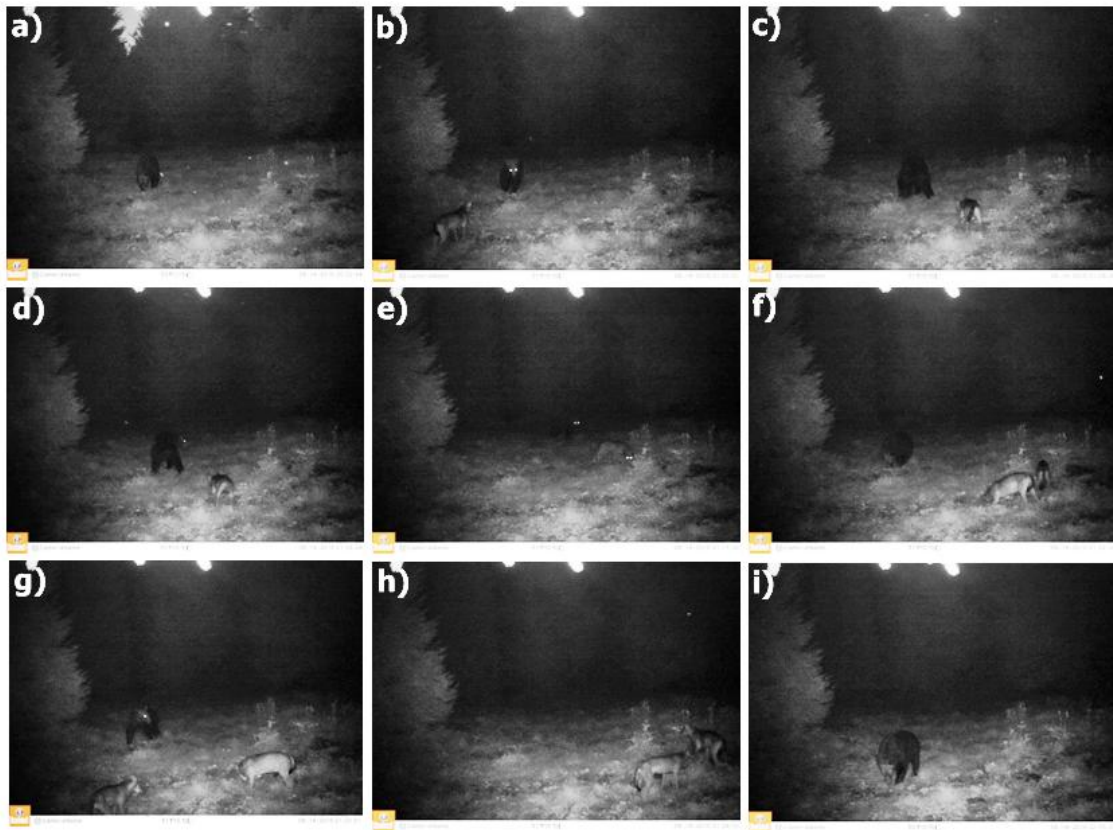
(Figure 3f, 3g), after which iv) the bear left the feeding station (Figure 3h) and v) returned an hour later after the wolves had departed (Figure 3i).

Although the scenario is based on a single record, it provides us with basic information about the species' behavior while coexisting in the presence of sufficient food resources. Additionally, it provides us with valuable data on the animals' presence, crucial for the planning of conservation activities. However, the observed confrontation should be considered strictly as a case study which may not reflect the animals' behavior generally.



**Figure 2.** Various species captured via photo cameras: a) brown bear (*Ursus arctos*) b) grey wolf (*Canis lupus*) c) fox (*Vulpes vulpes*) d) wild boar (*Sus scrofa*) e) roe deer (*Capreolus capreolus*) f) golden eagle (*Aquila chrysaetos*) g) European badger (*Meles meles*) h) Eurasian red squirrel (*Sciurus vulgaris*) i) Eurasian jay (*Garrulus glandarius*)





**Figure 3.** Bear and wolf confrontation recorded at the feeding station at the Janj locality

## DISCUSSION

*Can peaceful coexistence between bears and wolves be achieved while recolonizing common areas?*

Coexistence between species which compete for the same resources has interested scientists for the past century (Ritchie, 2002). Although interspecific competition appears to be frequent (Connell, 1978; Schoener, 1983) there is little evidence for competitive exclusion, in other words the impossibility of the coexistence of two species competing for the same resource (Gause, 1934). This is perhaps because these species are highly mobile and have the ability to choose. This accordingly increases heterogeneity in the distribution of resources and habitat which plays a significant role in competitive coexistence.

According to the extensive photo sets acquired during our projects to date, wolves and bears overlap within the territory they inhabit. They are both apex predators coexisting within a common ecosystem while competing for prey. However, data gathered from our projects show that the two species have developed a mechanism for coexisting without conflicts by avoiding each other. Thus, they manage to inhabit the same areas and remain tolerant of each other, which bodes well for the future existence of both species. Several mechanisms, examined in attempts to explain modes of coexistence without exclusion, suggest that species that compete for the same resource can coexist by using all available resources but at different rates (Wilson, 1990; Holt, 2001; Sommer and Worm, 2003). This might relate to our case study in

terms of i) differences in prey selection and/or ii) activities at different periods of the day for wolves and bears overlapping within the same territory.

Despite the fact that bears and wolves principally avoid each other, we were able to record a confrontation between the two species. The observed confrontation suggests that if wolves do not feel threatened by bears, or vice versa, they can function together without conflict. Furthermore, it shows that these animals possess degrees of restraint in the sense that if they are outnumbered there is a preference for retreat rather than aggression and conflict. According to Sommer and Worm (2003), each species differs critically in a way that allows it to avoid competitive exclusion, even when the competition is asymmetric, i.e., one species is significantly numerically dominant to the other.

Experience gained during the past two decades highlights the importance of applying camera trapping methodology to address conservation-related questions regarding native species populations, especially in the case of mammals (Swan and Perkins, 2014). Camera traps provide basic data on the distribution of mammals. This data is essential for conservation on both local and regional scales but is historically lacking for many species, especially those that are nocturnal, avoid humans or are otherwise elusive. Camera trapping has been significant for wildlife management and conservation throughout the world (Moriarty *et al.*, 2009; O'Brien *et al.*, 2010; Kucera and Barrett, 2011; Cremonesi *et al.*, 2018). Via this method various species that are new to science, those occurring in areas where they were assumed to be locally extinct, and those not previously known to exist, were documented (e.g. Sangay *et al.*, 2014). Accordingly, camera trapping can be a crucial tool for gathering and/or augmenting information about biodiversity in B&H.

## CONCLUSION

Monitoring via camera trapping provides us with data that can advance conservation activities in B&H. Nowadays, wolves and bears are in the focus of international conservation communities due to their significant revival across Europe, which will perhaps require the adoption of new management measures for their sustainable coexistence. The data accumulated from our projects are of significant conservation value due to the extensive information gathered regarding the presence, activity, behavior, and abundance of both species. This will, in turn, be helpful to the creation and/or renewal of existing conservation measures for both wolves and bears in B&H.

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## **DA LI MEDVJEDI I VUKOVI MOGU KOEGZISTIRATI U MIRU? STUDIJA SLUČAJA KONFRONTACIJE U BOSNI I HERCEGOVINI**

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### **Sažetak**

Postojeći podaci ukazuju na postepeno smanjenje populacije sivog vuka (*Canis lupus*) u Bosni i Hercegovini (BiH), ali uprkos tome, još uvijek ne postoji zvanična zakonska regulativa za ovu vrstu. U nastojanju da se riješi problem zakonodavstva, pokrenuti su projekti monitoringa sivog vuka u BiH uz podršku *Rufford* Fondacije. Cilj ovih projekata bio je prikupljanje podataka o prisustvu, aktivnosti, brojnosti i ponašanju vukova, uz kontinuirano proširenje područja monitoringa. Monitoring se sprovodi od 2015. godine primjenom kamera (fotozamki). Kamere su postavljene na nekoliko lokaliteta, od kojih je na jednom lokalitetu zabilježen susret vuka i evropskog smeđeg medvjeda (*Ursus arctos*). S obzirom da su ova dva vrhunska predatora u procesu (re)kolonizacije istih područja i staništa širom Evrope, kompeticija za resurse i mogućnost međusobnih sukoba potencijalno su vjerovatni. Navedeni

sukobi mogu ugroziti postojanje i buduću ekspanziju populacija obje vrste u (re)kolonizovanim područjima. Stoga, vrlo je važno proučavati prirodu njihove koegzistencije, a dobijeni podaci su krajnje važni za kreiranje planova upravljanja obje vrste. Pored toga, ovi podaci mogu pomoći u odabiru područja za buduću monitoring i prikupljanje podataka, te pružaju važne osnovne informacije za planiranje istraživanja.

**Ključne riječi:** medvjedi, Bosna i Hercegovina, fotozamke, koegzistencija, vukovi, monitoring

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