Beiträge zur
JAGD
&WILD
forschung · 41

Susanne Reimoser and Friedrich Reimoser, Vienna/Austria

Long-term trends of hunting bags and wildlife populations in Austria

Schlagworte/key words: Hunting bag statistics, wildlife habitats, long-term population trends, Austria, Jagdstrecken, Jagdstatistik, Wildlebensraum, langfristige Populationstrends, Oesterreich

1. Introduction

Typical for Austria is an intensive multiple use of landscapes by settlements, traffic infrastructure, agriculture, forestry, hunting, nature conservation and tourism. A sustainable integration of wildlife animals without serious problems for land-users or/and the species concerned is difficult in such habitats. In this study, we compared the trends of long-term hunting bag numbers of Austria since 1955 to estimate large-area population trends of 24 wildlife species or groups of species, typical for different habitat types. Habitat changes are discussed as potential causes for the trends.

2. Method

The hunting bag statistics were taken from the official statistical information of Austria. With the total yearly hunting-bag numbers (not differentiated between sexes and age classes) long-term, country-wide and regional population trends were compared.

3. Characters of Austria

The country area of Austria covers 83,858 km^2 with altitudes up to 3,800 meters (Fig. 1), 82,180 km^2 are huntable area (98 %). Austria has very different landscapes: from the alpine mountains in the western part to the lowlands in the east close to the river Danube. Vegetation cover and forest share differ markedly within the country. The total forest share of Austria is 48 %.

Fig. 1 Topography of Austria

The most common ungulate game in Austria is roe deer. The maximum population density reaches about 400 head per 10 square kilometres (in Alpine foothills). The yearly hunting bag in 2014 was 268,054 head. Further abundant ungulate species are wild boar and red deer. The other ungulates, chamois, ibex, mouflon, sika deer and fallow deer are restricted to smaller areas. Large predators (wolf, brown bear, lynx) are rare in Austria. They are under protection.

Wildlife management is regulated by hunting laws. Aims are high diversity of game species, protection of game populations, avoidance of game damage to vegetation, and sustainable use of game animals. Hunters and game wardens are responsible for wildlife management.

The hunting system is district hunting (hunting grounds, mostly leased), hunting rights are connected to the land owner, minimum size of hunting districts is 115 ha. Hunters must take special courses and pass an exam before they are allowed to hunt. The liability for game damage compensation in forests and agriculture is up to the hunter.

Supplemental feeding is done often for cervids in winter, only seldom for bovids, and luring very frequently for wild boar. There are regional differences.

Principles, criteria, and indicators for integrated sustainable wildlife management including hunting, forestry, agriculture and recreation were developed (Reimoser et al. 2013).

The hunting statistics for Austria show following figures (2014): 1.4 % hunters per inhabitants (in 1957: only 0.9 %), and also 1.4 hunters per square kilometre hunting area (in 1957: 0.8 hunters/km²); on average 4.6 wild ungulates were culled per km² hunting area in the year 2014 (in 1955 only 1.4 ungulates/km²); on average 3.0 ungulates were culled per hunter in 2014 (2.2 in 1957). The number of hunters was increasing. In 1957 about 62.600 hunters were registered in Austria, in 2014 their number reached about 123,300.

Game damage in agriculture is increasing due to the increasing number of rooting wild boar. The situation of game damage to forest (twig browsing, bark stripping), is an old and constant problem (Reimoser et al. 2010). Browsing damage to forest regeneration within the last two decades decreased in the "production forests" (main aim is timber production), but increased in the so called "protection forests" on steep areas of the mountains (protection against avalanches, rockfalls, erosion, etc.) where human disturbance of ungulates is less (areas difficult to access for man, therefore concentrations of escaping ungulates).

4. Hunting bags and population trends

The potential population densities and growth rates for wildlife species are primarily determined by the habitat quality. Also the sustainable level of possible or necessary culling depends strongly on habitat quality. For many game species habitat quality and survival rates changed markedly over the last 60 years. This is a main factor for changes of culling rates (Reimoser et al. 2010).

The retrospect on the developments of yearly culling rates for certain game species since 1955 (Table 1, Fig. 2) offers a better understanding of the habitat situation and development trends, from which objectives and measures for future wildlife management can be derived. An overview of the developments of all hunted wildlife species in different habitats of Austria for the period 1955–2003 was given in a 19 part series (Reimoser et al. 2005 and 2006).

Roe deer

Despite the increasing barriers and curtailing of habitats now much more roe deer (*Capreolus capreolus*) are culled than 60 years ago (Table 1, Fig. 2).

Political districts with best roe deer habitat in Austria (hilly landscapes with a mosaic of forest and agricultural areas) showed even in the first decade (1955–1964) as roe deer still was sparsely present in the mountains and lowlands, high culling rates (Fig. 3).

Noteworthy is the undulating course of the increase in culling rates with distinct summits in the years 1962, 1977, 1992, 2003 and 2012. A fluctuation cycle of about 10–15 years seems to be apparent (Fig. 2).

Table 1 Hunting bags in Austria per decennium, and in total 1955–2014

	Hunting bag per year (mean of decennium)						Total bag (60 yrs)
Species	**1955–64**	**1965–74**	**1975–84**	**1985–94**	**1995–04**	**2005–14**	1955 to 2014
Red deer	27,141	34,725	41,064	40,043	41,669	51,804	2,364,458
Roe deer	120,042	155,712	216,446	239,245	251,408	265,314	12,481,671
Chamois	12,397	15,890	24,938	26,773	25,610	20,739	1,263,471
Ibex	0	0	69	207	440	432	11,474
Mouflon	158	537	1,291	1,705	1,764	2,264	77,195
Sika deer	44	96	201	402	612	733	20,876
Fallow deer	18	80	127	235	358	639	14,568
Wild boar	1,230	2,515	4,440	9,706	22,021	32,014	719,262
Brown hare	316,768	336,936	255,764	198,477	169,128	143,386	14,204,579
Rabbits	4,938	11,470	24,184	8,568	2,150	2,261	535,707
Marmots	2,704	3,074	5,436	6,795	6,953	7,188	321,486
Pheasant	187,583	380,754	366,020	228,165	181,122	120,534	14,641,788
Partridge	101,424	92,585	40,573	8,883	8,970	8,725	2,611,612
Wild pigeons	22,559	37,497	25,933	20,195	20,581	18,462	1,452,269
Woodcock	5,784	4,532	4,177	3,230	4,761	3,374	258,572
Wild ducks	21,030	37,727	67,197	80,157	79,895	70,666	3,566,716
Wild geese	2,342	1,935	2,674	1,917	2,037	2,015	129,186
Coot	1,354	1,891	2,224	1,967	2,229	1,114	107,783
Capercaillie	1,523	1,030	482	556	417	383	43,903
Black grouse	1,863	2,147	1,905	2,357	2,156	1,717	121,447
Hazel grouse	744	497	278	274	203	141	21,364
Red fox	37,819	38,909	34,058	36,140	58,842	58,275	2,640,428
Badger	3,944	5,199	5,649	5,075	7,740	7,993	356,007
Martens	1,596	3,157	8,413	15,389	24,278	22,724	755,574
Polecat	7,730	11,602	10,054	7,845	6,763	5,833	498,253
Weasels	11,428	22,801	27,492	24,037	26,646	16,741	1,291,453

Red deer

In the past centuries habitats for red deer *(Cervus elaphus*) in Europa continually shrinked and got more isolated from each other. But in the last decades red deer populations began to increase with locally unnatural high concentrations causing serious problems in forest and agriculture. The population increase occurred mainly in the Alpine regions (Fig. 3). Similar to roe deer, red deer also shows fluctuation cycles in culling rates with an interval of about 15 years from one peak to the next (Fig. 2). In how far these cycles are caused by environmental factors (e.g. climate and natural food supply which influence population growth rates), or if they are primarily initiated by recurring discussions of game damage to forests (and in the follow changes in official shooting plans), or if the undulations are caused by periodical reductions of the shooting plans after years with increased culling numbers due to hunters' fear of over-

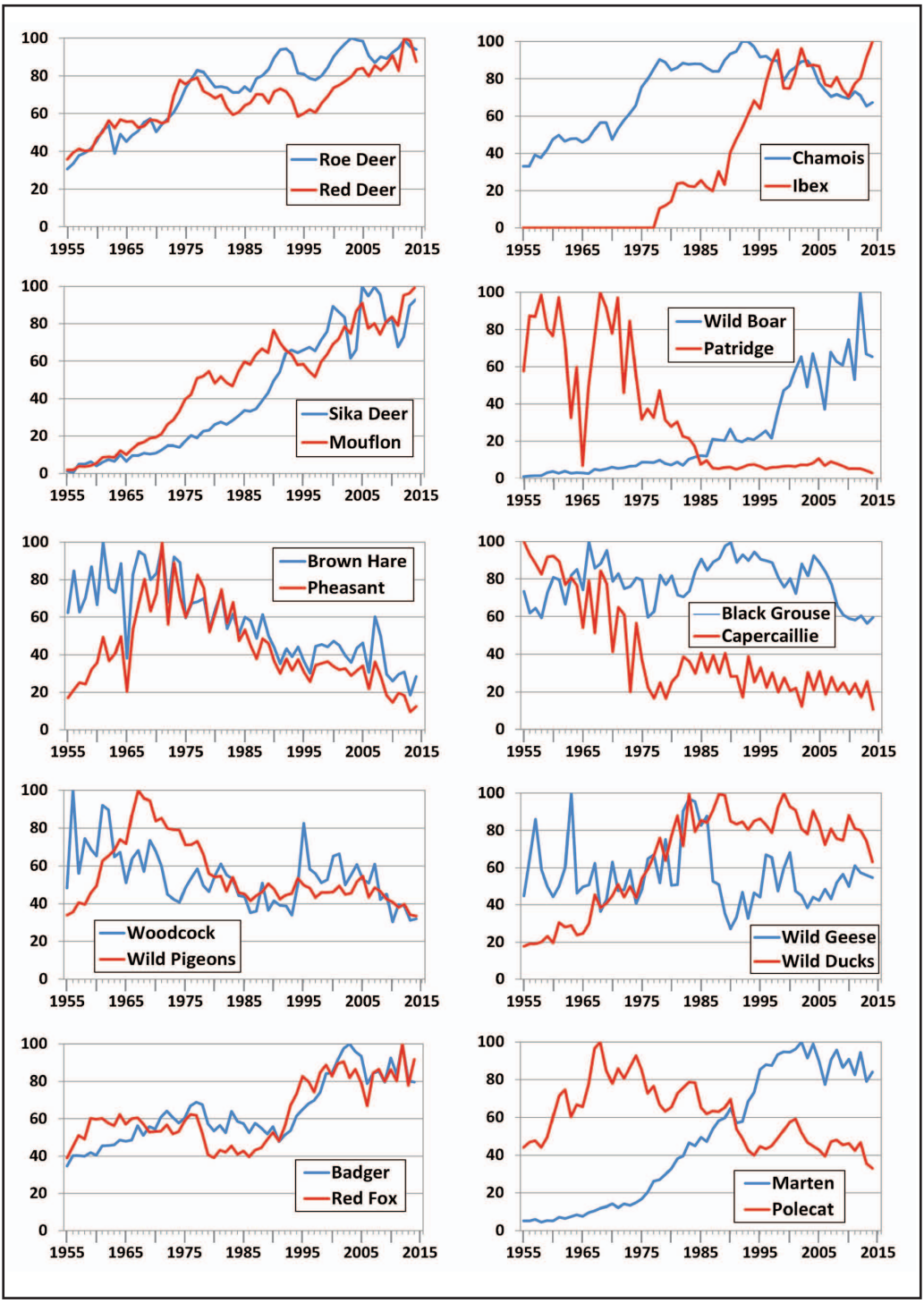

Fig. 2 Annual culling rates in percent (100 % = maximum rate) of 20 game species in Austria 1955–2014

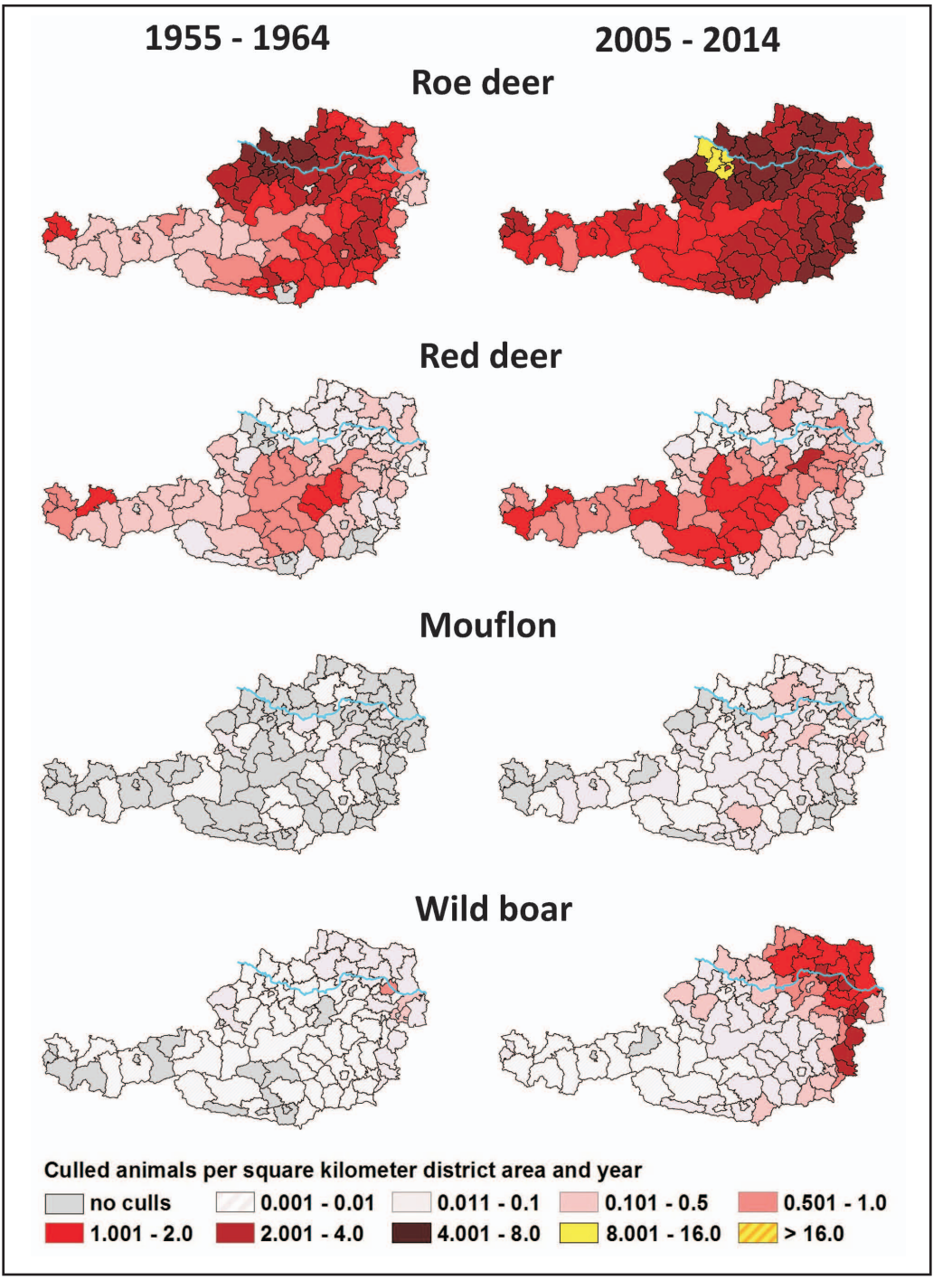

Fig. 3 The maps contain the average annual culling densities for roe deer, red deer, mouflon and wild boar (animals per 1 km² of district area) in the 99 districts of Austria (Vienna was regarded as one district), each map for one 10-year period (left: 1955–1964, right: 2005–2014); blue line = Danube river

hunting, or if other reasons are the cause, cannot yet be answered for Austria. More research on this topic is needed.

Chamois

Similar to other European countries with chamois *(Rupicapra rupicapra)* the culling rate first increased and then began to decrease in the 1990s (Fig. 2).
Enhanced culling might explain the population decrease of chamois, partly because of the increase of recreational activities (hiking, skiing, paragliding, etc.) in the alps above the timberline which is the main habitat of chamois; animals retreated into the protection forests, there cause game damage (browsing of forest regeneration) and had to be reduced. Just like roe and red deer periodical undulations in culling rates are evident, with a main cycle of about 10 to 17 years. Possible reasons for these fluctuations are mentioned under red deer.

Ibex

The ibex *(Capra ibex)* prefers similar habitats as chamois (steep, rocky and open terrain) but drier and sunnier with less snow in winter. After successful reintroduction of the once exterminated ibex in Austria, first culls of a few animals were registered in 1978 and since the mid-1990s 400–500 head are culled on a sustainable basis. Now about 6,000 ibex are living in Austria, i.e. 15 % of the total Alpine population of about 40,000 head.

Mouflon, Sika deer and Fallow deer

In early 19th century mouflons *(Ovis orientalis)* were released from enclosures in the wild. Since 1955 culling rates of mouflon multiplied by a factor of 50 (Fig. 2). Starting from small colonies scattered across the country, after 60 years mouflons are now widespread in Austria (Fig. 3). The alien Sika deer *(Cervus nippon)* has two main populations in the northeast of Austria stemming from enclosures. Their increasing trend in culling numbers since 1955 is similar to mouflon, but on a much lower level. Fallow deer (*Dama dama*) also shows strong increases in culling rates.

Wild boar

During the time of Empress Maria Theresa (mid-18th century) wild boar *(Sus scrofa)* was nearly eradicated in Austria to reduce damage caused on farmlands. Only very small remnants remained locally in the east of Austria. Since 1955 the population of wild boar started to increase and is still rapidly increasing (Fig. 2). Now boars are also permeating in mountainous areas, probably supported by mild winters and more food supply (luring, feeding), yet the highest increases are in the lowlands and hilly areas in the northeastern parts of Austria (Fig. 3).
The strong increases of wild boar populations coincide with the dramatic decrease in small game populations (e.g. partridge, hare). Wild boars which were initially eliminated like vermin were later favored as new game species in place of the declining small game species and therefore their increase and dispersal was supported by hunters (e.g. no adult females culled, feeding).

Brown hare

Culling rates for brown hare *(Lepus europaeus)* decreased significantly since 1955 (Fig. 2), with only small regions in northeastern Austria where still high numbers of hares exist (Fig. 4). Primarily changes in agriculture led to this decline.
Hares have high demands in food quality, especially in forage with high fat content. The formerly very beneficial patchy mosaic in land-use with many fallow areas including wild herbs were changed into intensely cultivated largely homogeneous fields which only provide inferior habitat for hares.

Common rabbit

Wild rabbits *(Oryctolagus cuniculus)* have been known in Austria since the 17th century. Their habitat is mainly in the warmer, drier northeastern parts of Austria, where they sometimes caused considerable damage in vineyards and fields.
Since 1961 culling rates showed a steep increase with a peak in 1978 (> 37,000 culled), after which culling numbers dropped to about 2000 in 1996 and remained stable since then.

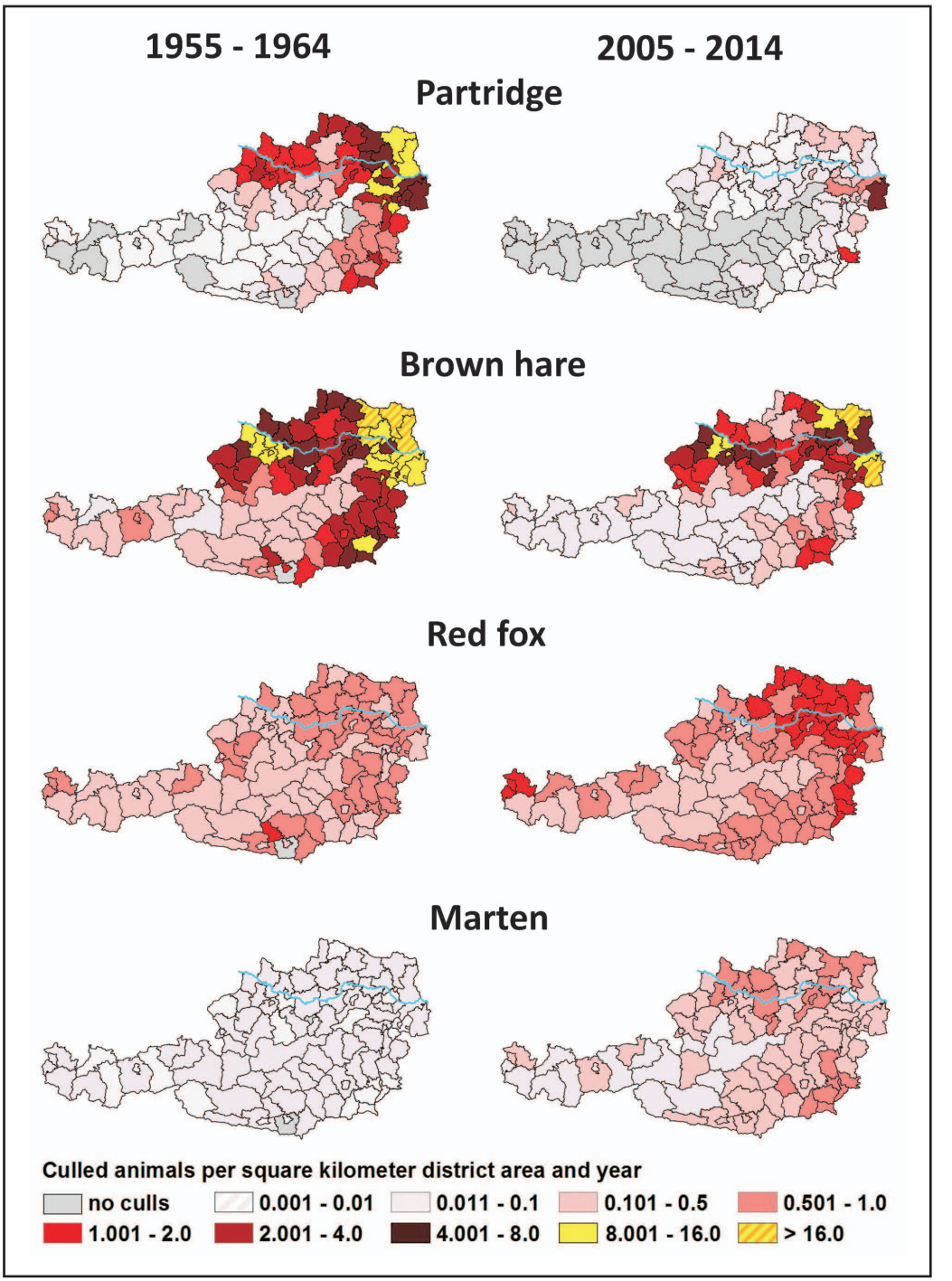

Fig. 4 The maps contain the average annual culling densities for partridge, brown hare, red fox and martens (animals per 1 km² of district area) in the 99 districts of Austria (Vienna was regarded as one district), each map for one 10-year period (left: 1955–1964, right: 2005–2014); blue line = Danube river

Alpine marmot

Marmots (*Marmota marmota*) inhabit the alpine pastures in Austria ranging from 1000 to 2700 m altitude. Partly due to release of animals in areas where they in earlier times had turned extinct by overhunting for their fat used for medical purposes, annual culling rates increased from about 2700 in the first decade to 7000 in 1985, and remained stable since.

Grey Partridge

Originally native in steppes partridges *(Perdix perdix)* prefer open areas with scattered clusters of scrubs. Chicks need seeds from wild herbs and insects. Since partridges react more sensitive and rapidly to habitat changes then hares, their populations began to decline earlier (in the 1970s) and reached a much lower level than hares. Only in one district bordering in the east on Hungary fair numbers of partridges are still culled (Fig. 4).

Pheasant

The culling numbers of pheasants (*Phasianus colchicus*) in Austria is partly influenced by release of reared animals, which makes the interpretation of trends in self-sustaining populations difficult. Culling rates increased rapidly until the mid-1970s, and is since then declining (Fig. 2).

Woodcock

The woodcock *(Scolopax rusticola)* is mainly a migratory bird staying from March to September in Austria, but also some overwintering birds can be observed. The culling rates of woodcocks were rather stable in Austria (Fig. 2).

Wild pigeons

The most common species in Austria is the common wood pigeon (*Columba palumbus*). Further species are Eurasian collared dove (*Streptopelia decaocto*), European turtle dove (*Streptopelia turtur*) and stock dove (*Columba oenas*). Culling rates of pigeons tripled from 1955 to 1967 and since then declined back to the initial value (Fig. 2). Hunting in spring is forbidden since the 1990s.

Wild ducks

The Austrian duck hunting bags consist of at least 90 % mallards (*Anas platyrhynchos*). Most of the other culled species are common teal (*Anas crecca*), tufted duck (*Aythya fuligula*) and common pochard (*Aythya ferina*).
The culling rates increased markedly until 1980, remained stable for the next three decades and are declining slightly in the last few years (Fig. 2).

Wild geese

Greylag geese (*Anser anser*) breed particularly in the very east of Austria, whereas bean geese (*Anser fabalis*) and white-fronted geese (*Anser albifrons*) are only encountered as overwintering guests. Culling rates of geese have been more or less stable since the last 60 years (Fig. 2).

Coot

The Eurasian coot (*Fulica atra*) is mainly found in slow flowing rivers, eutrophic lakes and ponds. Their culling rates increased in the first decade, remained fairly stable for the next decades and is now decreasing again in the past decade.

Hazel grouse

Hazel grouse *(Tetrastes bonasia)* are widespread in Austria. They prefer forests rich in conifers with denser structures. Culling rates of hazel grouse declined rapidly from 1955 to 1974, after which the downward trend still continued, yet with a slower rate.

Capercaillie

Culls of capercaillie *(Tetrao urogallus)* decreased, first rapidly until the 1970s, then slowly. Capercaillie avoid dense forests. Since Austrian forests at large are turning more and more dense due to cessation of forest pasture in many regions and insufficient forest thinning the habitats for capercaillie dwindle away. Conservation of capercaillie depends strongly on silviculture considering the habitat needs of this species. Since 1970 in some provinces of

Austria culling of capercaillie is only permitted every second year leading to a zigzag trend line (see Fig. 2).

Black grouse

Black grouse *(Tetrao tetrix)* needs half open habitat structures with an interweaving of forests or tree groups with open areas rich in heather as well as moorlands with interlocked dry areas. Culling rates of black grouse have been stable within the last 60 years (Fig. 2), but this applies only to the Alpine region (see detailed explanation below).

Black grouse in Austria's two different habitat types: Whilst the Alpine black grouse populations are stable, the former vital populations of black grouse in the Bohemian Massif north of the Danube River declined dramatically in the last decades unto small remnants (Fig. 5). This decline to near extinction in the North of Austria is caused by major changes in land-use, particularly intensification of agriculture, drainages, afforestation of former wetlands, increasing numbers of predators partly due to anti-rabies inoculation (Reimoser and Reimoser 2015). In the Alps the black grouse habitat is mainly near the timber line where the forest merges with alpine pastures.

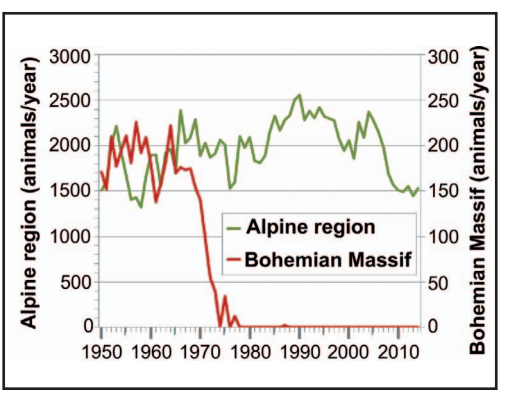

Fig. 5 Yearly culling rates of black grouse cocks 1950–2014 in the Austrian Alpine region (green) and the Bohemian Massif in Austria (red). In the Alpine region, through changed hunting conditions since 2008 a population decline is feigned. In the Bohemian Massif black grouse is under protection since 1978 (no hunting; reduced hunting since 1970) and declined to a few animals until 2014 (support through releases was not successful).

Since 2008, hunting of black grouse (and also capercaillie) in the Austrian alpine region is based on a derogation rule in article 9 of the EU Birds Directive. Limited and controlled hunting only of cocks exclusively in spring has the best preconditions for attaining the conservation objectives for this species (Wildauer at al. 2008). Since 2008 only one cock of 16 cocks can be culled (1 % of the calculated total natural mortality), in contrast to the years before when one cock of 7–12 cocks (depending on province) could be culled. In contrast to black grouse, the numbers of capercaillie are declining in the Alpine region too, due to habitat losses as described above.

Red fox and Badger

The culling rates of red fox *(Vulpes vulpes)* and badger *(Meles meles)* increased and doubled quite abruptly in the 1990s (Fig. 2).

This can be at least partly explained by the eradication of a former main mortality factor for foxes – rabies – by vaccine baits. Fox populations increased mainly in the eastern part of Austria (Fig. 4).

Martens

The pine marten (*Martes martes*) inhabits mountain forests up to the timberline, whereas the stone marten (*Martes foina*), which constitutes the larger portion of Austrian hunting bags is frequently found near human settlements. From the 1960s to the mid-1990s culling numbers of martens multiplied dramatically by 15 and is since then rather stable (Fig. 2). Population increased over all Austria from the lowlands to the Alpine regions (Fig. 4).

Polecat

The more common forest polecat (*Mustela putorius*) prefers water courses and wetlands, with structures rich in cover. The steppe polecat (*Mustela eversmanii*) is found only in the Pannonian plains and hilly regions in eastern Austria. Culling numbers of polecats doubled until 1968 and is since then declining steadily, in the meantime falling below the initial values (Fig. 2).

Weasels

Stoats (*Mustela erminea*) and Least weasel (*Mustela nivalis*) are mainly culled in the lower, northeastern parts of Austria. Culling rates of weasels showed great fluctuations and is declining in the past decade.

Raccoon dog and Raccoon

First raccoon dogs *(Nyctereutes procyonoides)* were sighted in the 1960s and are slowly spreading from the Danube valley in the east along smaller river valleys into western parts of Austria. First culls were officially recorded in 1993 and are steadily increasing, up to about 30 animals per year. The culling numbers of raccoons *(Procyon lotor)* are slowly increasing since official recording in 1993, yet less raccoons are culled than raccoon dogs (Duscher, 2016).

Other species

Hunting statistics for culling goshawks (*Accipiter gentilis*), harriers (*Circinae*), buzzard (*Buteo buteo*), and grey heron (*Ardea cinerea*) were discontinued since 1967, statistics for muskrat (*Ondatra zibethicus*), grebes (*Podicipedidae*), crows (*Corvidae*), jays (*Garrulus glandarius),* magpies (*Pica pica*), quail (*Coturnix coturnix*), and rock ptarmigan (*Lagopus muta*) do not exist anymore since 1978. Only very few great bustards (*Otis tarda*) were culled in the years 1961–1968; now they are strictly protected.

Synopsis

For the ruminant ungulate species the total culling rate more than doubled from 160,000 in the first decade (1955–1964) to 342,000 in the sixth decade (2005–2014), whereas wild boar culling multiplied 26 times from about 1,200 to 32,000 head. The culling rate of hares, rabbits and marmots was reduced by half in the same time period from 324,000 to 153,000. Also the culling number of game birds decreased from 346,000 to 227,000. The hunting bag of predators increased from 63,000 to 112,000 (Fig. 6, Table 1). "Other species" (without statistics in the last decades) are not included in the synopsis.

Biomass of the hunting bags was calculated by multiplying the hunting bag numbers with an average weight of the given species. Biomass of culled ruminants increased from 5,500 tons to 11,200 tons, and of culled wild boar from 100 to 1,900 tons. Biomass of culled hares, rabbits and marmots decreased from 1,000 to 500 tons, and of game birds from 400 to 300 tons. In the same period the biomass of culled predators increased from 300 to 500 tons (Fig. 7).
Related to all investigated wildlife species the total hunting bag of Austria increased from 894,000 in the first decade (1955–1964) to 1,203,000 in the second decade (1964–1974), and afterwards continually decreased to 866,000 in the last decade (2005–2014). The biomass of

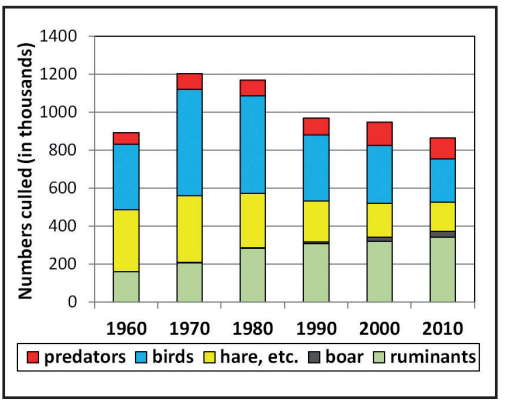

Fig. 6 Composition of hunting bag numbers (in thousands), annual mean over 10 years (1960 = 1955–1964, …, 2010 = 2005–2014)

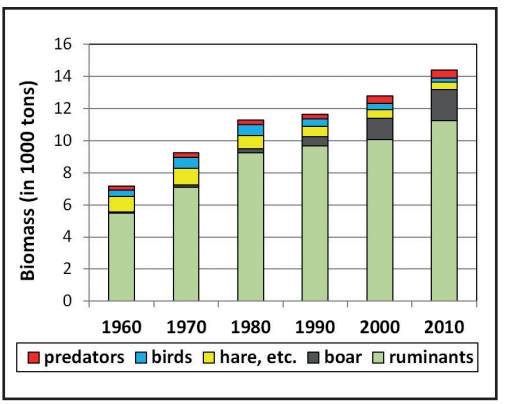

Fig. 7 Composition of culled biomass (in 1000 tons), annual mean over 10 years (1960 = 1955–1964, …, 2010 = 2005–2014)

the total hunting bag, however, doubled from about 7,250 tons (1955–1964) to 14.400 tons (2005–2014).

Trends in the Vienna woods since 1891

Long-term developments (1891–2009) of the hunting bag of 25 species were investigated in-depth for a 1000 ha hunting area in the southern Vienna-Woods (Reimoser et al. 2014). Main causes for long-term changes of the hunting bag were positive habitat changes (mainly for roe deer and chamois) or negative habitat changes (partridge, hare and capercaillie), changes of hunters' attitudes (e.g. protection of female boars) and the prevention of diseases (mainly anti-rabies inoculation). Both World War I and II and the immediate postwar period caused a drastic decline in the hunting bags (legislative hunting restrictions, poaching, ...) but also initiated the later on efforts to manage wildlife for population increase, which were very effective for wild ungulates. Long-term changes in hunting bag numbers were closely related to changes in hunting seasons only for few species, e.g. wild boar.

Discussion

Do hunting bag trends reflect population trends? The interpretation of culling data regarding population trends and the productivity of the species is uncertain. Hunting bags do not always reflect population trends correctly. Most likely hunting bag numbers can be a good basis for the assessment of development trends of wildlife populations, if a systematic, centrally organized documentation of culling data is available in long time series and uniform for large, population-based spaces (Reimoser and Reimoser 2016).

The hunting behaviour towards the wildlife species as well as the documentation mode should be constant, so that no bias for the development trend arises; changes have to be considered when interpreting the hunting bag trends. The authors can assess this largely for Austria.

Do population trends reflect habitat changes? This contribution should be understood as a synoptic approach to assess the whole effect of environment changes on wildlife. Not the single habitat factors, but the end result of all factors in their balance is in the foreground (Reimoser 1987, Reimoser et al. 2006). Excluding misinterpretations of trends, wildlife species can indicate habitat changes in a holistic way. In the long-term increasing population growths in single game species and simultaneously a loss of diversity of species able to be hunted is observable. This can be seen as an indicator for a progressively more unstable ecosystem "landscape" with more "problem species", on the one hand through regionally becoming extinct, on the other hand by partially causing serious damage both for humans and habitats. Main problems in wildlife management and management needs are similar to other Central European countries (Reimoser and Reimoser 2016).

A main consequence is species protection and game damage avoidance by large-scale habitat management. An instrument to coordinate and co-operate the different interests in the intensely multiple-used landscape of Austria on large-scales is the so-called WESP which means "wildlife ecological spatial planning" (Reimoser 1999). Altogether ungulate management consists of three main sections: the habitat, the game population, and the tolerance level to game damage. These three sections are strongly interconnected and have to be balanced in a holistic view (Reimoser 2003).

Summary

Long-term hunting bag trends of 24 species (species groups) since 1955 have been compared with regard to possible causes of these trends. During the past 60 years, some species increased significantly, others decreased, partly despite protection measures. Species diversity and the number of animals annually culled were reduced; in contrast the culled biomass increased.

For the ruminant ungulate species the culling rates more than doubled from 160,000 in the first decade (1955–1964) to 342,000 in the sixth decade (2005–2014), whereas wild boar culling multiplied 26 times from about 1,200 to 32,000 head. Culling rates of hares, rabbits and marmots was reduced by half in the same time

period from 324,000 to 153,000. Also culling numbers of game birds decreased from 346,000 to 227,000. Culling numbers of predators increased from 63,000 to 112,000 head.
Related to all investigated wildlife species the total hunting bag of Austria increased from 894,000 in the first decade (1955–1964) to 1,203,000 in the second decade (1964–1974), and afterwards continually decreased to 866,000 in the last decade (2005–2014). The biomass of the total hunting bag, however, doubled from about 7,250 tons (1955–1964) to 14,400 tons (2005–2014). Biomass of culled ruminants increased from 5,500 tons to 11,200 tons, and of culled wild boar from 100 to 1,900 tons. Biomass of culled hares, rabbits and marmots decreased from 1,000 to 500 tons, and of game birds from 400 to 300 tons. In the same period the biomass of culled predators increased from 300 to 500 tons.
Causes of hunting bag changes and management requirements are discussed. Wildlife Ecological Spatial Planning (WESP) is an instrument that can be applied successfully to integrate wildlife into comprehensive land management to avoid damage to wildlife as well as by wildlife, both nationally and across national borders.

Zusammenfassung

Langfristige Trends von Jagdstrecken und Wildtierpopulationen in Österreich

Langfristige Trends der Abschusszahlen von 24 Wildarten(-gruppen) in Österreich seit 1955 wurden verglichen. Die einzelnen Wildtierarten reagierten sehr unterschiedlich auf die Veränderungen ihres Lebensraumes. Einzelne Arten haben in ihrem Bestand stark zugenommen, das Vorkommen anderer ist trotz jagdlicher Schonung und Hege rückläufig. Artenvielfalt und Anzahl des jährlich erlegten Wildes haben in den letzten 60 Jahren abgenommen, die jährlich entnommene Biomasse stieg hingegen bis 2014 stark an.
Die Strecke der wiederkauenden Huftierarten hat sich von 160.000 im ersten Jahrzehnt (1955–1964) auf 342.000 Stück im letzten Jahrzehnt (2005–2014) mehr als verdoppelt. Bei Wildschweinen stieg die Jagdstrecke im selben Zeitraum um das 26-fache an (von 1.200 auf 32.000 Stück). Die Jagdstrecke von Hasen, Kaninchen und Murmeltiere nahm im selben Zeitraum von 324.000 auf 153.000 Stück ab, jene von Federwild von 346.000 auf 227.000. Die Raubwildstrecke stieg im gleichen Zeitraum von 63.000 auf 112.000 Stück an.
Bezogen auf alle untersuchten Wildtierarten nahm die Gesamtstrecke in Österreich von 894.000 Stück im ersten Jahrzehnt (1955–1964) auf 1.203.000 Stück im darauffolgenden Jahrzehnt (1965–1974) stark zu, um dann wieder kontinuierlich auf 866.000 Stück im letzten Jahrzehnt (2005–2014) zu fallen. Die Biomasse der Gesamtstrecke stieg hingegen von rund 7.250 Tonnen (1955–1964) auf 14.400 Tonnen (2005–2014) an. Die Biomasse des erlegten wiederkäuenden Schalenwildes nahm von 5.500 auf 11.200 Tonnen zu, jene der Wildschweine von 100 auf 1.900 Tonnen.
Die Biomasse von Hasen, Kaninchen und Murmeltiere nahm hingegen von 1.000 auf 500 Tonnen ab, und jene des Federwildes von 400 auf 300 Tonnen. In derselben Periode nahm die Biomasse von erlegtem Raubwild von 300 auf 500 Tonnen zu.
Ursachen der Jagdstreckenveränderungen und Konsequenzen für das Wildtiermanagement werden diskutiert. Das Management von Wildtieren könnte durch das Instrument der Wildökologische Raumplanung (WESP) in ein umfassendes Landnutzungsmanagement integriert werden, um Schäden sowohl an Wildtieren als auch durch Wildtiere zu vermeiden.

References

Duscher, T. (2016): The current status of the raccoon (*Procyon lotor*) and the raccoon dog (*Nyctereutes procyonoides*) in Austria. – Beitr. Jagd- u. Wildforsch. 41, Gesellschaft für Wildtier- und Jagdforschung e. V. (Hrsg.), Halle/Saale.

Reimoser, F. (1987): Umweltveränderungen in Österreich, ihr Einfluss auf die Populationsentwicklung jagdbarer Wildtierarten und Konsequenzen für eine ökologisch orientierte Landeskultur. – In: Verhandlungsband der Gesellschaft für Ökologie **15**: 129–144.

Reimoser, F. (1999): Wildlife Ecological Spatial Planning (WESP): An instrument for integrating wildlife into comprehensive land management. – In: C. Thomaidis and N. Kypridemos (eds.) Agriculture forestry – game, integrating wildlife in land management. – Proceedings of the International Union of Game Biologists, XXIVth congress (1999), Thessaloniki, Greece, 176–185.

Reimoser, F.; Lexer, W.; Forstner, M.; Hackl, J.; Heckl, F. (2003): Kriterien und Indikatoren einer nachhaltigen Jagd. – Zeitschrift für Jagdwissenschaft **49**: 275–287.

Reimoser, S.; Reimoser, F.; Klansek, E. (2005 and 2006): Lebensraum & Abschuss: Abschussdichten verschiedener Wildarten in den österreichischen Bezirken seit 1955. – Österreichs Weidwerk (19 parts); Download: wildlife.reimoser.info.

Reimoser, F.; Reimoser, S. (2006): Lebensraum und Wildabschuss in Österreich – was hat sich in den letzten 50 Jahren verändert? – In: Bericht über die 12. Österreichische Jägertagung: Erhaltung und Gestaltung von Wildlebensräumen. – Höhere Bundeslehr- und Forschungsanstalt für Landwirtschaft Raumberg-Gumpenstein des BMLFUW (Hrsg.), Irdning, Austria (ISBN 3-901980-86-5), p. 5-10.

Reimoser, F.; Reimoser, S.; Klansek, E. (2006): Wild-Lebensräume – Habitatqualität, Wildschadenanfälligkeit, Bejagbarkeit. – Verlag Zentralstelle Österreichischer Landesjagdverbände, Wien (ISBN 3-9501873-1-6), 136 pp.

Reimoser, F.; Reimoser, S. (2010): Ungulates and their management in Austria. – In: Apollonio, M., Andersen, R., Putman, R.: European ungulates and their management in the 21th century. – Cambridge University Press, Cambridge, ISBN 978-0-521-76061-4, pp. 338-356.

Reimoser, F.; Lexer, W.; Brandenburg, Ch.; Zink, R.; Heckl, F.; Bartel, A. (2013): ISWIMAN – Integrated sustainable wildlife management – principles, criteria and indicators for hunting, forestry, agriculture, recreation. – Austrian Academy of Sciences, Vienna, (http://wildlife.reimoser.info/download/2013_Reimoser%20et%20al_Integrated%20Sustainable%20Wildlife%20Management_with%204%20Annexes%20of%20Indicators.pdf).

Reimoser, S.; Smidt S.; Reimoser, F.; Wildauer, L. (2014): Entwicklung von Jagdstrecken und Lebensraum im südlichen Wienerwald seit 1891. [Changes of hunting bag and habitat in the southern Vienna-Woods since 1891.] – Allgemeine Forst- und Jagdzeitung **185**(1/2): 16–27.

Reimoser, S., Reimoser, F., 2015: Black grouse habitat assessment (GIS Modelling) as a basis for habitat improvement and restocking of black grouse in the "Waldviertel" region. – wildlife.info, online publ., 111 pp., ISBN 978-3-9504175-0-0. DOI: 10.17439/Birkhuhn_Waldviertel.

Reimoser, F.; Reimoser, S. (2016): Long-term trends of hunting bags and wildlife populations in Central Europe. – Beitr. Jagd- u. Wildforsch. 41, Gesellschaft für Wildtier- und Jagdforschung e. V. (Hrsg.), Halle/Saale.

Wildauer, L.; Schreiber, B.; Reimoser, F. (2008): EU-Vogelschutzrichtlinie, Auerhuhn (*Tetrao urogallus*) und Birkhuhn (*Tetrao tetrix*), Gutachten zur Anwendung der Richtlinie 78/409/EWG des Rates vom 2. April 1979 über die Erhaltung der wildlebenden Vogelarten. Zentralstelle Österreichischer Landesjagdverbände, Wien, 88 pp.

Addresses of authors:

Dr. Susanne Reimoser
University of Veterinary Medicine
Vienna, Austria
E-Mail: susanne.reimoser@vetmeduni.ac.at

Univ. Prof. em. Dr. Friedrich Reimoser
University of Natural Resources and
Life Sciences, Vienna, Austria
E-Mail: friedrich.reimoser@boku.ac.at