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Forests and Wildlife Management in Germany - A mini-review -

SCHALLER Markus J.*

Technische Universität München (TUM) (University of Technology Munich),
Munich Business School, Chair of Forest Economics,
Am Hochanger 13 D-85354 Freising, Germany

Abstract

If wildlife management fails, high population densities of hoofed game will determine the future existence of forests in the absence of predators. The “green third”, as German forests are often called, provide precious services for the environment as well as society. Most German forests are multi-purpose forests and provide economic, ecological, environmental and social benefits for their owners and the population. Sustainable forest management was first implemented in Germany almost 300 years ago. In 2005, approximately 60 million m³ of wood were harvested in German forests. This is nearly three times as much as in Japan, which has more than double the forested area compared to Germany. Wildlife management and hunting are practised on nearly every hectare of German forests. Currently, only 0.4 % (approx. 340,000) of all Germans are hunters. Due to the absence of predators in German forests, the hunters need to control the populations of hoofed game. Each year, more than 1 million roe deer (*Capreolus capreolus*) are shot. Nevertheless, the hoofed game populations are still too high, causing severe damage to the forests. The effects of the damage vary such as reduction in growth, quality, value, diversity, or stability of the flora, or even the destruction of the protective functions of the forests. Particularly in mountain regions, where forests fulfill extremely important protective functions, browsing and debarking by hoofed game is a hazard to the entire forest ecosystem. In the last 20 years, the State of Bavaria had to invest about 60 Mill. € for the restoration of alpine protective forests. These restoration measures have become necessary due to several reasons, but one of the most important ones being browsing damage by large populations of hoofed game. Due to their differing aims, many hunters are struggling with forest owners and the forest administration. To solve part of the problem, German hunting laws provide the right to claim compensation for wildlife damage to forests. Successful wildlife management is becoming more and more important, especially in the mountainous regions of Germany.

Key words: Assessment of wildlife damage to forests, conflicts between wildlife and forests, forests and wildlife management, hunting and hunters in Germany and Europe, hunter motivations

1. Introduction

Primarily human impact reduced the forest area in Germany from more than 90% of the land area to the current 32%. The clearings started more than 1200 years ago and about 500 years ago the distribution of agricultural land and forests, for the first time, was very similar to the current status ("<http://www.wald-online.de/>" 2007-01-17).

Growing populations with rising land use for settlements, industry, infrastructure etc. during the industrial revolution in the 18th and 19th centuries and later caused further losses in forested areas. Only about 30 years ago could the loss be stopped and since then forested areas have slowly been increasing again and will probably grow in the future.

The extinction of all predators about 200 years ago, in combination with a wildlife management system, which aimed to raise populations of hoofed game in many places, caused serious problems for the regeneration of forests. The influence of wildlife as one part of the forest ecosystem, in some cases, is so dominant that the

status and future development of some German forests depend primarily on the population density of hoofed game in these forests.

Wildlife management in forests tries to manage wildlife with the goal of preventing damage caused by wildlife. Part of wildlife management is hunting, which has a long history and tradition in Germany. Hunters on the one hand, and foresters and forest owners on the other, in many cases have different aims and different backgrounds. For the first party, which consists predominantly of private hunters who hunt as a hobby, good hunting with abundant game is their main interest, whereas the foresters, who are normally hunters as well, see hunting as a way to reach and to keep healthy, mixed forests that deliver many important functions for society and nature. For many of the forest owners, hunting is of importance too, but the selling of wood is their primary concern.

These three groups of concerned people currently play the most significant role in the political discussion of wildlife management, but in addition to this there are

more people and groups involved (e.g. environmentalist and other NGOs) and their influence may become more important in future.

For the analysis of the relationship between forest ecosystems and wildlife management it is necessary to describe the current status of the German forests and hunting in Germany. Although only less than one percent of the German population hunts, those hunters are often politically and economically very important people who have the influence and power to strongly support their personal aims.

This paper wants to show the relationship between forests and wildlife and note possible developments. Last but not least, it wants to give food for thought on these issues in the readers' home countries.

2. Statistical information about German forests

The latest Global Forest Resources Assessment 2005 (FRA 2005) published by United Nations Food and Agriculture Organization (FAO) states German forests cover 11,076 million ha or 32% of the land area (see also National Forest Inventory 2002 <http://www.wald-online.de/> 2007-01-17). Nearly one third of the German land area (357,030 km²) is covered with forests. Regional differences in forest cover are big. There are areas with less than 10% of forest cover, especially in lowland regions with fertile soils, but more than 80% in some mountainous regions.

In comparison to other countries in the European Union, a forest cover value of about 30% is just average. In the United Kingdom, for example, only about 12% of the land is covered with forests, whereas 74% of the Finnish land area consists of forests. All German forests would only cover a little bit more than 1% of all Russian forested land. The Amur Region in Russia, where the symposium took place, for example owns about 32 million ha of forests, nearly three times as much as Germany. On the other hand the German wood harvest in 2005 was about 56.9 million m³ over bark (Dieter 2006, p.5) which is thirty times as much as the official figures for the annual harvest of wood in the Amur Region. The 56,9 million m³ over bark is one third of the removal of wood products officially given in FRA 2005 for the whole of Russia in 2005 (180 million m³) (FRA 2005, p. 283).

Japan is about 20.000 km² bigger than Germany. The Japanese forest area with about 25 million ha, however is more than double the size of the German one. But, according to FAO statistics (FRA 2005, p. 281) Japanese removal of wood products was only about 22 million m³, a little bit more than one third of Germany's in 2005. The total consumption of wood in industrialized countries is supplied by their own national production and imports. Imports make up an especially large share in Japan.

The extent of timber consumption per capita depends on many criteria, such as economic status, legal restrictions for the building industry, traditions and so on. In general it is likely that with a growing income per capita the demand for timber per capita increases. A study done by the World Bank and PPI (2000) proves that the consumption of paper and paperboard is strictly

connected with the gross domestic product (GDP) per capita (Juslin and Hansen 2004). Higher GDP per capita means higher consumption of paper and paperboard.

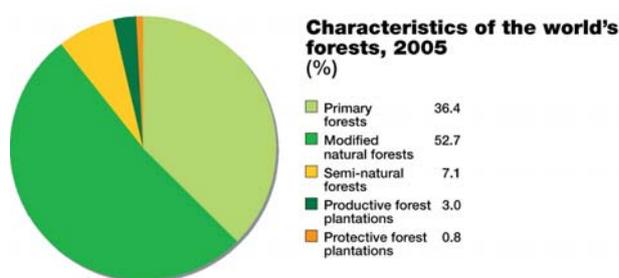
The international timber trade supplies consumers with wood and wood products, but it cannot supply the demand for the environmental, social and recreational functions that forests have to deliver. In a country like Russia, with 5.66 ha of forest per capita, it is very probable that the demand by the population for all the functions that a forest can provide can be met by local resources. Japanese only have 0.19 ha of forest per capita, and Germans have 0.13 ha of forest per capita, which means that statistically about 30 Japanese, or more than 40 Germans have to share the same size of forest area that one Russian statistically can use.

A comparison of the carbon stock in forests shows, that in German forests about one billion tons (1010 million tons FRA 2005 p. 264) of carbon are stored in above ground biomass. Japanese forests, which cover about 2.5 times as much land as German forests, only store about 1.5 billion tons of carbon in above ground biomass and the Russian forests, which are 73 times as big as German forests, only store about 25 times the amount of carbon as German ones. Table 1 gives a summary of the quoted data.

Table 1. Comparison of some important forest data between Russia, Japan and Germany.

Country	Forest Area 1000 ha	% of land area	Removals of wood products 2005 (1000 m ³ over bark)	Carbon stock in forests 2005 (million tonnes) in above ground biomass	Forest area per capita in ha
Russia	808,790	47.9	180,000	25,787	5.66
Japan	24,868	68.2	22,334	1,526	0.19
Germany	11,076	31.7	60,770	1,010	0.13

Figure 1 shows the characteristics of the world's forests in 2005.



Source: Global Forest Resources Assessment 2005 (FRA 2005)

Fig. 1. Characteristics of the world's forests, 2005 (FRA 2005).

FAO defined 5 different Forest Characteristics (FRA 2005, p. 171). All German forests are, according to the FAO statistics, “Semi-natural forests”, which means “forests of native species, established through planting, seeding or assisted natural regeneration.” The figures for Japan (FRA 2005, p. 222) show about 20% of primary forests (“Forests of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed” FRA 2005, p. 171) and about 40% of modified natural forests (“Forests of naturally regenerated native species where there are clearly visible indications of human activities...” FRA 2005, p. 171). The remaining part, also about 40%, is characterized as protective plantations (“Forests of native or introduced species, established through planting or seeding mainly for provision of services...” FRA 2005, p. 171). About two thirds of the forests of the Russian Federation are characterized as modified natural forests (FRA 2005, p. 226). A little bit less than one third is primary forests in Russia (FRA 2005, p. 226). The area defined as productive plantations in Russia is still bigger than all German forests.

German forest ecosystems and sustainability

“We have to make every effort in science and forest practice to find methods for the protection and production of timber in a sense, that a permanent sustainable utilization can be realized; otherwise we will experience serious economic problems” (Carlowitz 1713). Hanns Carl von Carlowitz, a member of the administration of the mining industry in Freiberg/Saxony, responsible for the timber production in the year 1713, was the first person to describe the necessity of sustainable forest management. About 300 years ago sustainable forest management focused on sustainable timber production. If you look at many countries around the world, sustainable timber production has not been realized until today. In the last few decades the term sustainability came into fashion and has been used in many different fields. Today in Germany sustainable forest management includes the sustainable management of all the economic,

environmental and social functions of forests. These demands are fixed in the German Federal Forest Law (BWaldG “<http://bundesrecht.juris.de/bwaldg/BJNR010370975.html>” 2007-03-06) and the Bavarian Forest Law (BayWaldG “http://by.juris.de/by/gesamt/WaldG_BY_2005.htm” 2007-03-06). All German forest owners and the general public accept the necessity and superiority of sustainable forest management.

Public interest in forests in Germany has always been high. It did not happen by accident that the research system called “Waldsterben” started in the early 1980s in Germany. For about 20 years, the condition of the forests has been monitored every year with the help of the “Waldzustandserhebung,” at first only in Germany, and then later all over Europe (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2006, Waldzustandsbericht 2006). Out of about 82 million German inhabitants two million are forest owners and own an average of about 2.5 ha. Figure 2 gives an overview of the distribution of forest property in Germany (Mrosek *et al.* 2005).

The cluster study conducted by Mrosek *et al.* (2005) also shows that the economic importance of forestry and the timber branch has been underestimated. The whole cluster in Germany has a turnover of about 181 billion € per year. More than 1.3 million people are employed in forest and timber enterprises. The worldwide economic development, especially of states like China and India, has caused an increase in demand in worldwide timber markets. Growing international trade is the result, which influences the German timber market as well. The demand for energy from renewable resources and the shortage of oil leads to an increased demand for wood and wood products. This, and a higher demand from sawmills, caused a 30% increase in the price of wood in Germany in 2006.

In the future the economic function of forests will probably become more important again. While in the 1990s, the annual harvest of wood in Germany fluctuated between 34 and 40 million m³ (Dieter 2006). In the last five years the annual cut has increased significantly from 39.5 million m³ in 2002 to 56.9 million m³ in 2005, an increase of 44%. Following

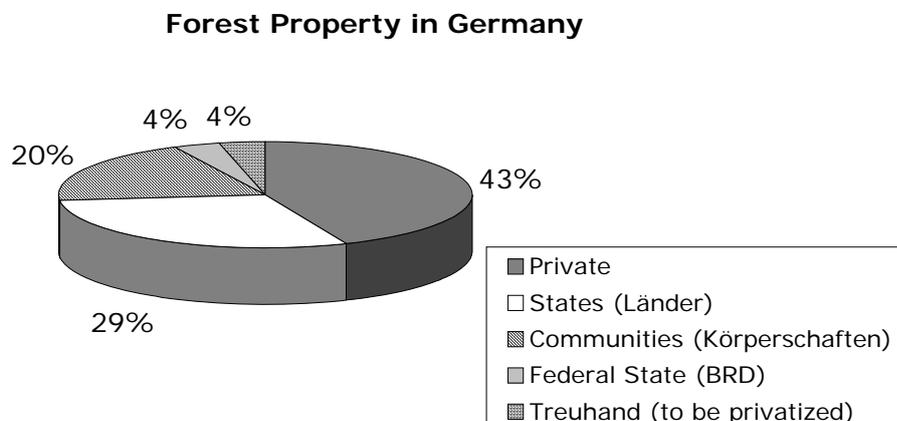


Fig. 2. Distribution of forest property in Germany by different types of landowners.

rising demand and the increased capacity of the sawmill industry, higher annual harvesting is expected for the coming years. According to a study on the timber harvesting potential in Germany for the years 2003–2042 there is a potential sustainable annual harvest of 78 million m³/year (National Forest Inventory 2002 (<http://www.bundeswaldinventur.de/enid/8199eb301fe1e7c2065ae761b8403cbc,56d0ab305f7472636964092d09343938/7p.html>) 2007-01-17). In the coming decades a higher annual timber harvest can be realized without harming the principles of sustainable forest management.

The National Forest Inventory in the year 2002 measured the growing stock in German forests. It was 3.4 billion m³ of wood or an average of 320 m³/ha of forest. In comparison with all other European countries Germany has the highest total stock and together with Austria also the highest stock/ha (National Forest Inventory 2002 (<http://www.bundeswaldinventur.de/enid/8199eb301fe1e7c2065ae761b8403cbc,dedd0a305f7472636964092d09323130/4m.html>) 2007-01-17). But the environmental, social and recreational functions are becoming more and more important.

The density of the German population per km² is 28 times higher than the population density of Russia. Especially in the Alps and other mountainous regions. Therefore the protective functions of forests, for the prevention of soil erosion, avalanches, and floods are of the highest priority. Today four times as many people live in the Bavarian Alps as 150 years ago (Waldzustandsbericht 2006, p.53). Especially around big cities the forests are the source of high quality drinking water and have a positive influence on the regional climate. Forests often contain protected areas and sustainable management of the forests keeps and enhances biodiversity.

Another effect of having a population density of nearly 237 persons per km², in combination with the German climate and the German love for walking (“Wandern”), is the importance placed on the social and recreational functions of German forests, which are guaranteed by German law (e.g. German Federal Forest Law, BWaldG and German Federal Nature Protection Law BNatschG). Everyone has the general right to access every forest and it is widely used.

3. Wildlife Management in Germany

“Wildlife management is the process of keeping certain wildlife populations at desirable levels determined by wildlife managers. Wildlife management is interdisciplinary, integrating science, politics, mathematics, imagination, and logic. It deals with protecting endangered and threatened species and subspecies and their habitats, as well as, non-threatened agricultural pests and game species. Aldo Leopold, one of the pioneers of wildlife management, defined it as “the art of making land produce sustained annual crops of wildlife.” (http://en.wikipedia.org/wiki/Wildlife_management) 2007-01-12).

The question could be asked whether in a country like Germany wildlife management is necessary. The answer to this question, looking at the “green third”, the

32% of Germany that is covered by forests, is “yes”. In Germany all predators like wolves or bears were eradicated about two hundred years ago. In the summer of 2006, a young bear migrated by natural dispersion from Italy to the Bavarian Alps. In his first days in Bavaria he was given a friendly welcome by the media and the Bavarian Environmental Minister. After it had killed several sheep and roamed through some villages without being afraid of humans the minister ordered it to be caught alive. After many attempts to catch it failed, the minister assigned some hunters to kill the bear to protect the population from danger. This incident makes it clear that there are almost no areas in Germany where predators can be reintroduced to control wildlife.

As a consequence hoofed game has no “predators” besides hunters and cars. Without wildlife management in a forest area, the distribution of species would probably change negatively and the protective functions of forests would severely suffer. Wildlife management in Germany tries to satisfy the various claims of the different groups of society. The number of people involved in this field is huge. The most important actors are the legislators, the hunters and their associations, the hunting administration, the shooting cooperatives, the forest owners and their associations, the foresters and NGOs that deal with nature and animal protection. The hunting law, the forest law, the nature protection law and the animal protection law provide the legal basis for wildlife management.

Before I discuss the problems between wildlife and forests, with the help of some questions, I will give an overview of wildlife and wildlife management and hunting in Germany.

Where to hunt in Germany?

Germany covers an area of 357,030 km² (Statistisches Jahrbuch über Ernährung und Landwirtschaft und Forsten 2004, p.77). The hunting area comprises of 319,000 km² or 89% of the total area. According to German Hunting Laws the right to hunt is connected with the ownership of land. In Bavaria, for example, a landowner, under the precondition that the landowner owns more than 81.755 ha of one piece of land, can decide who will have the right to hunt there. Only hunters who hold a hunting license are eligible. The required size can vary regionally and from state to state.

But in all of Germany there are not many landowners who own the legally prescribed size of land, so there are few who have the sole right to decide who can hunt on the land. Landowners who own less than the legally required size of land in one piece are, by law, a member of a shooting cooperative – “Jagdgenossenschaft” (members are all small landowners). The little pieces of land are combined to shoots (Jagdrevier). The cooperative decides by majority vote who gets the right to hunt in a certain shoot. Therefore, most landowners only have small say in the decision about who will hunt on their land. This probably was the main reason that the legislator gave the right to landowners to claim compensation from the shooting cooperative for wildlife damage. Renneke (2005) stated that in

Germany ca. 70,000 shoots exist with an average size of about 450 ha. The price for the rent of a shoot varies between 1 and 150 €/per ha, depending on many factors such as the number and distribution of game species, the location, local demand and so on. On average one shooting tenant pays about 7000 €/per year for rent plus additional costs.

Who is hunting?

The first human beings appeared in Bavaria about 200,000 years ago, Ergert (1984 p.7.) and was a hunter-gatherer society. In ancient times everyone was allowed to hunt, but already in the 5th and 6th centuries AD evidence of the restriction of rights can be found. Madl (2004) explains the development and changes of the hunting law. Especially during the period of absolutism in the 16th century the right to hunt was reserved for royalty and nobility. Especially the farmers who suffered from a high density of hoofed game, which damaged their agricultural harvest, were most affected by those regulations (Madl 2004, p.11 and Hespeler 1999, p.7). Their human labor and time was exploited to support the hunting activities of the nobility. In addition, even in times of food shortage the farmers could not use the game for food, which has created unrest many times in the past.

In 1848, Germany's last revolution also caused changes in the hunting laws. During the revolution nearly everyone hunted without any restrictions. One of the results of the radical decrease in hoofed game are wonderfully mixed forests, which can still be seen in many places in Germany. After the revolution a new hunting law was defined and it again connected the right to hunt with the ownership of land, but with some preconditions. For example the minimum size of 81.755 ha for a private hunting area derives from the law of 1850.

Nowadays, in order to become a hunter in Germany

you have to fulfill several preconditions. Firstly, you have to be older than 16. Secondly, you have to attend a training course that lasts between 6 and 12 months. One or two evenings of theoretical training per week and practical exercises are mandatory. Thirdly, you have to pass the hunting examination. About 11,000 applicants take this 3-day examination each year, about 25% of the participants fail. The examination is called "das grüne Abitur" (the green final exam) ("<http://www.jagdonline.de>" 2007-01-17)

Figure 3 shows the increase in the number of hunters in Germany starting from 1968.

In 1968/1969 about 220,000 Germans held a hunting license. The reunion of the two German states in 1990 brought about an extraordinary increase, but while a reunited Germany is 44% bigger than West Germany, the number of hunters only increased about 20%. In 2004/2005 340,000 hunters were registered in Germany this means, compared to 37 years ago, an increase of about 56% or about 1.5% per year. But in contrast to the 82 million Germans, German hunters are a very small group. Only about 0.4% of the total population are hunters.

In Bavaria, only a little over 100 people are professional hunters ("<http://www.stmlf.bayern.de/presse/2006/22958/index.php>" 2007-02-27). Bavaria occupies 20% of the German area, therefore it can be estimated that the total number of professional hunters in Germany will not exceed 500. For a certain number of private and state foresters hunting is part of their professional duties. Compared to the total number of hunters in Germany only few have hunting as their profession. It is estimated that for more than 95% of all German hunters, hunting is a hobby. Wulff (2004) states that, in public discussions, the impression is often given that hunting in Germany is only a hobby of the rich. He points out, however, that hunters come from many different social classes. According to data



Fig. 3. Increase in the number of hunters in Germany between 1968 and 2005. ("<http://www.jagd-online.de>" 2007-01-15)

Hunters in Europe in % of Population

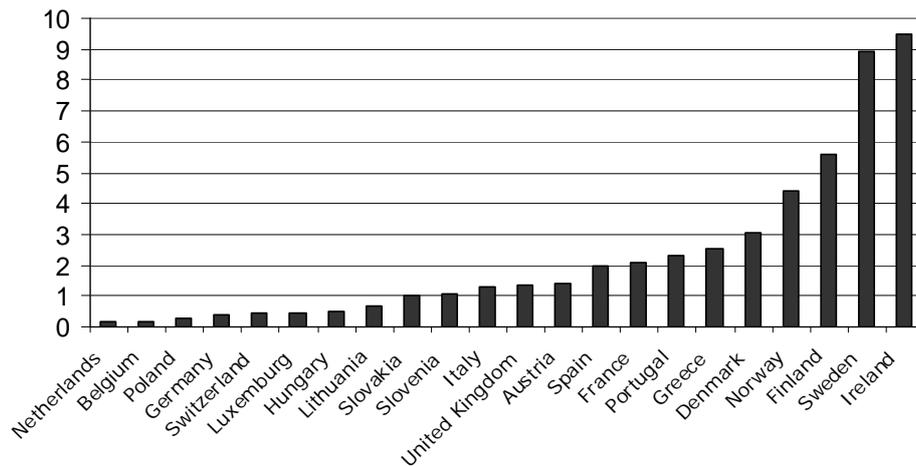


Fig. 4. Number of hunters in 22 European countries as % of the total population. ("http://www.jagd-online.de" 2007-01-15)

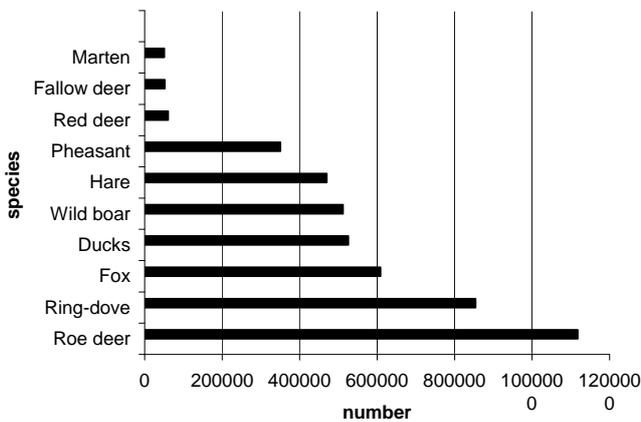


Fig. 5. Ten most harvested game animals in Germany 2002/2003. ("http://www.jagd-online.de" 2007-01-15)

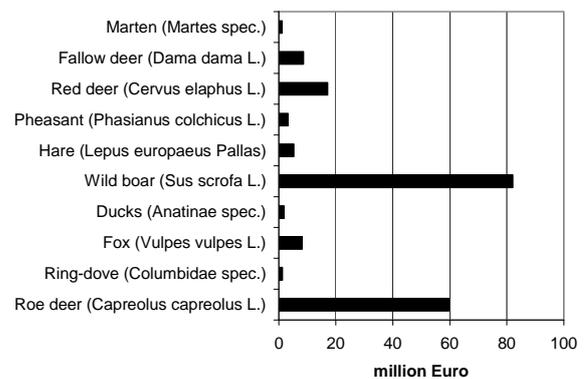


Fig. 6. Economic value of the ten most harvested game animals in Germany 2002/2003. ("http://www.jagd-online.de" 2007-01-15)

published by the Federation of Associations for Hunting and Conservation of the E.U. (FACE) (http://www.face-europe.org/huntingineurope/nationalsections_de/germany.de.pdf Sozio-demographisches Profil 2007-02-27) 47% of German hunters are employees, 15% are farmers, 27% are self-employed and 5% come from other professions.

Figure 4 gives an overview of the percentage of the population that hunts in 22 European countries. Out of a total population of about 450 million people in these 22 countries on average 1.5% of the local population hunts. Germany's 0.4 % is a low percentage compared to Sweden with 8.9%. German hunters make up about 5% of all hunters in these 22 countries. In comparison to other European countries (Figure 4) the percentage of hunters in the total German population is quite low. There are probably several reasons for this. The most important reasons are probably the difficult and expensive training and examination needed to get a hunting license and the other high costs involved with hunting in Germany.

What animals are hunted?

Around 50 different species are subject to the German hunting law (Bundesjagdgesetz – BJagdG) out of which around 35 different species can be hunted, with some differences depending on the region. Of the 50 species there are about 25 species of quadruped game and about 25 species of feathered game. About 15 species are subject to the hunting law but currently have no hunting season.

Figure 5 lists the ten most frequently hunted species of game. By far the most important game in forest ecosystems and other ecosystems in Germany is the roe deer (*Capreolus capreolus* L.). Every year nearly 1.2 million roe deer are harvested in Germany, (2005/2006 1.08 million roe deer, delivering about 9500 tons of game "http://djv.newsroom.de/" 2007-01-12). Hunters take nearly 80% of the roe deer, with the remaining killed in accidents with cars. That means on average every hunter kills about 3 roe deer per year. But on the other hand some professional hunters and foresters shoot between 40 and 80 as part of their jobs. The total

value of the annual harvest lies at about 60 million Euro for all roe deer shot in Germany or about 53 Euro per animal (Figure 6). This is the average price when it is sold directly by the hunter.

The annual economic damage caused by collisions between cars and roe deer is much higher than the value of the harvest, if we assume that the average damage amounts to 350 Euro, which is a very low assumption. The economic damage of accidents caused by roe deer is economically much more important than the total selling price of the meat, as every year in Germany about 200,000 roe deer die in collisions with vehicles (<http://www.jagd-online.de/downloads/Unfallwild.PDF> 2007-01-12). Schuhmann and Schwabe (2002, p.2) quote the National Highway Traffic Safety Administration in the USA that states that 120 deaths were the result of deer-vehicle-collisions in 1990. The annual national cost in motorist loss of life and injury is nearly US \$200 million.

In the years 2005/2006 (<http://djv.newsroom.de/2007-01-12>) about 476,000 wild boars were shot, which delivered about 11,700 tons of meat. As the average weight of hunted wild boars is much higher than the average weight of roe deer the total value of the annual harvest of wild boar was about 40% higher than the total value of roe deer. Although the price per kilo of meat of wild boar is normally lower than the price paid for roe deer. The number of harvested wild boars varies more than the number of harvested roe deer from year to year. Since the beginning of the 1980s the annual harvest of wild boars has been increasing and reached its peak in 2001/2002 with 532,000 wild boars being taken. The growth of the wild boar population is caused by higher corn production. Corn plantation areas have tripled in the last 50 years in Germany.

In addition, climate change has brought mild winters and strong beech and oak-masts, providing abundant food for wild boars. As a result of the atomic fallout after the Chernobyl disaster in 1986 in some German regions the meat of wild boars still cannot be eaten because it contains too much radioactive Cesium (Federal Research Centre for Nutrition and Food (BfEL)

http://www.bfel.de/cln_045/nn_783386/DE/forschung/kulmbach/kulmbach__veroeffentlichungen/CARRYOVER_KURZF.html__nnn=true 2007-03-06). Figure 5 shows the ten most harvested game animals and Figure 6 shows the economic value of the annual harvest of game in Germany 2002/2003.

What are the motivations of Germans to hunt?

There are a lot of reasons to become a hunter: The primary interest of hunter-gatherer societies was to provide food, clothes and tools by hunting. Kühnle (2003) summarizes: "All over the world, the hunting of game in our time is rarely practiced for entirely necessary reasons (e.g. the hunting for food). The motives are rather emotional (the excitement of killing the animal, pleasure, happiness, distraction, relaxation, adventure). Hunting is a great passion and a dedication."

The DJV (Deutscher Jagdschutz-Verband German Hunting Association) describes in its general mission statement (Jagd heute – Hunting today) the objectives of hunting and hunters (<http://www.jagd-online.de/seite.cfm?010503> 2007-03-06). According to this general statement hunters have to conserve a healthy and species-rich stock of game that is adapted to the landscape and the local situation. To fulfill this duty hunters also have to take care of the game habitat and all areas concerning animal protection. Wildlife damage in agriculture, forestry and fishery has to be prevented as much as possible. Hunters should make a sustainable use of the stock of game including predators, if those threaten the population of other species or degrade their sustainable use. Hunters have to make sure that the regulations for the protection of game and the hunting are obeyed. The motivations for hunting found by Kühnle (2003) cannot be found in this general statement of the DJV. In opposition to Kühnle (2003), hunting association representatives stress the ecological reasons for hunting. The DJV (<http://www.jagd-online.de/seite.cfm?030207> 2007-03-06) sees the hunter as a user and protector of the game. Due to the absence of predators for hoofed game in Germany, hunters aim to keep the natural balance of the ecosystems and try to replace wolves, bears and other predators. To prevent or to fight epizootics is another motivation. An essential part of the motivation for hunting for many hunters in Germany is described through the German word "Hege." "Hege" includes many different activities of hunters such as the protection of ecologically valuable habitats and increasing the quality of wildlife habitats in general. Hunting often is described as applied nature protection.

From personal experience the author can state that as a consequence of miscellaneous meat scandals, game as source of food is again gaining more consumer interest. Still more important for a large number of hunters in Germany, is their aim to harvest nice trophies. For many hunters hunting is a wonderful recreational activity, which in many cases is celebrated with passion and contains many traditions. Hunting still has high social prestige, which also motivates some people to become a hunter. The motivation to hunt will usually include several of these elements but the composition and the importance may differ from hunter to hunter, as well as their objectives.

But apart from all the differences in motivation for hunting, it is possible to identify two important groups of hunters. Group number one is hobby hunters. For them hunting is basically a hobby. The hunter goes hunting to relax from work, to have wonderful experiences in nature, and to have some kind of adventure. The trophy (antlers, horns...) is often very important. Traditions are cultivated. The social status of the hunters often is high and hunting means social prestige. The number of prey is not so important. Hunting must be fun!

This is probably the biggest group of hunters in Germany. It is estimated that more than 95% of the 340,000 German hunters belong to this group. Group number two is hunters for whom hunting is necessary

to achieve a good agricultural/professional performance or to manage their property. This group mainly consists of foresters and hunting forest owners. For them a reduction in the density of hoofed game populations through hunting is necessary to prevent wildlife damage to forests and to prevent economic loss. These hunters want to have mixed forest by natural regeneration without the costs of planting. In many places excessive game populations makes regeneration of forest trees impossible. Unfortunately, especially in the Alps a high population of hoofed game prevents or strongly hinders the regeneration of dying protection forests. The Group number 2's motto can be defined as "Wald vor Wild" (The forest is more important than the game). The principle "Wald vor Wild" is also fixed in Article 1 of the Bavarian Forest Law (BayWaldG).

Compared to the big group of hobby hunters the number of hunters for whom hunting is a profession or part of their profession is very small, many of them are forest officers. Despite their small number, this little group is very important, because of the forest and hunting laws (BWaldG, BJagdG) in Germany. By law the hunting administrations, together with the state forest administrations, determine the annual harvest of game.

4. Problems between wildlife and forests in Germany

Foresters and forest owners often argue that if the populations of hoofed game and hare are too high, intensive browsing, debarking and rubbing of forest trees can have negative effects on the regeneration of forests. These effects can reduce tree growth, quality and the value of the wood to be harvested. It can reduce the diversity and stability of forest ecosystems and it can lessen the protective and recreational functions of forests. All in all it can endanger sustainability. Scientific proof of the impact of herbivores on plant communities can be found at Eiberle (1967), Putman (1986), Naiman (1988), Huntley (1991), Bryant *et al.* (1991).

Gill (1992a) and Gill (1992b) give an excellent overview of the impact of deer on trees. Ammer (1996) researched the impact of ungulates (*Capreolus capreolus* (L.), *Cervus elaphus* L., *Rupicapra rupicapra* CL.) on the structure and dynamics of natural regeneration of mixed mountain forests in the Bavarian Alps. His results show that ungulates play a very important part in the structure and dynamics of the regeneration of mountain forests. Without browsing, growth rate and species composition of the natural regeneration are mainly determined by the light conditions and on intra- and interspecific competition effects. The impact of red deer, roe deer and chamois brings about a complete change in the situation. According to Ammer (1996), "A high percentage of fir and sycamore saplings" is damaged. The survival rates of older fir plants are drastically reduced. In all species, except spruce, height is significantly reduced. A huge loss of estimated biomass was observed. Subsequently the interference processes amongst the saplings also changed." Harrison and Bardgett (2004) found that

browsing by red deer negatively impacts the availability of soil nitrogen in regenerating native forests.

Motta (2003) stated that browsing of the terminal leader acts as an important factor that limits the height growth of the regenerated forest. In the case of sustained browsing saplings remain for decades in a non-reproducing state and at a height vulnerable to browsing. Niese (2004) argues that in alpine protection forests two thirds of the total area must regenerate if these forests are to fulfill all their functions. The Austrian Forest Inventory 2000/02 (Österreichische Waldinventur (ÖWI) 2000/02), however, found that 70% of the protection forest area is not naturally regenerating. Browsing by wildlife and pasturing by cattle are the most important reasons for this situation.

The summer of 2003 in Germany was extraordinarily hot. Raspe *et al.* (2004) report that forest soils dried up so severely that on many sites the water supply of the trees was completely stopped, resulting in root damage and reduced vitality of the trees.

The crown condition of forest trees in Germany has been recorded annually since 1984 in the national forest condition survey (Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz 2006). The crown condition is an "early indicator" which reacts quickly; it is easy to record and provides reliable information on the health of the trees. Forest trees are recovering only slowly from the consequences of the arid summer of 2003.

The proportion of trees without crown defoliation in 2006 was 32%, that means more than two thirds of all trees in Germany showed crown defoliation. The survey demands a further reduction in the strain on the forests caused by air pollutants. In short, the forests suffer from man-made air pollution, and climate change leads to problems in the water supply for the trees thus weakening their power of resistance. Additionally, pests like bark beetles are strengthened in warm summers and can also be found at higher elevations (Immler *et al.* 2006). The forecasted climatic changes will lead to a higher number of storms, droughts and periods with very high temperatures. The number of extreme climatic situations will increase (Waldzustandsbericht 2006 p.48).

Today many Alpine forests can no longer fulfill their diverse functions to protect people from erosion, avalanches or floods. In Bavaria, about 9% of the Alpine protection forests are severely limited in their functions. The seedlings and plants necessary to replace the dying protection forests in the Alps are too often over browsed by roe deer, red deer or chamois. Therefore, since 1986 about 60 million € had to be spent for the restoration of protection forests, in Bavaria alone (Waldzustandsbericht 2006 p.53-54). The current poor status of mountain forests in Germany, of course has many causes. A sufficient natural regeneration of the forests will be necessary to solve existing and future problems. The absence of sufficient regeneration in many locations has been mainly caused by poor wildlife management or the lack of it in the last few decades.

Human impact can change landscapes totally. On many European islands like Crete, Malta, or Ireland the human population destroyed nearly all forests and now suffers from the results. Reforestation is often difficult and very expensive. Forests have to meet various demands from many different groups of the population. It is nearly impossible to fulfill all the demands simultaneously to the same extent. Therefore some of the demands have to step back for the others.

From the point of view of many hobby hunters, their major demand of forests is to provide enough game for hunting. High populations of different game species enable hunters to enjoy their hobby. In a balanced forest ecosystem where natural regeneration of the forest is possible, normally only low populations of hoofed game can be tolerated. Hunting under such conditions is no longer a hobby, but it is very hard work, which can only be done by hunters with high skills and a lot of time. These are things hobby hunters do not normally have.

Forest owners and foresters often demand a reduction of the populations of hoofed game to reach their aim of natural, sustainable forests and it is understandable that hobby hunters are not especially fond of the reduction as it reduces their chances to enjoy their hobby, while they have to pay a lot of money to have the permit to hunt. Browsing and debarking by hoofed game can lead to severe ecological and economic damage. To prevent the forest owner from suffering economic damage the "Bürgerliches Gesetzbuch (BGB) – Civil Code, the Bundesjagdgesetz (BJagdG) – Federal Game Law and the „Landesjagdgesetze“ – game laws for each state in Germany, provide in certain cases, the right to compensation for wildlife damage to forests for forest owners. Smaller landowners, who own less than about 80 hectares in one piece of land, must by law become members of a "Jagdgenossenschaft" (shooting cooperative). The "Jagdgenossenschaft" rents the shooting rights to hunters and receives a shooting lease, which is normally divided among the landowners.

As a result of the hunting law in Germany, the landowner in many cases is not the hunter on his own ground. The landowner's say in who gets the right to hunt on his land is often very limited. In Germany this is the main reason for the legal regulations, which under certain conditions, provide landowners compensation for wildlife damage to forests (Moog 2002).

The shooting cooperative, which by law under certain preconditions, has to compensate the landowner for wildlife damage to forests, normally transfers this duty to the shooting tenant, who then has to pay for the damage. According to the Federal Game Law (BJagdG §§ 29 – 32) liability exists for damage caused by hoofed game animals, rabbits and pheasants. But the landowner will not to be compensated for all damage to trees. If, for example, a forest owner increases the risk of browsing damage by planting beech (*Fagus sylvatica*) into a Norway spruce (*Picea abies*) forest, he normally has to build a fence to protect the beech, otherwise he has no right to compensation for browse

damage to the beech. In other words, only compensation for damage to regular species (Hauptholzarten) of a certain area will be paid.

To assert a claim a prescribed procedure must be followed. Owners of damaged forests have to file their claims before May 1 of each year for damage that occurred during autumn and winter, or before October 1 of each year for damage that occurred during spring and summer. Claims are restricted to the past half-year. After these dates the right for compensation expires. Schaller (2002b) explains the statutory basis for the compensation, shows how to file a claim for compensation and gives examples for different methods of assessment of damage by browsing. Similar regulations that give a chance for compensation for wildlife damage can be found in some other European countries like Austria, Switzerland, South Tyrol and in the Czech Republic (De Klemm 1996). But there are also European countries with almost no regulations for this problem such as the United Kingdom and Denmark. Furthermore in the USA or Japan no similar regulations exist. Even though there are no regulations for compensation for wildlife damage to forest, this does not mean that there is no damage.

Yokoyama *et al.* (1996 S. 161) reports severe problems of debarking of "Hondo spruce" (*Picea jezoensis* Sieb. et Zucc.), as well as "Nikko fir" (*Abies homolepis* Sieb. et Zucc.) by Sika deer (*Cervus nippon centralis* Temminck) in Japan. The black bear (*Ursus thibetanus*) debarks forest trees in Japan and causes rotten trunks (Kadowaki *et al.* 1997 and 1999). For Watanabe (1976 S.8) the "Wild Japanese black bear" (*Selenarctos thibetanus japonicus* Schlegel) is the most destructive mammal, especially for conifers in central Japan. Hygnstrom (1994) and Ziegeltrum (2004) in the USA report serious economic damage caused by *Ursus americanus*, but in the USA, as in most other countries around the world, (De Klemm 1996) there is almost no chance to get any compensation for wildlife damage to forests.

Germany is not the only country where hoofed game can have a strong impact on forests, but the difference between Germany and many other countries around the world is that the impact can have legal consequences. Because of these regulations there is always a major discussion about wildlife damage to forests in Germany, especially between forest owners and hunters. These regulations made it necessary to develop methods for the economic assessment of wildlife damage to forests. Leonhardt *et al.* (2004) present some assessment methods, describe the legal background and give examples in their handbook for claim settlements. Schaller (2002a) gives additional information on the legal background of wildlife damage compensation and analysed the existing methods for the assessment of damage caused by debarking. He developed a new flexible method, which can be adapted to the current assessment situations. On the basis of current tree growth data, the number and distribution of damaged and undamaged trees in a stand, as well as their social status influence the calculated amount of compensation.

The economic assessment of wildlife damage to

forests is very difficult and the discussion about the results of such assessments can occasionally end in litigation. Another disappointing fact is that the litigation does not often help to solve the problem. Despite all the imperfections with the system, compared to other countries with similar problems between wildlife and forests, in Germany the existence of the right to compensation has helped us to analyze the causes and effects of wildlife to forests. This has started a process with the goal of solving the problems I have outlined.

5. Concluding remarks

As I have already described in the beginning, many Germans have a special relationship with their forests and most Germans are aware of their importance. Unfortunately, it cannot be said, however that the relationship between wildlife and forest regeneration is understood by all hunters and the general public. The forests provide a variety of positive effects and functions that will increase in importance in the future. The discussion on the effects of climate change, the potential of carbon storage in forests, the booming energy sector for wood and the increasing potential of using wood as a substitute for oil in chemical production are just a few examples.

In densely populated countries like Germany, forests are more multi-purpose than forests in countries with a lower population. Hoofed game is a natural component of forest ecosystems. To control it with the help of hunters is extremely difficult because most hunters prefer high numbers of hoofed game as a precondition for pursuing their hobby. The resettlement of predators is, in most cases, not accepted by society and if it takes place it is only possible in sparsely populated regions. An overpopulation of hoofed game disturbs the natural and artificial regeneration of forests. Forests without any regeneration will disappear in the long run, together with all their positive effects. Therefore, it is crucial to protect the forests and to enable forest regeneration.

Foresters and forest owners have the duty to create an awareness of the coherences between wildlife and forests in hunters and society. In 2006 in Bavaria the 8th "Vegetationsgutachten" (expert opinion on the state of forest regeneration) was published ("http://www.forst.bayern.de/jagd_in_bayern/verbiisgutachten/2006/index.php" 2007-01-17). With the help of this research, which is updated every three years, the hunting administrations determine the number of game to be shot per year in the shooting districts with the aim of reaching a balance between game and forests.

All over Bavaria, compared to the last "Vegetationsgutachten," more trees were browsed. In more than two thirds of all Bavarian forests the level of browsing is unacceptable, consequently 65% of the shooting cooperatives were advised to increase or drastically increase their annual harvest of hoofed game. In about one third of the cooperatives no change was recommended or a decrease was suggested in the annual harvest of hoofed game.

Communication, not confrontation between the different groups involved is required. Effective wildlife

management must help to balance the various demands of the ecosystem! Decision makers in countries where forests and wildlife are still in a positive balance should not underestimate the extreme importance of this situation.

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