

**Czech University of Life Sciences Prague  
Faculty of Forestry and Wood Sciences**

**Final thesis of the master's programme**

**The influence of game management on forest  
enterprise economics**

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**In Prague 2011**

## **Declaration**

Hereby I declare that I have written my diploma thesis with the name: “The influence of game management on forest enterprise economics” all by myself. The literature used is to be found at the end of my thesis, as well as the sources of the company “Lesné hospodárstvo Inovec, s.r.o.”

In Prague, 30 April 2011

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# 1. Introduction

The forest ecosystems are one of the essential parts of the environment. They influence and improve the climate, water distribution, they create a natural environment for many species of plants, animals and various communities. The indisputable part of the forest ecosystems is also game. There are many mutual relations among the forest and the game. Forest ecosystems influence the species composition, abundance and quality of game foremost by the fact that they provide game with shelter together with the source of food and space for basic life functions, mainly reproduction.

On the contrary, game by its existence, especially by its feeding claims, influences the growth and development of the forest tree species, the structure and the species composition of stand. The equilibrium among production and consumption has been created in forest ecosystem for ten thousand years during evolution. The cloven-hoofed game, mainly red deer, has always been of a great importance as far as the formation of the forest ecosystems structure and its dynamical development is concerned. (Putman, 1996).

In many cases game can have a harmful impact on the forest ecosystem. Specifically, when there is inequality between the amount of natural food and the amount of game, the harmful impact on the forest enterprise, but also on field crops could be really huge. The forestry management is often disputed by forest enterprise and game management and hunting. With the aim of producing bigger amounts of game and trophies, in some cases the amount of game is being artificially and purposely enlarged which is for the forest enterprise unbearable. Often there is no proper communication and coordination between the forestry management and game management and hunting. The aim of the former is to have a prosperous forest, while the aim of latter is to have a high quality forest district. Both sides are responsible for the damage in the forest. One the one hand hunters in a way that they do not have sufficient knowledge for breeding the game, according to the quality of the environment, on the other hand foresters in a way that with their silvicultural measures they are not improving the quality of environment which is needed for game.

Game has not only a negative but also a positive effect on the environment which often remains forgotten. The positive effect of game can be seen in influencing the variety of vegetation and composition of species resulting in changes of concurrent relations, when by browsing of more dominant tree species, these are being partly eliminated from the species

composition, resulting in growth medium for the less dominant species. (Putman, 1996). Game has also a good impact on improving conditions for germination of seeds by ripping and aeration of soil as well as for fertilization. For economics of an enterprise the economical impact is also very important, meaning the value of game and fee for hunting.

The economic questions in Czech game management are currently playing a more significant role. The year 1989 has been a milestone also for game management because with the change of the political system which brought changes in the hunting law as well as considering the unsolved economical problems in relation to the right to perform the hunting rights. It is crucial to note that currently under the term game management, as specified in the law number 449/2001 Sb. about game management, it is to be found a wide spectrum of activities related to the whole ecosystem. Game management is therefore characterized as one of the basic attitudes of modern management of nature.

The definition of game as a renewable nature resource that is an object of game management is very important because game does not belong to anybody as it does not respect boundaries, unless it is caught. The law also defines the hunting rights and game keeping. Hunting rights are defined as a set of duties to protect, breed, hunt, and care for game. Game keeping is specified as a set of special activities towards keeping balance between hoofed game and its natural environment, as well as maintaining of natural quality of gene pool of game, improving the quality of game keeping and the changes to manage an optimal state of game. It is necessary to realize that all these activities have economical bases.

Game keeping as well as the performance of hunting rights are a part of economical activity of renewable resources which are not fully used by forest or agricultural production. There is a connection with environmental protection as well as game protection. Actual stock of game together with natural environment serving game as a shelter and food form a bases for game management.

When the duties regarding game law shall be fulfilled, desired production of trophy game as well as venison included, there is a need to take a good care for game, to protect it and also properly hunt. Costs to maintain the suitable natural environment for game as well as permanent use of stock of game are also indicators of value of this natural resource.

Surprisingly, despite the fact that our society is economically driven with all the activities considered according to the economical profit, there is the absence of this attitude in game management. In order to evaluate game management according to the ecosystem, it is necessary to include the value of input resources as well as the human labor. The idea of game

management and its impact on maintaining the living nature could be evaluated on the bases of dates regarding inputs and outputs.

Already in the first half of 20<sup>th</sup> century many game management specialists were emphasizing an economical evaluation of game management, which is documented by the following quotation.

“Thus, a modern game management and its art shall result in maintaining of accurate stock of game without damages on both forest and field management being caused by game.”  
(Anderle, 1902)

## 2. The aim and the methodology of thesis

First step of thesis was the choice of a forest enterprise where it was possible to gain the data about forestry management for a longer period of time. One of the preconditions was also the choice of territory that could to some extent represent the conditions of Central Europe, the composition of game species included, for the results to be representative for wider territory.

The next step appeared to be more complicated than presumed. The first enterprise, where the collecting of the data has begun, was willing as far the attitude was concerned, however some important information for the thesis has not been available, other classified.

The next enterprise to have been chosen was the “Lesné hospodárstvo Inovec s.r.o.” This enterprise fulfills all the above mentioned requirements.

Then the more complex research about the territory has begun, generally about the data of game species, the game management, breeding and hunting. The know-how and opinions of foresters and other specialists knowing the territory and its environment very well was being investigated. Their knowledge and remarks were crucial for the thesis. The forest district of the enterprise provided me with all the economical data, as well as the data about game management on the whole territory of the hunting district. The data used are mapping the period between the years 2006-2011.

The field research part started in 2008. First step was to find stands, where regeneration was finished about 1-10 years ago, in order to qualify damages on youngest stands. The next criterion was protection, the stands-their parts had to be protected by several methods - game-proof fence, coating and no protection. Three stands, which fulfilled these criterions, were chosen.

The next step was the establishment of the research plots. Size of a plot was set at 1are. In every part of a stand there were 3 plots-in each stand 9 plots. These were visited annually in spring and autumn to observe, compare and evaluate the situation.

The aim of the thesis is to evaluate the forestry management with the game management, as well as the consideration of the impact on economics of forestry management. The impact is being considered not only for this very area, but also as a general



example of the conditions in Central Europe. The aim is also to propose ideas how to improve the breeding and economics of forestry management and as a result the proposal of reducing the harms done on forestry and agricultural lands.

### 3. Literature Analysis

This topic has been widely discussed, not only in scientific journals, but also in popular literature. The general game management was described by many authors and there are also a few works evaluating game management economics.

My theses is slightly different from the literature to be found on this topic, as the aim was to evaluate the impact of game management on forest enterprise economics, not the economics of game management only. For the purposes of these theses a terrain research has been conducted, as described below.

Among the most useful sources used were books (Feuereisel, 2010, Kupčák 2006, Gloser, 1996, Vach, 1997), documents (forest law and game management law), internet resources (myslivost.cz), periodic (Journal of forest science) and also interviews with foresters and hunters.

The evaluation of game management activities by economical parameters also contribute to acceptance of hunters by general public. (Feuereisel, 2010)

Game causes most damage to the forest stand by browsing, grazing, pinching off (buds and shoots), peeling and winter browsing, knocking out and ripping out seedlings, picking fruit and seeds. The largest and most extensive damage to forest stand is caused by hoofed game, mostly red deer and roe deer. Wild boar is damaging mainly field crops. The amount of damages is closely related to the frequency of animals per unit area. (Kupčák, 2006).

Good care of game is possible only with a perfect knowledge of the ecological requirements of game. Only a person who knows which external and internal factors have an influence on game and which of those affect them positively and negatively. Knowledge of ecological relationships is the key to success of breeding, ignorance is the root of many breeding failures. Ecology is not a young discipline, and yet only a few hunters recognize principles of ecology and work accordingly (Vach, 1997).

The root causes for forest damage by game are disproportion that is locally, regionally, by season and conditions of field crops caused by the gap between the nutritional capacity of

the environment and the urgent need of food for game. There is a direct correlation between the size of the gap and the amount of damage caused by game. (Gloser, 1996).

Various professional journals, as well as some general media, recently claim that damages caused by game are one of the root causes of industrial monocultures in our forests, threats to the stability of forest ecosystems and enormous economical losses. It is an undeniable fact that the game in some areas has caused considerable damage to forests. These damages are also partially caused by humans and are mainly due to a large outbreak of game (Navrátil, 1996).

Consistent practice with primary non-technical measures (optimal regulation of stock of the game, increasing the carrying capacity of the game, reduce stress factors) to reduce damage to the forest must inevitably result in significant minimization of harm to the forest by game and also in minimization of the costs incurred for the measures of a technical nature (coating, fencing, individual protection). The most expensive game feeding are young seedlings (Gloser, 1996).

It would be possible to continue and discuss the various human activities, however the conclusion would always be the same, every individual of human society affects in some way the movement and behavior of game, and thus contributes to the damage. It is therefore not correct to make the game the only culprit in the current state of forests and seek to exclude it from the ecosystem (Navrátil, 1995).

Increasing demands on the functions of forest in protection and nurturing of environment lead to the efforts to quantify and economically evaluate the non-productive forest functions at the level corresponding to the traditional performance of the sector of social production. Implementation of both of the two groups of functions is ensured by our legislative measures (Pulkrab et al., 1993).

## **4. The Characteristics and history of the enterprise and forest district**

### **4.1 The Characteristics of the Enterprise**

The enterprise “Lesné hospodárstvo Inovec, s.r.o.” is located in the northwestern part of the Povážský Inovec Mountains in western Slovakia. The enterprise has been founded in December 1992 on the area of five administrative districts and it has been a direct successor of the enterprise from 1936.

The company administrates an area of 2228.37 ha, the timber land covers 2182.14 ha. The enterprise is very varied, especially as far as the highs are concerned, it ranges from 340 to 1040 meters a.s.l., but there are also the lowlands to be found. The area is mainly covered with beech, in higher parts there is also spruce and the highest places where the conditions are not easy there is also maple. On the other hand, the lower parts are with some representation of oak trees. Regarding the production, the lower parts with mainly beech trees and partially oak trees are of a high quality, on the contrary the highest sites and the areas with steep slopes are of lower quality and do not generate any profit. Stands are problematic because they are not adaptable as well as with badly-shaped, over mature, partially broken or even decay trees. However it is necessary to state that the stability of stands and their resistance towards biotic and abiotic actors, as well as towards calamities is rather high. Therefore the amount of felling urgency during the last years was only between 8 and 16%, which is a lot lower than average. Generally, average yield would characterize all of the sites together that is closely connected with the amount of planned felling quantity and harvesting.

The enterprise is currently run by six employees – the administrator, his deputy who is also a game manager, accountant and three foresters who are heads of three forest districts.

## **4.2 The history of the enterprise and forest district**

According to the historical, political and social circumstances and changes between years 1936 and 2004, the management could be divided into several eras.

### **The first period: 1936 - 1947**

The territory of approximately 2500ha was administrated privately. The forest with its stands was young with the trees aged of 20 years and clear-cuts, as a result of economical activity of the previous owner during the World War I.

World War II was for the forest district very harmful, especially as far as the game was concerned. The reason was mainly poaching by partisans and local people too. The game management was conducted by the then owner and its few employees.

### **The second period: 1948 - 1992**

In 1948 was all the property confiscated, *de facto* it was owned by the state, however *de iure* it remained a property of a previous owner that helped greatly later during restitutions. As a matter of fact was this property part of a bigger forest district which was then maintained by the state, its role was to serve for the purposes of political, military and police representatives. Thus all forestry management was to serve only for game management. A characteristic feature for this period was high game population. As a result there were troubles with securing young and newly planted trees from browsing by game, currently these highly damaged trees are at the age of 20, 30 mainly in far distances with difficult access-ability of the forest property.

The other problematic issue remains poachers. Poaching among local inhabitants were suppressed, however the one among local hunters has grown. At the end of this period, when return to the former owners was soon expected, disorganized and chaotic hunting without rules occurred.

### **The third period: 1993 – 1994**

In December 1992 the claims for restitution were clarified and the property was returned to the ownership of the former owner. The execution of law of game keeping was processed with the hunting lease signed by the OLZ Trenčín for the period of twelve years, (January 1993 – December 2004). The structure of management forestry was as follows: four

paying guests both from Slovakia and abroad, eleven employee of the state forests and two employees of the LH Inovec s.r.o. enterprise.

In the above mentioned hunting lease, the article V had following wording:

*“The leasee has a duty to establish and maintain the required hunting equipment. The new hunting facility is established with the consent of tenants. Upon the termination of the contract the leasee is obliged to leave all the hunting equipment in the district without compensation.*

*There is currently too much game in the district due to improper management in the previous period, therefore the tenant does not claim compensation for damage caused by game.”*

This clause describes a state of population of game and the situation in the forest. During this period, in accordance with stock of game as stated in law, there should be 27 pieces of red deer.

According to report on the activities of hunting district Inovec in 1993, authorities have reduced the proposal for planning to hunt deer from 140 to 80 pieces in the “Plan for breeding and hunting hoofed game”. Overall, 63 pieces were caught and 10 were dead, so altogether 73 pieces, which is about 91%. During this period 3 pieces of deer were proved to be poached, they were found beheaded at the border district with field plots.

In 2004, only 23 pieces of red deer were caught. As a result of this drastic plan for hunting, population was reduced to an acceptable level, and thus a lot of damage to forest vegetation was avoided. Arguably, this was reflected in a significant accelerating in established plantation in old long-existing openings. By acceleration of established plantation in the next period, the number of fines in the stretch of forest management was reduced and harvesting was enabled in over mature stands. This resulted in an improvement of the economical situation of forest property.

On the other hand, uncontrolled hunting of male deer at the end of the previous period and an increase in catching in 1993 reflected the significant reduction in the deer population in the third and fourth age class, which nearly led to its complete absence in the coming years.

#### **The fourth period: 1995 – 2004**

For a period of ten years, between January 1995 and December 2004 there was a lease agreement signed for the performance of game management in the certified forest district “Paluch” between the majority owner of the land Ing. Emil Modr and the other owners on the one side, and “Forest Enterprise Inovec s.r.o.” as the leasee, on the other side. The part of the contract was an operating procedure of “Forest Enterprise Inovec s.r.o.” for the performance of the game management of the “Paluch” hunting district.

This operating procedure could have been continuously amended. Mainly employees of LHI s.r.o. and charged guests hunted in the hunting district. During this period the area changed twice, as well as the name of the district and its including into the breeding areas. In addition, in 1998 there was a transfer of ownership from Ing. Emil Modr to the company Lesy MODR s.r.o.

The subject of the contract of lease from 1995 was the lease of hunting rights performance in the recognized hunting district under the name “Paluch” of an area of 2925.27 hectares. The hunting district was the final decision of the Forest Office Trencin of October 26, 1994 File LU - 407/1994 - 206.9 issued at the request of Mr. Emil Modr, the owner of hunting land with a total area of 2268.68 hectares, after discussion SPZ (Slovak game management association) in Trencin and at the Office for environment in Trencin. Under this decision the hunting district was located in the area of deer breeding S - VI Povážský Inovec, sub location of Inovec. The administrative authority included different types of animals into quality classes, according to these period valid directives on the organization of hunting districts, designated NKS and growth rate. Although the hunting district was on the border with the red deer area, according to the above mentioned directives it was possible to keep red deer at the expense of stock of game of roe deer at a rate of 10% of roe deer units of the state of roe deer. Standardized stock of roe deer was 109 pieces and 3 pieces of red deer. Given the fact that in the newly created hunting district there were 269 hectares of groups of forest types located suitable for the breeding of mouflons, forest authorities determined the NKS for 6 pieces as standard also for this kind of animal.

Although wild boar does not compete with other game for food, it was also standardized to the entire acreage of forest land, stock of game was normalized at 20 pieces.

In 1998, the District Office in Trencin, in a decision directed a revival of the case in the recognition of hunting district “Paluch” and its inclusion in the hunting area because of

changes in ownership of certain property rights and changes in hunting areas, which resulted from MPSR Decree No. 91 / 1997 (MPSR, Slovak Ministry of Agriculture) law of hunting areas, hunting property of the owner Ing. Emil Modr with area of 2261.95 was acknowledged for the hunting district called "Paluch". Total area of hunting district with other land owners after the adjustments made was 2796.18 hectares.

According to this new and so far last decision is the hunting district "Paluch" located in area of red deer breeding J-XXXII Povážský Inovec, sub location Invoice. The main bread species in the hunting district is red deer with the standardized stock of game at 47 pieces.

The next species bread is roe deer with standardized stock of game at 24 pieces and also wild boar at 27 pieces.

Standard stock of red deer and wild boars are determined on the basis of identified groups of forest types in the hunting district. Standard stock of roe deer is set on the basis of counting of the main species of bread game.

A newly created hunting district with changed borders creates sufficient space for the norm species and enables proper game management.

Reasonable catches of red deer during this period vary between 19 to 30 pieces per season. Towards the end of the period population begins to grow from year to year. Since 2003, are already damages caused by game quantifiable under Guidance of the Ministry of Forestry and have a rising tendency. This increases the costs of protecting forests against browsing of game.



### **4.3 Present**

As the current period the period since 2005 can be considered, when the contract of lease and execution of performance of game management in recognized hunting district “Paluch” was signed and approved. The sides of the contract were the current majority owner - the landlord of hunting land Lesy MODR, s.r.o. which owns 78.46% of hunting land in the common hunting district, and Lesné hospodárstvo Inovec, s.r.o.

The contract was signed for 10 years.

The purpose of this contract is the lease of hunting rights for the performance in the hunting district “Paluch”, which was recognized by Local District Office in Trenčín in 1998.

In 2004 a new directive on the performance of hunting in hunting district “Paluch” was signed. There is the division of responsibilities between the executive of the company, LHI manager and game manager to be found, as well as general binding rules for the hunting in the “Paluch” hunting district, such as game management, hunting, but also awards and penalties, security rules in the handling of a firearm and ammunition and other provisions. In the subsequent amendment to the 2005 Directive, was this Directive approved by the district forest office in Trenčín in 2006.

Today, LHI s.r.o. ensure the implementation of hunting rights by its own employees, workers on an agreement on the work done and contract individuals, a total number of 9 people. Trophy hunting of game in this group is in a form of reward and it is not claimable.

The main financial revenue is from fees of shooting trophy animals, charged common hunting, and sell of venison. Revenues are at about 3% of total economical management of LHI s.r.o.

Damage caused by game maintains an increasing tendency and this is related to the rising costs of protecting forests against browsing. Red deer population continues to rise slightly.

## **4.4 General binding rules for operating in hunting district “Paluch”**

### **1) Game management**

- a) The hunting equipment (feeding and hunting, including hunting cottages) is in care of the foresters in their sections of the forest. Damaged hunting equipment will be in agreement with the game manager either repaired or disposed of. Hunting cottages and its surroundings are kept in good order.
- b) At the direction of game manager will be both started and terminated the feeding of game in winter season. After the feeding period, feeding equipment will be cleaned.
- c) The foresters will continuously monitor the health of animals. At the direction of the game manager, the game shall be preventively treated with medical products.

### **2) Hunting**

- a) Allowances for individual hunts are in agreement of game manager and administrator of LHI at the disposal. Before issuing any permits, the representative of the owner of the forest district shall be informed about its scope and to whom it is to be issued.
- b) Annual allowance to a trophy red deer is issued to an employee (for a treatment, anniversary, or just because of his turn in the order).
- c) Draft list of guests who will be invited to the wild boar game will in advance approved by the representative of the owner of a hunting district.

- d) All game caught in an individual game hunting shall be immediately reported to the game manager either the same or next day, as well as to the representative of the owner of the hunting district. (Shooter, weight, approximate value of the trophy). Likewise, (second day at latest) shall be the result of a driven game shooting for wild boar reported to the owner's representative.
- e) All walks in the district shall be written into the established books. Only the walks of the game manager himself as well as those by LHI administrator or representative of the owner of the hunting district shall not be registered (due to control options).
- f) It is possible for the fee hunting guest to buy venison of hunter kill. The employees and shooters are also allowed to buy venison or its part from the caught game. Records of hunted game shall be kept by delegated person.
- g) Refreshment for the drivers of game shooting is possible in the restaurant at their own expenses (with exceptions approved by the owner of the hunting grounds).

3) For other hunting activities, which are not specified here, it shall be proceed in accordance with the principles of hunting, traditions and ethics.

4) Rewards for escorts, for trophy deer, fox, wild boar, hinds and calves remain the same under Annex 2 employment contracts from April 1, 2003

### **5) Penalties for non-compliance**

- a) Penalties for failure to comply with the above rules will apply to all employees and will be primarily financial in accordance with the seriousness of the offense. The financial penalty will be discussed by the game manager, administrator of the LHI and the representative of the owner of the hunting district.

- b) In case of mistake in catching trophy game by employee, the shooter loses eligibility to the trophy and the trophy will become the property of the owner of the hunting district.

## **Operating Procedure of the LHI S.r.o. for the performance of hunting rights in the hunting district "Paluch"**

### **General provisions**

This operating procedure is the elaboration of the game law, guns and ammunition, tents of the SPZ and game management regulations. It specifies concrete rights and obligations of hunters, so that they carry out and promote natural resources.

### **Organization of the forest district**

Activity shall be managed by the game manager and LHI. For this work they shall be responsible to the owners of hunting district. Game manager shall manage and ensure joint actions. He also shall control the activities of each of the hunter.

### **Attendance at the forest district**

1. Any hunter, who is entitled to perform the hunting rights throughout the year in this forest district, shall attend hunting district also outside the hunting season. Especially when game is in need and additional feeding and protection against animals damaging game management, and against other harmful factors, is necessary.
2. Upon entering the hunting district, each and every hunter must carry shooting license, hunting permit and firearms license. Performance of the hunting law could be executed only with weapon that has been registered in the firearms license.
3. Visit of the hunting district shall be written in the guestbook of the hunting district by each hunter.

4. Each hunter is obliged to fill in forms according to the model in the guestbook of the hunting district. It is signed upon ending of the visit of the hunting district.
5. When choosing a site of the hunting district to be visited by the hunter, the hunter must ensure that his entry does not disturb already registered hunters. He has to enroll in the book, according to the district where he is going to perform the right of hunting.
6. The entry in the guestbook of the hunting district shall be exercised only personally and legibly.
7. Invited guests shall be written into the guestbook by administrator.
8. Accompanying guests, who participate in hunting for fees, will have priority in selection of the part of the hunting district. This fact must be respected the other hunters.

They must also respect the limitations of walks and hunting in parts of the district, which will be mentioned by the game manager before the arrival of the guests paying the fee. Similarly, hunters must respect the choice of guest for accommodation at the hunting cottages.

### **Duties for hunters**

1. Every hunter shall participate in all common hunting activities, for which he will be invited, eg. joint meetings, seasonal jobs, counting of game, etc.
2. In addition, each hunter and a guest are obliged to demonstrate functioning of his weapons, if they are asked to do so by game manager.
3. Each hunter will be included in a group for big red deer rack for feeding, which shall be filled in jointly by a feeding volume. In winter, supplementary feeding by fleshy and grain feed shall be individually provided. In addition, every hunter will be assigned to take care for one rack for feeding and salt marshes.

Similarly, they shall also take care of the feeding hoppers. Salt marshes shall be filled throughout the whole year.

Every week in the winter season shall grain feed and dried twigs and shoots of some broadleaved species be put into the roe deer rack for feeding. The part of this order shall also be the distribution list of those facilities and activities.

4. Racks for feeding must be filled before the beginning of August and the volume of feed shall be supplemented as needed. Every hunter is obliged to produce at least 20 bunches of dried twigs and shoots of some broadleaved species for the allocated roe deer racks for feeding and to distribute it to roe deer in time of need.
5. In the spring, no later than 15 May, must be racks for feeding dug up and cleaned as well as its surroundings, including feeding hopper and salt marshes.
6. When the meadows are used for collection of feeding volume, they must be mowing no later than at the end of June, the best would be mid-June (depending on weather).
7. Hunters will be divided into groups, each group will be assigned sections of sidewalk cleaning, or drinking water wells, especially near the hunting cottages. Similarly, the hunter will be assigned the cottages. In the cottages the order is to be maintained, as well as cleanliness, washing of floors and linen change shall be done once or twice a year.
8. Hunter writes all of his activities to the back of the book of visits according to the model, time for which his work was done included.
9. Any hunter who will hunt or will be accompanying a guest must abide the measures for proper selective hunting, depending on the type and structure, the measures are strictly required.
10. Hunter has the obligation to report any change in possession of weapons to the game manager.

11. Also, changes in the possession of hunting dogs and passing examinations.
12. When a hunter finds out about an illegal harvesting or removal of wood, his must immediately be reported to LHI.

### **Performance of hunting rights**

1. For every 500 ha (started included) shall be determined the hunting guard.
2. Performance of the right of hunting is possible only in the manner prescribed by law and regulations.
3. Shooting of the cloven-hoofed game is only possible on the basis of an established plan of breeding and hunting according to the allowance of game manager and also with the permit for hunting, issued by the game manager. In the allowance there shall be determined species, age class, or the number of individuals permitted to shoot. Hunter is allowed to hunt only the game that has been safely recognized. Hunting of the cloven-hoofed game is possible only with rifles, wild boar can also be hunted with shot guns, but only from the hour before sunrise to an hour after sunset, with the exception of game, which the law permits to hunt also at night - wild boar and woodcock. The wild boar hunt is possible only on clear nights within 3 days before and 3 days after the full moon, and only with good observation and shooting optics. For night hunting, the hunter must enroll in the guestbook with the exact location where he will wait. When he is to leave this place, he must have lit a small torch.
4. While performing of hunting rights, hunters are required to observe safety rules when handling firearms. Especially when shooting in a near proximity of the villages, resorts and hiking trails it is necessary to follow the rules with utmost caution.

5. During the joint hunts the instructions of the game manager or the head of hunting must be followed. No joint hunting is allowed without the presence of game manager.
6. During joint and individual hunts, when bearing arms, consumption of alcohol is strictly prohibited.
7. Each piece of caught hoofed game must be shown to the game manager, if appropriate, to the director of LHI. In such case, the reporting must be done within 24 hours. The game manager then assesses the age and also the disposal of venison. The one destined for the purchase must be perfectly processed and cooled. From caught game intended for selling that has been presented to the director of LHI, has to have out of does, roe-does, roe-calves and wild boar their jawbone removed to be shown to the game manager. This concerns venison for LHI, s.r.o.
8. Hunted hoofed game has to be notified into the guestbook by the shooter upon his leaving the district, as well as into the personal annex of this book. The hunter is also required to vindicate for registration of the caught hoofed game into the book of evidence within 48 hours. Accompanying person has to manage all these procedures for the charged guests. Last caught a piece of a certain type of game must be reported and recorded in all the books and attachments during the day.
9. The shooter is required to proof the submission of wild game to the purchase within three days to the game manager.
10. The shooter, who wounded hoofed game, shall use all means available to trace it. He is obliged to invite the whippers with their hunting dogs to help and report this fact to the game manager.
11. The hunted trophy of the game has to be presented to the game manager by the shooter within five days, after responsible treatment and with lower jaws. Shooter is obliged to present the trophy at the county livestock show.



Trophy game caught by the charged guests shall be evaluated and photographed by the game manager, unless indicated otherwise.

12. Digging of badgers is strictly prohibited in the district.
13. Hunter never shoots a doe guiding its young ones. When a reason for hunting a doe arises, the deer-calves should always be caught first.
14. Hunter participates in a hunt properly dressed. For the dressing colors are considered dark green and brown.
15. Hunter is obliged to take care for dead animals, wild animals caught in hunting and game pests, they shall be removed by burial or incineration. An exception in this respect is bait designed to catch prey or harmful animals.
16. At the time of publication of extraordinary veterinary measures, the guidelines of game manager shall be followed.
17. Each piece of hunted wild boar must be examined for trichinosis (*Trichinella spiralis*). The results have to be verified. In the case of a positive finding, the fact has to be reported immediately to the game manager. To consume venison is then prohibited. For the charged guests this has to be arranged by their escort.
18. The hunted game is always treated with respect by the hunter who also takes care that others do so as well.
19. Hunter must not lend his gun to any unauthorized person.
20. Guests can be invited by game manager and by the director of LHI upon mutual agreement. Hunting guest is obliged to pay fees for the costs associated with hunting. Trophy game shall be paid by the guest according

to the applicable tariff, or under the decision of either the game manager or the director of LHI.

21. For the charged guest is the caught game disgorged by the escort. An exception might be if the host strictly wants to disgorge game himself.

### **Evaluation of the activities of hunters**

All activities and duties will be assessed by the game manager. The evaluating period is annual, from January, 1 to December, 31 in each calendar year.

Based on the evaluation activities there will also be given the permits for hunting hoofed game. The game manager shall decide about the amount and type of venison to be sold every year.

### **Activities evaluated**

- participation in joint events, counting game, joint hunts, vaccination
- cleaning and filling of salt marsh mangers, racks, feeding hoppers, cleaning of the hunting trails, hunting field care, repair and construction of new hunting equipment, works to ensure a grain and fleshy feed, feeding in times of need
- guidance of hunting guest
- participation in a joint hunt as a dog whipper
- catching trophy game in an individual way
- hunting and catching prey and harmful game (fox, pye-dogs, pye-cats)
- keeping hunting dog for one year according to the quality
- successful search for hoofed game by the hunting dog
- for excised trophies for the charged guest shall the preparator be rewarded, as determined by game manager

### **Raising hunting dogs**

Financial contribution to the breeding of hunting are suggested upon decision of the game manager according to the quality and use.

### **Final Provisions**

Operating Procedure, approved on April 20, 1996 by the game manager and LHI, is every hunter that shall perform the hunting rights in hunting district "Paluch" obliged to comply

with. Gross or repeated violation of operating rules or regulations may result in termination of hunting rights in this district or possible disciplinary sanctions.

## **5. Cost-benefit analysis and calculation results of the Game**

Revenues for the owners of the hoofed game hunting district are possible to divide into two basic categories – out of the venison and out of the charged hunts. The possible extend of the hunt and following revenues out of game management are determined by real numbers of stock of game population. The qualified estimation is regarding some kinds of game much higher than it should be, according to the normalized stock of game.

The current revenues are rather higher due to the higher stock of game, but when the stock of game is normalized in order to keep the forest in healthy condition the revenues from hunting shall be considerably smaller.

The estimation of the costs for game management is much more complicated, because hunters often work in the forests in their free time and for free and they use their cars to come to forest without demand on compensation.

One good example of this “hidden costs” of game management is feeding. As mentioned before, most of the hunters do this for free and additionally, the feed is often not bought, but exchanged for some of game management products like venison or permission to hunt.

Law on forest management (§ 11 par.4) states: “The user of the forest district has a duty to run racks, hoppers, salt marshes and watering-place, and in time of need to feed game additionally.”

The results of researches of digestions of hoofed game show the fact how very important it is for game to create a fat cell reserve in autumn. This is crucial in order to successfully overcome time of need and at the same time reduction of food demand, resulting also in decrease of damage caused on forest stands.

Majority of forest stands in the Czech Republic do not provide to the hoofed game in winter time sufficient supply of food. The time of need connected with the increase negative impact on forest vegetation is to be seen even at the beginning of autumn, not with the first snow as probably expected.

The overall period of additional feeding of hoofed game is set from the half of September to the end of March (195 days). The costs of production of feed by self-help in small-scale production are much higher than in large-scale production. Thus, many forest

enterprises try to decrease (and hide) this costs by exchanging feed for some other goods- mostly products of game management like venison or permission to hunt..

The following tables show the economical results of game management in the enterprise LHI in the period 2006-2010.

## 2006

| <b>Costs:</b>                                  | <b>Euro</b>            |
|--|------------------------|
| - Material usage – fixing of hunting equipment | 2,535.40               |
| - Cost of representation                       | 54.26                  |
| - Forestry activities – wages                  | 791.07                 |
| - Other game management services               | 664.30                 |
| - Rent for part of forestry district           | 1,443.26               |
| - Permanent staff – wages                      | 228.70                 |
| - Other wages                                  | 3,056.90               |
| - Fees – forestry office, stamps               | 191.69                 |
| <b>Total costs:</b>                            | <b>8,965.57</b>        |
| <b>Revenue:</b>                                |                        |
| - sale of venison                              | 1,103.02               |
| - charged hunting                              | 1,692.73               |
| <b>Total revenue:</b>                          | <b>2,795.75</b>        |
| <hr/>  |                        |
| <b>Result in 2006</b>                          | <b>- 6,169.82 Euro</b> |

**2007**

| <b>Costs:</b>   | <b>Euro</b>      |
|---|------------------|
| - Material usage – fixing of hunting equipment            | 347.50           |
| - Cost of representation (refreshment for driven hunting) | 275.88           |
| - Forestry activities – wages                             | 800.33           |
| - Rent for part of forestry district                      | 1,776.62         |
| - Permanent staff – wages                                 | 521.70           |
| - Other wages   | 2,066.10         |
| - Fees – premium for forest guard                         | 20               |
| <b>Total costs:</b>                                       | <b>5,808.12</b>  |
| <br>  |                  |
| <b>Revenue:</b>   |                  |
| - sale of venison   | 3,147.90         |
| - charged hunting   | 8,732.67         |
| <b>Total revenue:</b>                                     | <b>11,880.57</b> |
| <hr/>   |                  |
| <b>Result in 2007</b>                                     | <b>6,072.45</b>  |

**2008**

| <b>Costs:</b>                                  | <b>Euro</b>       |
|--|-------------------|
| - Material usage – fixing of hunting equipment | 752.33            |
| - Cost of representation                       | 49.20             |
| - Forestry activities – wages                  | 2,048.87          |
| - Other game management services               | 1,670.35          |
| - Rent for part of forestry district           | 87.41             |
| - Permanent staff – wages                      | 220               |
| - Wages  | 2,893.60          |
| - Premium                                      | 33                |
| - Fees – forestry office, stamps               | 173.33            |
| - Fees – premium for forest guard              | 433.33            |
| <b>Total costs:</b>                            | <b>8,361.42</b>   |
| <br>   |                   |
| <b>Revenue:</b>                                |                   |
| - sale of venison                              | 3,781.36          |
| - charged hunting                              | 11,309.16         |
| <b>Total revenue:</b>                          | <b>15,090.52</b>  |
| <hr/>  |                   |
| <b>Result in 2008</b>                          | <b>+ 6,729.10</b> |

**2009**

| <b>Costs:</b>   | <b>Euro</b>      |
|---|------------------|
| - Material usage – fixing of hunting equipment            |                  |
| + Material for organizing driven hunts                    | 1,468.98         |
| - Small tangible property – digital game weighing machine | 638.72           |
| - Forestry activities – wages                             | 2,504.47         |
| - Other game management services                          | 485.61           |
| - Rent for part of forestry district                      | 7,423.29         |
| - Wages   | 2,204.69         |
| - Fees – forestry office, stamps, premium                 | 374.50           |
| <b>Total costs:</b>                                       | <b>15,100.26</b> |
| <br>  |                  |
| <b>Revenue:</b>   |                  |
| - Sale of venison   | 4,362.36         |
| - charged hunting   | 18,187.32        |
| <b>Total revenue:</b>                                     | <b>22,549.68</b> |
| <hr/>   |                  |
| <b>Result in 2009</b>                                     | <b>+ 7449,42</b> |



**2010**

**Costs:**

**Euro**

|  |          |
|--|----------|
| - Material usage – fixing of hunting equipment |          |
| + Material for organizing driven hunts         | 1,222.11 |
| - Forestry activities – wages                  | 2,321.02 |
| - Other game management services               | 596.30   |
| - Rent for part of forestry district           | 1,545.14 |
| - Permanent staff – wages                      | 43.24    |
| - Wages  | 2,049.16 |
| - Fees – plumb seals, premium                  | 596.30   |
| - Membership fee in Slovak forestry chamber    | 496.07   |

**Total costs: 8,869.34**

**Revenue:**

|                   |           |
|-------------------|-----------|
| - Sale of venison | 5,487.34  |
| - charged hunting | 16,376.35 |

**Total revenue: 16,963.69**

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**Result in 2010 + 8,094.35**

Out of the economical reports it is obvious that the Enterprise Lesné Hospodárstvo Inovec consistently pays great attention to game management.

A substantial part of income are the hunting taxes for trophy game hunting received by charged guests, and fees from the common wild boar hunts. Another important income is the sale of hoofed game venison. Sale of venison is mostly intended for customers' consumption, the rest is purchased through specialized firms. When venison is being sold, especially a wild boar, this sale must be strictly complied with basic hygiene requirements and some veterinary tests. Among the cost item is to be found the cost of animal feed, material for maintenance and construction of new hunting equipment, various fees for veterinary executions, storage, bonuses and shares of the catch and earnings of employees substantially in the care of animals and hunting equipment. Part of the work is performed by employees or hunters in their spare time without being paid for it. For these reasons, while maintaining quality care for animals in comparison with the main economical activity, a profit from hunting is rather unimportant.

During the reporting period, in the last five years there is an apparent imbalance in the overall economical results. While the costs do not fluctuate significantly, the proceeds do. This is due to the different number of driven game shooting in each year and their success. The success to catch of trophy game by charged guests is also included.

Number of charged guests and joint driven game shooting depends on the correct setting procedure for the marketing and sales presentation.

Regular guests are very important. In this case, it is important to create the atmosphere before, during and after the hunt itself, so that the guests have a good feeling and a desire to join the hunt again.

The success of each of the driven game shooting depends on several factors and these comprise a significant amount of the cost of hunting:

a) the personal quality as well as professional quality and shooting ability of the guest (an arrogant person who does not respect the instructions of his escort, the law on hunting and firearms, is impatient and has lack of time, dramatically reduces the hunting success, and also poses a threat to himself and his surroundings),

b) personal quality and professional skills of the escort (knowledge of the game in the hunting district as well as behaviour of game is crucial, for a good atmosphere it is also important to be professional and good companion, especially after the

unsuccessful hunt motivation of the escort is also very important. As a motivating factor serve shares of caught game. When the escort is demotivated, it is not a good companion, moreover he does not care for a positive outcome.)

c) Organizational security of driven game shooting (disorganization, inadequate transport, etc. significantly undermines schedule of driven game shooting, because the behaviour of game in different seasons has to be taken into account. It is needlessly to conduct a hunt for wild boars, which has not returned from a night searching for food yet or already departed to search for food itself. Tiredness and physical fitness has to also be taken into account)

d) good care for game and related site suitability (appropriate care of animals increases the likelihood of encountering with animals)

e) appropriate equipment for hunters to hunt (seats, benches, sidewalks, bench on which there is a necessity of holding a tree, significantly reduces the mobility of the hunter).

All measures for ensuring a successful hunt are very time consuming to manage and sometimes organizationally difficult manageable, because the main activity of the company is harvesting and cultivation of the forest.

On the other hand, failure to provide game shooting as well as care for animals causes an unbearable outbreak and subsequently increases damage by game. The costs of preventing or disabling the damages by game are rising and sometimes it is even made impossible for the forest to regenerate.

Therefore, it is absolutely necessary to maintain the population of game at an acceptable level. For the forest it is best to keep hoofed game at the minimum level of population. Wild boar is indifferent in relation to forest, but it makes big damages on field crops. In the forest, it has both positive (destruction of harmful insects, aerate the soil ...), as well as negative influence on the forest (ripping out of seedlings, excessive consumption of acorns and beechnuts ...). When there is a wild boar outbreak, it has markedly negative effect on the forest, especially with regards to natural regeneration of beech and oak.

Lack of care for animals increases the damage to the forest vegetation. On the other hand not even an extreme care for game will prevent damage and high costs without the appropriate reduction in the number of individuals.

The following table shows calculations of profit, efficiency and profitability for each year during the period 2006 - 2010. The state of game management is best represented by the indicator of profit. The data is in a clear imbalance. The reasons for these differences are partly inclusion of various costs of items as well as imbalance in number of driven game shooting in the respective years.

Table no.1 – The main indicators of the economical effectiveness of the game management in LHI enterprise.

| Year | Costs            | Revenues         | Economic results | Effectiveness | Profitability |
|------|------------------|------------------|------------------|---------------|---------------|
| 2006 | <b>8965.57</b>   | <b>2795.75</b>   | <b>- 6169.82</b> | <b>0.312</b>  | <b>-0.688</b> |
| 2007 | <b>5808.12</b>   | <b>11880.57</b>  | <b>6072.45</b>   | <b>2.045</b>  | <b>1.045</b>  |
| 2008 | <b>8361.42</b>   | <b>15090.52</b>  | <b>6729.10</b>   | <b>1.805</b>  | <b>0.805</b>  |
| 2009 | <b>15 100.26</b> | <b>22 549.68</b> | <b>7449.42</b>   | <b>1.493</b>  | <b>0.493</b>  |
| 2010 | <b>8869.34</b>   | <b>16 963.69</b> | <b>8094.35</b>   | <b>1.913</b>  | <b>0.913</b>  |

## 6. The costs of forest protection against game

Among one of the basic duties of the manager of the forest district is to maintain the game breeding on the scale between minimal and normal stock of game that is stated in the decision on recognized forest district in certain age and gender composition (§ 3 paragr. 2 of law on game management).

“The most important economical factor in the forest management as well as the basic source of revenue is the number of population of game, including increment being also source for hunting.”

The main goal of the forest management is to achieve such an estate of hoofed game that is in balance with the food supply of the forest environment.

Normalized stock of game is the spring stock of game, from March 31 at latest of the common year. This estate corresponds with the quality of environment of game and the carrying capacity of forest district. Normalized stock of game reflects also age and gender composition of the forest district according to the qualitative class, as well as the assumed reproduction (§ 3 paragr. 2 of law on game management).

Damages started to be different in meaning, nevertheless the influence of game on state and development of youngest mixed and deciduous growth is permanent. Damages caused by game are not the same on the whole territory of the Czech Republic, it significantly differs regionally. At about 65% of the area of the Czech Republic has been damaged about 10% in the stands, on the contrary in some regions there are repeatedly permanently damages occurring since 1995 (the damaged areas are identical).

It is not possible to undergo similar evaluation in relation to agricultural lands and crop plants due to the inability of processing the inventory of damages on agriculture in praxis. Out of the official activities as well as of the dealing with agricultural public it is clear that damages caused by game are locally unbearable. Mainly these are damages caused by wild-boar.

It is necessary to state though that the stock of game are positively influenced by agricultural production, especially large scale increase growing, such as corn, rape, sunflower and cereals that provide game with sufficient shelter and calm and make it uneasy to hunt game during growing season of these increase. Among the reasons for growth caused by game

is ignorance and sometimes also unwillingness of the owners of forest districts actively contribute to the control of hunting management in hunting district with the application of all instruments and arrangements for reduction of stock of game that is enabled under the current law. Reduction of population of hoofed game, especially in forest hunting districts, is absolutely necessary in order to reduce damages and harms caused by game, to improve the health conditions of the forest, adjustment of age and gender structure of population of bred game. It is crucial to reduce the stock of kind of hoofed game for which there are no limits for normalized stock set, after that other arrangements can be effective.

### **Recommendations and arrangements for reduction of game stock:**

1. Control the hunting plan of the game management, whether the number of caught hoofed game has been fulfilled
2. Transact applications for deliverance from government administration of game management without delay and with patience regarding hunting those kinds of female hoofed game as well as male hoofed game until two-years of age for which there are no limits (normalized or minimal) set, in accordance with law § 36 par. 5 law on hunting (meaning, *no setting of limits like “20 young stock and 5 female” etc., because the law enables to hunt this kind of game without any restrictions as well as without negotiating nor dealing the plan*).
3. Make full use of possibilities under law on hunting, § 39 to reduce stock of hoofed game, such as:
  1. In all cases where it is necessary to reduce stock of hoofed game in the interest of the owner or the lessee of the hunting district, or in the interest of agricultural or forestry production, protection of nature, or in the interest of game management
    - a) Either to allow at the proposal of the user of hunting district
    - b) Or in all other cases order the adjustment of some kind of hoofed game with the application of following rules
      - Prefer to hunt young game
      - Out of the mature game, focus primarily on female or young male until two-year age
  2. In cases when the owners of hunting districts accomplished adequate arrangements against inception of damage caused by game, and still it was proved that it is not possible to reduce neither technically appropriate nor

economically bearable ways damages caused by game, by decision on the basis of the proposal of the owner or lessee of the hunting district, or according to the environmental protecting body or the forest administrative body

- a) Reduction of stock of game to the minimal level, or
- b) Cancellation of breeding of the kind of hoofed game that causes damage

4. During implementation of arrangements stated in paragraph 3, it is always desired to cautiously and objectively with the cooperation with forest administrative body or environmental protecting body consider whether the assumption of effectiveness allowed or ordered arrangements shall or shall not be extended also to the other neighbouring hunting districts where the arrangements for reduction of hoofed game shall also be applied. If so, the arrangements ordered under the proposal of the body of government forestry administrative or environmental protecting body (see 3.2) shall be extended to reduce stock or cancel breeding of those hoofed game that causes damage to all neighbouring hunting districts. Set hunting amount of hoofed game according to retrospective counting.
5. Before the decision about adjustment of stock of hoofed game according to the § 39 of law on hunting, it is recommended, in order to enhance the effect of adopted arrangements:
  - a) to cooperate with the agricultural subjects as well as with the owners of forests in negotiating about specific conditions and scope of accepted arrangements from both the side of the users of the hunting district as well as the side of owner of the hunting district with the aim of improving the conditions for hunting hoofed game in large areas of high growth by creating breaks or straps of low growth, etc.
  - b) When dealing with owners or lessee who agriculturally manage the hunting districts to stress that implementation of arrangements mentioned in a) is a duty of the owner (lessee) of the hunting district in order to prevent damage caused by game according to the § 53 of law on hunting. Implementation of such provisions improves the credit of the owner of the hunting district when dealing with users of hunting district about the

replacement of damage caused by game, even at the possible court of justice about the replacement of damage.

The above mentioned recommendations shall be implemented differentiate according to the concrete conditions...

Owners of the forests are the ones having options how to reduce the negative impact on forest caused by game. Damage to forests can be often very effectively prevented. In particular, foresters should care about natural increasing of the carrying capacity of forests for game. These measures should be taken for granted for every administration of forest estate. For example, when pruning is conducted, the oak crowns shall be loosened in order to have a larger crop of acorns. On suitable sites – near the skidways etc., foresters should plant chestnut trees and other fruiting trees. When browsing, game's preference is certain tree species, often secondary. Secondary tree species grow very often as natural regeneration in clearings after harvesting and can therefore serve well for game browsing. Similarly, for game browsing can serve also stump suckers of ash, maple, oak, etc. It is therefore necessary to keep secondary trees and stump suckers in the clearings, not cleaning them out.

Users of hunting grounds have a duty to care for increasing of carrying capacity of hunting grounds for bred game and thus prevent more damage to forest stands by game. Especially during late autumn and winter, natural carrying capacity of hunting ground can be achieved by planting such growths in fields for game that can be browsed by game also during times in need. It will be the crops that tolerate frost. It could for example be feed rape, feed cabbage, etc. Fields for game shall be accessible to as many of them as possible, it is very important. Among major crops grown on the fields is also topinambour, it is pastured by game until the winter comes, and in winter it feeds on wild boars by its tubers. The most common way to reduce negative effects on forest stands in the winter times of need is planned additional feed. It is possible to keep game in the winter in good health and in good condition by additional feed. Equally important is to make game to give priority in times of need to food presented before browsing tree species or tree bark. How would be reducing the negative effects on forest stands successful shall depends on the types of feed presented, on placing of the mangers and also on times when feed is presented to game. Game finds remaining concentrated feeds - beets, potatoes, etc., in the fields in autumn. At this time it is to be usually found only concentrated feed in mangers. Hay is useful to begin to present to game at



Christmas time, when it begins to snow and freeze. Even if high quality hay is put into manger at the end of autumn, it becomes wet, mould and game will not take it. When hay is to lure game from damaging forest stands, it has to be of a high quality. Especially hay that is presented to roe-deer must be harvested on excellent meadow with representation of various dicotyledonous plants and grass must be mowed in time for the plants to stay fresh. Equally appropriate is the well-dried aftermath. Dried hay must have green colour and smell pleasantly. Dried hay from the high and hard grass is inappropriate for roe-deer. Red-deer is not so demanding regarding the quality of hay. Feed volume for game should be available in racks throughout the winter without any restrictions.

Concentrated feed provides game with easily digestible carbohydrates, especially starch. Game usually prefers high-quality concentrated feed over other types of feed. It should be emphasized that the concentrated feed attracts game to racks. Based on the knowledge of experts in recent years, the glut by concentrated feed in the winter time of need may harm game. A significant increase of acidity in proventriculi is caused, resulting in suppression of bacteria and ciliates. It causes deterioration of fiber degradation and received other disorders of complex plant food for digestion by microbes. Among the various types of the concentrate feed with regard to the digesting of game are big differences. Suitable concentrated feed, which is presented to hoofed game, is oats, wheat is inappropriate.

A good lure for game to mangers is also fleshy feed. The most frequently presented fleshy feed is feeding beets, carrots, apples, etc. Fleshy feed are taken very intensively by game and are preferred to browsing of trees. When additionally fed, for example apples are very appropriate. Fleshy feed must be served in smaller quantities to the game, so it would not freeze even in heavy frosts and could be eaten by game.

Game shall in time of need keep in close vicinity of manger, if possible, that is the purpose of the intensive additional feeding. If there is not enough feeding, it results in unacceptable damage to forests. Feed costs for this type of feeding increases, but they often return in the form of minor damage to forests and also in the quality of trophy game.

The most commonly used mechanical protection is fencing. For the fencing of forest plants is mostly used wire mesh, manufactured for this purpose. These fences are often made by using the wood waste from saw. When the fence is being used for protection of large areas,

game often manage to penetrate it and this protection is ineffective since. Therefore it is important to plant threatened tree species in small compact groups and these smaller areas fence. Fir when young grow very slowly and it takes about ten years before it grows out of the danger of being browsed by game, thus it is advisable to protect planted fir seedlings by fencing. On the contrary, wood such as maple and ash have strong seedlings which grow out of danger by being browsed by game within two years, when protected by coating.

Chemical protection of forest seedlings is applied with repellent with a brush on the terminal. Coating is carried out before the winter starts and shall protect plants from damage by game until the spring comes.

Coating is applied on bark of trees against damage caused by red-deer in spots until about high of two meters. This coating usually protects only those logs that shall later form the so-called main stand. Protection of logs against browsing by game could also be conducted mechanically by binding of logs with wire plastic mesh or by attaching branches to logs, etc.

The protection of stemming is used against damage of logs of young trees by shaking out by roe-deer.

Protection of forest stands against damages caused by different types of game is also different. The effective protection from red-deer needs to be performed within the larger area. Red-deer change their sites in relatively large stretches distant several kilometres from one another. It is important that the red-deer is undisturbed and enabled to use pasture or manger. Red-deer hide themselves under the young spruce stands with no grazing option. This is often closely connected with browsing of the bark of young spruce stands.

One of the most effective ways of preventing the damage of forest caused by red-deer in winter periods is to lock them in wintering enclosures. These enclosures tend to measure between five to ten hectares and the place for them must be carefully selected, it shall be a calm place. There must be running water and the place must be well within reach. There shall be certain area serving as a hideout for game in the enclosure. There is also a need to build facilities to accommodate all needed types of feed. Game is lured into the enclosures since the autumn by intensive additional feeding and in early winter, when red-deer from surrounding

areas are used to come in and most of game is present, doors are closed. The game that remained outside of the enclosure is lured inside. The main promoter of wintering enclosures was Mr. J. Lochman, from the Research Institute in Zbraslav. Wintering enclosures for game are rather expensive, as far as both the cost of building them and cost for their operation is concerned. Wintering enclosures enable breeding of red-deer without more damage to tree bark is being caused by browsing. The first wintering enclosure started to be built at about thirty years ago. Some are proven to be very good and serve fully its purpose even now. It is possible to name the Beskydy-Krásné as an example, where over fifty pieces of red-deer is to be found every winter. Red-deer come from surrounding hunting grounds with the area of about four thousand hectares.

In the hunting grounds where game has the possibility of coming out on regular basis to pasture in fields, such as in joint hunting grounds in the lower altitudes, is the carrying capacity in summer almost unlimited. After the harvest of agricultural crops however, the carrying capacity decreases rapidly and game finds feed only in the meadows or in not ploughed stubbles.

An essential arrangement in protecting forest stands against game must be sophisticated biological protection of forests and care for game aimed at preventing damage to forests caused by it.

Mechanical and chemical protection shall be only a complement to the biological protection. Currently all the attention is paid to expensive mechanical and chemical protection of the forest. The possibility of using biological protection of forest is possibly not even being considered by managers and this is a pity for both forest economy and game management.

The following tables show the costs of forest protection against game in the period 2006-2010 in the enterprise LHI.

**Table no.2 – The extent and cost of forest protection against game in 2006**

| Way of protection | Area (ha) |        | Costs (Euro)    |
|-------------------|-----------|--------|-----------------|
| Repellents        | 27.75     |        | 3,440.37        |
| Fencing           | 0.65      | 0.35km | 2,932.10        |
| Total             | 28.40     |        | <b>6,372.47</b> |

**Table no.3 – The extent and cost of forest protection against game in 2007**

| Way of protection | Area (ha) |        | Costs (Euro) |
|-------------------|-----------|--------|--------------|
| Repellents        | 19.21     |        | 2,850        |
| Fencing           | 2.96      | 1.67km | 4,935        |
| Total             | 22.17     |        | <b>7,785</b> |

**Table no.4 – The extent and cost of forest protection against game in 2008**

| Way of protection | Area (ha) |        | Costs (Euro) |
|-------------------|-----------|--------|--------------|
| Repellents        | 12.97     |        | 2,281        |
| Fencing           | 1.47      | 1.05km | 3,020        |
| Total             | 14.44     |        | <b>5,301</b> |

**Table no.5 – The extent and cost of forest protection against game in 2009**

| Way of protection | Area (ha) |       | Costs (Euro)    |
|-------------------|-----------|-------|-----------------|
| Repellents        | 20.60     |       | 4,172.70        |
| Fencing           | 2.95      | 1.9km | 3,524.40        |
| Total             | 23.55     |       | <b>7,697.10</b> |

**Table no.6 – The extent and cost of forest protection against game in 2010**

| Way of protection | Area (ha) |       | Costs (Euro)   |
|-------------------|-----------|-------|----------------|
| Repellents        | 11.65     |       | 2,054.7        |
| Fencing           | 3.35      | 1.8km | 5,526          |
| Total             | 15        |       | <b>7,580.7</b> |

The cost of protecting forest plantations by repellents depends on the type of product used. In 2005 it was product called Lavanol used. At that time it was half the price as product named Cervakol and consumption of the product for a single seedling was lower. The problem occurred with the application at low temperatures, Lavanol got stiff and fell out from the terminal. Phytotoxicity was also observed at oak.

Due to the changing climatic conditions, resulting in lengthening of the growing season in autumn (rather a continuation of summer than onset of autumn) and an early onset of winter (showers, low temperatures, snow, early damage to young stand by animals), the appropriate time of application of the repellent has been reduced. For instance, in 2005 the application of the repellent has begun after the growing season ended, in late September. Nowadays it is rather the end of October or even early November. The problem arises: "I cannot yet today, and tomorrow I cannot already." The short period of time suitable for the repellent application also places increased demands for securing more personnel, as well as

the organization of work. It is therefore necessary to use expensive repellents with applications in less suitable conditions. For this reason it was decided to use Cervakol.

Besides from the suitable conditions for application in harsh climatic conditions, it is necessary to weigh the phytotoxicity of repellents used. With high probability, which was underpinned by experienced staff of the enterprise, application of repellent on various types of wood, these products are not suitable for the valuable species such as ash and maple, as well as the larch, usually causing growth cessation or death of the terminal. In some cases, dying of current year shoot of beech can be seen. Pine resists without problems, but suffers from spring browsing of the new annual shoots, so it is recommended the application of summer repellents. Due to these reasons it is recommended to use plastic tubes on the valuable hardwoods. They are more expensive and in localities with high concentrations of red deer also not very effective because the game browses them after they grow up out of the tube. That fact in application of repellent as well as pressure caused by the game resulted in the shift to the homogenization of woody plants composition to beech and spruce only. Even in certain locations naturally appropriate to varied wood species composition for natural regeneration. In these locations the most effective protection is fencing.

The type of protection is selected according to the size of the area which needs to be protected, financial possibilities, site and other conditions as well. Not to be forgotten, however, that success cannot be achieved using only unilateral action, but their combination and in particular the achievement of the basic premise, and viable stock of game.

Protection should be economically bearable, at least it should not exceed the revenue from game management. Today's high numbers of game make it both difficult and prolong the forestry management.

## 7. Damages by game

Most damage caused by game to the forest is by browsing, grazing, pinching off (buds and shoots), peeling and winter browsing, knocking out and ripping out seedlings, picking fruit and seeds. The largest and most extensive damage to forest stand is caused by hoofed game, mostly red deer and roe deer. Wild boar is damaging mainly field crops. The amount of damages is closely related to the frequency of animals per unit area. (Kupčák, 2006).

Browsing as damage caused by game is economically most important. Aggrieved trees are permanently harmed the wounds in a short time are attacked by the secondary damaging agent - wood decaying fungi. (Pfeffer, 1961).

But not every damage to bark or twigs should be considered as damage to the tree and not every tree injury as damage to vegetation (Reimoser, 2003). According to Bališ (1980), it is the damage caused by game, where game by its actions damages the forest vegetation in its economical function. Novák (2007) states that damage means property damage that is possible to express financially. Recognized are the actual damages and lost profits. As the real damage it is considered the reduction of property of the affected. Loss of profit is what the victim could have achieved if there was no damage.

There are plenty of causes of damage, but the main reasons why they occur can be simply summarized into three basic groups.

1. Increased stock of game and mistakes in its management (they occur mainly as a result of faulty game management planning, not sufficient or not well conducted hunting, improper hunting care, but also inconsistent application of controls and the absence of sanctions from the state administration).
2. Violation of environment and the natural biological rhythm of the game due to economical interests and human activities (these include mainly land settlement, transport, forestry, agriculture, tourism, but as well as hunting).
3. High disposition of forest stands and agricultural land to damage (arising mainly as a result of strong economical orientation of forestry management and farming).

Game damages forest timbers particularly by browsing of terminal and twigs of young trees, and also by browsing and peeling of bark of trees. The more significant deterioration of the forest stand by game comes outside of growing season, when the game is in need for food. In winter, it is difficult for game to get through the snow to herbaceous cover of soil, it is forced to graze mainly twigs of trees, shoots of deciduous and coniferous trees. Game by grazing prefers certain tree species to others. Out of the coniferous tree species, the most affected and endangered by the browsing is fir, so it is necessary to protect the fir seedlings until they grow out, even at the minimum stock of game. Game firstly nibbles soft deciduous (basswood, aspen, rowan, alder, and willow), but does not spare even hard deciduous trees (ash, maple, elm, beech, oak). Out of coniferous species, game gives preference to fir, pine and Douglas fir.

In winter is main damage caused by red-deer, mostly in young spruce stands, sometimes also by mouflon, exceptionally by browsing of bark by fallow-deer. The most serious damage to forestry management is caused by red-deer in the spruce pole timber. Red-deer browses logs and peels barks that rot in time and rot spreads up to about four meters high. This leads to a degradation of the most valuable stool part of the log. If the percentage of damaged logs is not too high and damaged trees can be harvested in advance of harvesting time, the damage is not that serious. If it is not possible and damaged trees remain until harvesting age, loss of wood mass and gain for wood is considerable.

At the time of vegetation the damages to the forest stand are caused by game significantly lower than in winter season. For example, the game rarely harms coniferous trees by browsing in vegetation time. In spring greater damage to newly planted seedlings of some deciduous trees such as maple, ash may occur, the game especially browses budding shoots of young trees.

Wild boar usually does not harm forest stands. Exceptionally seedlings are engraved by wild boar when searching for food in the soil. If the wild boar occurs in hunting grounds, it is not possible to carry out forest regeneration by sowing acorns. Wild boar is more useful to forestry management by destroying various insect pests, which are mostly located in forest litter.

The damage caused by game on forest stands are closely related to the carrying capacity of the hunting grounds. Game shall be enabled to graze different kinds of herbs, grasses or feed



by presented food, which is preferred to food obtained by browsing of branches and barks of tree species.

The damage to forest stands by game are caused also by different activity of game than obtaining of food. One of these activities is so called shaking out of antlers. Roe-deer causes particularly damage by shaking out of antlers, especially in April, when bast is dying out on the antlers of roe-deer.

The natural carrying capacity of the forest stands outside vegetation period is low. In some growth there is blackberry to be found with still green leaves, some species of green grass, twigs of blueberry, etc. If there is high layer of snow and ice is formed on it, game is dependent mainly on browsing of forest trees. It may cause unbearable damage to forest stands, even at the minimum stock of game.

In joint hunting grounds, where game has the possibility to pasture on the agricultural land, there is no problem with the carrying capacity. The lack of natural grazing occurs in the hunting grounds when temperatures are lower and snow occurs. It is therefore necessary to focus on improving the carrying capacity during winter in forest stands and on fields for game.

In mountain hunting grounds, which are largely covered by contiguous stands of spruce, is the carrying capacity for game usually inadequate, often even in the growing season. Increasing the carrying capacity of mountain hunting grounds and additional feeding of red-deer was not paying sufficient attention. In the summer on sites with higher concentrations of red-deer due to the grazing even a change in the composition of plant communities occurred. By grazing of certain species of plants by game, some of them almost entirely disappeared, being "weeding out". These types of grasses and herbs that animals neglected, occupied the habitat in those locations. It must be acknowledged that in these mountain hunting grounds are usually neglected forest meadows and pastures that have previously contributed significantly to carrying capacity of hunting ground.

When stock of game is high, the insufficiently treated cultures are severely damaged, particularly where is planted only certain amount individuals that would not require any additional thinning. Browsing of one-year old terminal shoots with buds stops their height growth for at least another year. For many years in most forests new cultures are being fenced against game, however there is an increased strain on the unfenced areas. Protection against

browsing by game is in some places not sufficient, resulting in occurrence of “nice bonsais” instead of healthy growing conifers.

In the Czech Republic, for damage evaluation caused by game is used Agriculture Decree No 55/1999 Coll. In Slovakia are damages evaluated according to the "Methodological procedure for calculating compensation for game damage to forest stands", see Appendix 1. This procedure is taken into account only in those cases where, in the new stand - over the last year - the damaged of the growth is 10% or more. Unfortunately, game mostly does not choose to deteriorate already damaged individuals, but on the contrary. Then it is possible to see stand, which was ten to twenty years ago without damage, but now there is no single healthy tree to be seen, despite the fact that in the stated period there was no damage noticed! Needless to say, the revenue of such a stand is to be in the harvesting period only as paper wood or fuel.

It is in the interest of the manager of the forest district at the same time to maintain optimal stock of game according to the local environmental and forestry conditions and to keep or even increase the attraction of the forest district to its user.

When the forest district is of a high quality, the fee for charged hunters is also high and they are willing to pay it. It is advisable for the managers of the forest district to critically evaluate the scope and purpose of arrangement for protection of forest against game influence. Better balance between inputs and outputs could be achieved by optimal level of these arrangements, especially for the managers of forest district with a high level of forest ground.

Individual factors that influence the formation of damage, are in their effects interlinked. Many of them cannot be completely removed, but there are always ways to mitigate their negative effects. In order to achieve lasting improvements regarding damages, is necessary to have a broader perspective and find solutions that will combine measures aimed at both maintaining adequate stock of game, depending on the carrying capacity of the environment, and also at improving their living conditions. It is this latter aspect that plays a very important role in improving the living condition of game, it increases the resistance of the environment and reduces the risk of damage.

## 8. Field research

The field research part started in 2008. First step was to find stands, where regeneration was finished about 1-10 years ago, in order to qualify damages on youngest stands. The next criterion was protection, the stands-their parts had to be protected by several methods - game-proof fence, coating and no protection. Three stands, which fulfilled these criterions, were chosen.

The next step was the establishment of the research plots. Size of a plot was set at 1 are. In every part of a stand there were 3 plots, meaning in each stand 9 plots. These were visited annually to observe, compare and evaluate the situation.

In the Czech Republic, for damage evaluation caused by game is used Agriculture Decree No 55/1999 Coll. In Slovakia are damages evaluated according to the "Methodological procedure for calculating compensation for game damage to forest stands", see Appendix 1. For the purposes of this work the Slovak version was used, as the research has been conducted in Slovakia.

Methodology works with Slovak crowns but the results have been recounted into Euros.

### **Damages on young stands**

Trees, which either have the terminal shoot bitten off, or those with less than 60% of above-ground biomass combined.

### **Destruction on young stands**

Trees with no perspective of regeneration. Trees, which either have the terminal shoot bitten off, or with more than 60% of above-ground biomass combined.

### **Compensation for damage on young stands**

$$N = CPP \cdot (1 - k)$$

$N$  – compensation of damage-loss of increment in Sk/ha

$CPP$  – total average increment in Sk/ha of the species in rotation period

$K$  – increment coefficient

## Compensation for destroying on young stands

$$N = CPP \cdot T + C \cdot [(u-t)/u]$$

$N$  – compensation of destruction of young stand in Sk/ha

$CPP$  – total average increment in Sk/ha of the species in rotation period

$t$  – age of the stand in the time of its destruction

$u$  – rotation period

$C$  – annual average costs in Sk/ha for establishment, care, protection of the forest till its destruction

The first stand is located on northwestern slope in an elevation about 600 m.a.s.l. The slope is about 40%. The site quality is expressed by 28. It is to be found under number 243.

In the stand 243 the regeneration started in 1999 and was completed in 2000. Reforestation took place in 2002. The total crop area represents 1.37 ha of which there was a need for artificial reforestation of 0.40 ha - beech on the area of 0.30 ha, 0.10 ha of spruce. The rest was natural regeneration - beech, sycamore maple and ash. The weed control was done and two fences were built on an area of 0.53 hectares, the protective coating on area of 0.4 hectares and no protection on the rest of the area. Posts of the fences have a height of 2.40 m, the mesh is 2.05 m high and in the upper part of the fence it is 2.5 meters. At 0.15 hectares seedlings died, thus the area had to be reforested in the following year. Furthermore, in 2003 the weed control in the whole area and protection coating on the area of 0.37 hectares was done. By this the care of the fenced area of the stand has ended, but not of the unfenced part. Until and 2006 included, there had to be done weed control and coating on some parts. The stand was not fenced completely, mainly due to the shape and migratory routes of game. If we would enclose the area, game would probably destroy the fence.

The species composition and growth in the game-proof fence and the unfenced part is completely different. In the unfenced part survived almost beech only, which now has the height of 1-1.5 m while in the fence the growth is triple. Much higher is also stocking, there stayed almost all the species that were planted, but also from the natural regeneration, so we have a chance to reach the target tree species composition. Moreover, thanks to the fence, willow occurs that is appreciated. However birch occurs too and would need further intervention, because it has already overgrown the surrounding vegetation. Inside of the fence there is time for thinning. Outside of the fence it is possible to observe massive damage of beech, ash and maple being bitten by browsing. There is some small difference between the

coated and unprotected part of the stand, but as the table shows, it is not significant. This is due to the spring browsing and to the fact that the coating was not always done regularly (due to weather conditions). The biggest problem is that coating can not be conducted in spring, because it would cause phytotoxicity.

Inside of the fences the establishment period was shorten of four years. If there was parent stand, since 2004 it could be continued with the assigning of other regeneration elements.

**Table no.7,8 Stand 243 - game damage - 2008**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 26       | 4          |
| Sycamore<br>maple | -        | 100        |
| Ash               | -        | 100        |
| Spruce            | 6        | 7          |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 22       | 2          |
| Sycamore<br>maple | 12       | 88         |
| Ash               | 14       | 86         |
| Spruce            | 2        | 3          |

**Table no.9,10 Stand 243 - game damage - 2009**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 28       | 3          |
| Sycamore<br>maple | -        | 100        |
| Ash               | -        | 100        |
| Spruce            | 5        | 6          |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 28       | 4          |
| Sycamore<br>maple | 9        | 91         |
| Ash               | 14       | 86         |
| Spruce            | 2        | 3          |

**Table no.11,12 Stand 243 - game damage - 2010**

Unprotected part

|                | %damaged | %destroyed |
|----------------|----------|------------|
| Beech          | 31       | 8          |
| Sycamore maple | -        | 100        |
| Ash            | -        | 100        |
| Spruce         | 4        | 7          |

Coated part

|                | %damaged | %destroyed |
|----------------|----------|------------|
| Beech          | 20       | 5          |
| Sycamore maple | 8        | 92         |
| Ash            | 6        | 94         |
| Spruce         | 2        | 4          |

**Table no.13 Stand 243- game damage evaluation in the unprotected part in 2011**

|                | %damaged | Damage (Eur) | %destroyed | Damage (Eur) |
|----------------|----------|--------------|------------|--------------|
| Beech          | 30       | 17.19        | 5          | 261.78       |
| Sycamore maple | -        | -            | 100        | 6,442.92     |
| Ash            | -        | -            | 100        | 5,825.19     |
| Spruce         | 5        | 5.44         | 5          | 292.43       |

**Table no.14 Stand 243- game damage evaluation in the coated part in 2011**

|                | %damaged | Damage (Eur) | %destroyed | Damage (Eur) |
|----------------|----------|--------------|------------|--------------|
| Beech          | 22       | 12.61        | 2          | 104.71       |
| Sycamore maple | 10       | 6.73         | 90         | 5,798.63     |
| Ash            | 8        | 4.18         | 92         | 5,359.16     |
| Spruce         | 2        | 2.15         | 3          | 175.46       |

**Table no.15 Actual species composition in the different parts of the stand 243**

|                | Unprotected (%) | Coated (%) | Fenced (%) |
|----------------|-----------------|------------|------------|
| Beech          | 83              | 72         | 14         |
| Sycamore maple | -               | 5          | 80         |
| Ash            | -               | 8          | 5          |
| Spruce         | 17              | 15         | 1          |

The second stand is located on northern slope in an elevation about 700 m.a.s.l. The slope is about 45%. The site quality is expressed by 20. The soil is stony and exposed to the parent rock. The stand is to be found under number 120.

In the stand 120 the regeneration started in 2003 and was finished in 2006. Reforestation started in 2004 and was finished in 2007. The total crop area represents 2.19 ha of which was the need for artificial reforestation of 0.63 ha. Beech on the area 0.30 ha, 0.33 ha of sycamore maple, the rest was natural regeneration - beech, sycamore maple, ash and spruce. The weed control was done since 2004 annually and two fences were built on an area of 0.53 hectares, the rest stayed unfenced for economical reasons. The protective coating was done on area of 0.4 hectares and there was no protection on the rest of the area. At 0.14 hectares seedlings died, so this area had to be reforested in 2007. In the same year the regeneration was finished and the rest of the area was reforested. 0.12 hectares were reforested artificially by beech and spruce, and 0.49 hectares was natural regeneration - beech and sycamore maple. The fence was built on an area of 0.61 hectares. Posts of the fences have a height of 2.40 m, the mesh is 2.05 m high and in the upper part of the fence is 2.5 meters. In 2008 an area of 0.05 ha had to be reforested again because it was browsed. In that year ended the care of the fenced area of the stand, but not of the unfenced part. Until now, there has to be done weed control and coating on some parts.

The species composition and growth in the game-proof fence and the unfenced part is completely different. In the unfenced part survived just beech and spruce, which now have the height of 0.5-1m, the maples are dead or about 10cm high. Inside of the fence the growth of the trees is about 1-2m, much higher is also stocking. Moreover, there stayed all the species that were planted, but also from the natural regeneration so we have the chance to reach the target tree species composition. Moreover, thanks to the fence, willow occurs. Outside of the fencing it is possible to see the massive damage of beech and sycamore maple, being bitten by browsing. There is some small difference between the coated and unprotected part of the stand, but as the table shows, it is not significant. This is due to the spring browsing and to the fact, that the coating was not always done regularly (dependency on weather conditions). The biggest problem is that coating can not be done in spring, because it would cause phytotoxicity.

**Table no.16,17 Stand 120 - game damage - 2008**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 26       | 7          |
| Sycamore<br>maple | -        | 100        |
| Ash               | -        | 100        |
| Spruce            | 21       | 0          |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 21       | 4          |
| Sycamore<br>maple | -        | 100        |
| Ash               | 23       | 77         |
| Spruce            | 10       | 0          |

**Table no 18,19 Stand 120- game damage - 2009**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 31       | 11         |
| Sycamore<br>maple | -        | 100        |
| Ash               | -        | 100        |
| Spruce            | 26       | 0          |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 31       | 5          |
| Sycamore<br>maple | -        | 100        |
| Ash               | 17       | 83         |
| Spruce            | 16       | 0          |

**Table no. 20,21 Stand 120- game damage - 2010**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 35       | 12         |
| Sycamore<br>maple | -        | 100        |
| Ash               | -        | 100        |
| Spruce            | 30       | 0          |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 36       | 7          |
| Sycamore<br>maple | -        | 100        |
| Ash               | 9        | 91         |
| Spruce            | 22       | 0          |



**Table no. 22 Stand 120 – game damage evaluation in the unprotected part in 2011**

|                | %damaged | Damage (Eur) | %destroyed | Damage (Eur) |
|----------------|----------|--------------|------------|--------------|
| Beech          | 41       | 7.73         | 11         | 453.41       |
| Sycamore maple | -        | 0            | 100        | 4,551.26     |
| Norway maple   | -        | 0            | 100        | 4,551.26     |
| Spruce         | 32       | 8.76         | 0          | 0            |

**Table no. 23 Stand 120 - game damage evaluation in the coated part in 2011**

|                | %damaged | Damage (Eur) | %destroyed | Damage (Eur) |
|----------------|----------|--------------|------------|--------------|
| Beech          | 36       | 6.80         | 8          | 329.74       |
| Sycamore maple | -        | 0            | 100        | 4,551.26     |
| Norway maple   | 5        | 1.39         | 95         | 4,323.67     |
| Spruce         | 24       | 6.57         | 0          | 0            |

**Table no. 24 Actual species composition in different parts of the stand 120**

|                | Unprotected | Coated | Fenced |
|----------------|-------------|--------|--------|
| Beech          | 88          | 82     | 20     |
| Sycamore maple | -           | -      | 36     |
| Norway maple   | -           | -      | 22     |
| Spruce         | 12          | 18     | 22     |

The third stand is located on northwestern slope in an elevation about 400 m.a.s.l. The slope is about 25%. The site quality is expressed by 26. The soil is partly shallow. It is to be found under number 185.

In the stand 185 the regeneration started in 2002 and was finished last year. Reforestation started in 2004 and was finished last year as well. The total crop area represents 0.8 ha of which was the need for artificial reforestation of 0.52 ha - beech on the area of 0.25 ha, oak on 0.32 ha. The rest was natural regeneration - beech, oak, ash and maple. The weed

control was done since 2004 annually. The game-proof fence was built on an area of 0.5 hectares, the protective coating on an area of 0.2 hectares and on the rest of the area there was no protection. Posts of the fences have a height of 2.40 m, the mesh is 2.05 m high and in the upper part of the fence is 2.5 meters high. At 0.18 hectares seedlings died because of drought so that area had to be reforested in 2006. In 2008 an area of 0.12 ha had to be reforested again because it was browsed. In that year ended the care of the fenced area of the stand, but not of the unfenced part. The unfenced part had to be replanted twice on total area of 0.3ha. Until now there has been a need to do weed control and coating in all parts.

The species composition and growth in the game-proof fence and the unfenced part is completely different. In the unfenced part survived just few pieces of beech, which now has the height of 0.5-1.5m. The maples and oaks are dead or about 10cm high. Inside of the fence the growth of the trees is about 1-2m, much higher is also stocking. There also stayed all the species that were planted, from the natural regeneration as well, so we have the chance to reach the target tree species composition. Outside fencing it is a massive damage of all species to be observed, species were bitten by browsing. There is some small difference between the coated and unprotected part of the stand, but as the table shows, it is not significant. This is due to the spring browsing and to the fact that the coating was not always done regularly (influenced by weather conditions). The most serious problem again is the impossibility of coating in spring, due to causing of phytotoxicity.

**Table no.25,26 Stand 185 - game damage - 2008**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 39       | 14         |
| Oak               | 69       | 5          |
| Sycamore<br>maple | 38       | 16         |
| Norway<br>maple   | 52       | 28         |
| Ash               | 48       | 17         |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 12       | 4          |
| Oak               | 55       | 23         |
| Sycamore<br>maple | 32       | 9          |
| Norway<br>maple   | 26       | 7          |
| Ash               | 37       | 14         |

**Table no.27,28 Stand 185 - game damage - 2009**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 43       | 17         |
| Oak               | 75       | 11         |
| Sycamore<br>maple | 44       | 19         |
| Norway<br>maple   | 54       | 31         |
| Ash               | 54       | 24         |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 53       | 12         |
| Oak               | 68       | 23         |
| Sycamore<br>maple | 38       | 14         |
| Norway<br>maple   | 29       | 11         |
| Ash               | 45       | 18         |

**Table no.29,30 Stand 185 - game damage - 2010**

Unprotected part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 52       | 18         |
| Oak               | 86       | 14         |
| Sycamore<br>maple | 52       | 30         |
| Norway<br>maple   | 56       | 33         |
| Ash               | 59       | 27         |

Coated part

|                   | %damaged | %destroyed |
|-------------------|----------|------------|
| Beech             | 53       | 12         |
| Oak               | 72       | 28         |
| Sycamore<br>maple | 44       | 17         |
| Norway<br>maple   | 46       | 16         |
| Ash               | 52       | 21         |

**Table no.31 Stand 185 - game damage evaluation in the unprotected part - 2011**

|                | %damaged | Damage (Eur) | %destroyed | Damage (Eur) |
|----------------|----------|--------------|------------|--------------|
| Beech          | 59       | 28.35        | 18         | 801.66       |
| Oak            | 73       | 44.85        | 27         | 1,359.62     |
| Sycamore maple | 55       | 31.70        | 33         | 1,731.34     |
| Norway maple   | 58       | 33.43        | 33         | 1,632.40     |
| Ash            | 62       | 27.55        | 29         | 1,360.98     |

**Table no.32 Stand 185 – game damage evaluation in the coated part in 2011**

|                | %damaged | Damage (Eur) | %destroyed | Damage (Eur) |
|----------------|----------|--------------|------------|--------------|
| Beech          | 53       | 25.46        | 12         | 534.46       |
| Oak            | 72       | 44.22        | 28         | 1,409.99     |
| Sycamore maple | 52       | 29.98        | 29         | 1,434.56     |
| Norway maple   | 51       | 29.38        | 26         | 1,286.15     |
| Ash            | 58       | 25.79        | 22         | 1,032.50     |

**Table no. 33 Actual species composition in the different parts of the stand 185**

|                | Unprotected | Coated | Fenced |
|----------------|-------------|--------|--------|
| Beech          | 89          | 91     | 32     |
| Oak            | -           | -      | 31     |
| Sycamore maple | 3           | 4      | 9      |
| Norway maple   | 4           | 2      | 18     |
| Ash            | 4           | 3      | 10     |

To summarize the research, there were two kinds of protection compared and contrast with no protection investigated. The first way to prevent damage caused by game was chemical coating, the second was fencing.

Chemical coating showed not to be very reliable. It showed almost the same results as no protection. It could have reached better results if it would have been possible to conduct it in spring too, without danger of phytotoxicity. The next fault of this method is the weather restriction, so it can not always be applied regularly.

According to the research results, fencing is the most reliable method as far as protection of the young stands in the times of overstocked game is concerned, the only working way of protection is the game-proof fence. However it also has certain disadvantages. Among them foremost the price of this protection being very high, and also the necessity of instant control whether it has not been damaged.

The last option, no protection showed that in overstocked forests it is often impossible to establish any forest despite good care of game. The species composition is changed

dramatically due to different food preferences of game. Food-attractive species like maple or ash showed markedly higher percentage of mortality.

To conclude, it is crucial to protect all young stands by fencing, which is however unbearably costly. The stock of game must be reduced to a level which corresponds with carrying capacity of the environment. Since then, the protection can be effective.

## 9. Conclusions and recommendations

Economical questions are still more in focus of current Czech game management. Changes connected to the year 1989 and after the Velvet revolution resulted in recovering of the market economy as well as the notifications of the importance of economy in every human activity. Finally this led to the recognition of the economical problems regarding performance of hunting rights that has for a long time being overseen.

Current game management is characterized as a set of various activities in nature regarding game as a part of ecosystem. Game management thus has a role of modern management of nature.

The idea of this work was to compare the costs and the revenues of game management in the context of an usual forest enterprise and usual hunting district. The influence is not only the direct incomes and costs, which can be easily calculated, but also more complicated structures especially the damages on forest stands.

Facts about dynamics of development of shooting of hoofed game points at the growth of shoot of all kinds of hoofed game. After the short period of decrease of game population in the 90's of 20<sup>th</sup> century, all hoofed game significantly increased. For current state it is typical stock of game many times higher than the normalized one. Red deer has been counted at 166% of normalized stock. However, based on the reverse counting of long standing production of game population are the real numbers even higher than officially stated in statistics.

Reduction of current population of game to the normalized stock would have a significant impact on game management of the users of forest district, because the level of shooting would decrease. This economical pressure on users of forest district is a crucial reason for preventing reaching of normalized stock of game according to the law.

Real number of population of hoofed game also influences the offer of charged hunts that can create a significant part of revenues from game management.

Game management has an irreplaceable role in caring for game, increasing biodiversity, landscape formation and protection. It has a clear social importance, careful handling can increase the prestige and, conversely, inappropriate game management may

cause a negative perception in public. It has an economical impact on the economy both of the forest, but also of agriculture.

These are the main reasons that the firm must take into account in respect to their strategies and performance of their own decisions.

The same is accountable in LHI enterprise. A substantial proportion of its income form fees from charged hunting guests for trophy game hunting, and also fees from the common wild boar hunts. Another important income is sales of venison of hoofed game. Cost items are formed by the cost of feeding, material for maintenance and construction of new hunting equipment, various fees for veterinary inspections, storage, bonuses and shares of the catch and last but not least earnings of employees caring for game as well hunting equipment. While maintaining the quality of care for game in comparison with the main economical activity is the profit from hunting rather weak.

The damages on wood caused by game are great and they have an increasing tendency, particularly in relation to population growth of the game. Most foresters agree with the claim that today's game populations are too high. There are many causes of damage, here are summarized those that seem most relevant to me.

- Over-stocking of game
- Stressed game
- Inadequate conditions for grazing

Overstocking of game is primarily a problem of a correct setting of normalized stock of game and subsequent compliance with these set conditions.

Stress is linked to the lack of calm for game and the disruption of game's biorhythms. At present there are many areas where the grazing cycles for game has been reduced to night hours due to the influence of human activities.

Poor conditions for grazing is mainly related to factors such as large-scale cultivation of agricultural crops, vast one-species cultures and overall change of landscape and living conditions of game, while the biggest problem in forest is low carrying capacity.

Recommendations to reduce the damages caused by game:

- Promote forest priority over the game.
- Improving care for game.

- Increase the share of auxiliary and bedding wood to save the cost of afforestation, while improving the carrying capacity. If these trees do not affect the target woody species, they would be tolerated when growing.
- Before reaching the viable state to implement an effective protection against damage accused by game.
- Consistently detect damage and compensate it, to determine the damage objective detection methods shall be applied (control enclosures).
- Enforce penalties for defaulting of hunting plan.
- Work closely with government to reduce stock of game to an acceptable level (Minx, 1995).

The negative impact of game on forest stands is not possible to eliminate completely, not even when the minimal stock of game is being bred. Without proper care of carrying capacity of hunting ground and of bred game, there will always be damages to forest stands. If biological protection of forest is implemented (natural care for carrying capacity of hunting grounds) and the planned additional feeding of game is conducted (also regarding the need to prevent the game from browsing of woody plants), the risk of damage to forests is significantly lower. This is valid even if the stock of game is much higher than at the minimum level.

Reconciling the interests of game breeding and silviculture requires considerable interest on both foresters and gamekeepers sides, but also sufficient knowledge in the field of forest cultivation and game breeding. The lack of knowledge may result in great damages to the forest stands, despite high costs spent on mechanical and chemical protection of the forest even at minimum stock of game.

Game management has a personal, social and it is also possible to state prestigious consideration. These reasons are putting pressure on increasing the population density of game. It brings immediate and direct effect in terms of increased sales of venison, more successful fee hunts, personal and social recognition in the neighbourhood and the perfect care for the game and its stocks.

Although this increases the prestige in the eyes of the general public, we are destroying our own future income from forestry management activities.



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## **11. Appendices**