UNGULATE IMPACT ON DIFFERENT BEECH REGENERATION SITES

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ABSTRACT

Forest game damages lead to a serious conflict between forest and game managers, both in Hungary and worldwide. For forestry units the most important source of incomes is the logging. However, ungulates can have serious local browsing pressure on reforestation sites by their normal feeding activities.

Foresters believe that the only way for reducing that damage is the radical reduction of number of large herbivorous game species (mainly red deer) in the forest. But for game managers a suitable level of ungulate density is necessary to gain incomes from hunting. As a consequence there is no agreement about the ecologically and economically sustainable ungulate density and impact. To decrease this difficult contradiction we need scientific data about the real browsing effect of large herbivores on forest vegetation of different characteristics.

In this study we investigated the available food supply and the browsing effect of ungulates on artificial and natural beech regeneration sites of different ages. Density of beech saplings and number of available and browsed sprouts of all woody species present were estimated.

We found significantly more beech saplings and sprouts and also higher browsing impact on beech in the natural than in artifical sites. Although we did not reveal a clear linear correlation, the highest browsing values (more than 20%) were detected when the proportion of the alternative food supply was less than 10 %.

We propose to maintain natural species diversity in beech regeneration sites from the very first period for giving chance to ungulate species not to browse target tree species. Based on our results diverse woody vegetation can have a great importance not only in artificial monospecies beech regeneration sites, but even in case of natural beech regeneration.

Keywords: forest management, game damage, deer, browsing, food supply

INTRODUCTION

Forest game damages cause serious conflicts between forest and game managers (FESTA-BIANCHET, 2007; KATONA ET AL., 2007). Forestry units obtain significant incomes from logging (FARAGÓ, 2006). However, ungulates can have serious local browsing pressure on reforestation sites by their normal feeding activities (PUTMAN & MOORE, 1998). This problem resulted in establishing more than 7500 km fences in Hungarian forests (KATONA ET AL., 2011). This kind of separation of large herbivores from their habitats should not be the best solution to prevent forest game damages. Foresters suggest that the best way for reducing those damages is the radical reduction of number of large herbivorous game species (mainly red deer, *Cervus elaphus*) in the forest (BARTHA, 2000; PUTMAN & MOORE, 1998). But for game managers a suitable level of ungulate density is necessary to gain incomes from hunting. We believe that handling this problem from both sides, by improving the habitat quality and regulating game density would be effective (KATONA ET AL., 2011).

In our recent studies we analysed and compared the “ungulate-habitat” relationship in different beech (*Fagus sylvatica*) regeneration sites. We described in all areas the forest regeneration capability, the food supply for game species and ungulate impact on forest regeneration.

We assumed that there are more beech saplings and sprouts as deer forage in the natural sites than in artificial ones and more in elder than in younger ones. This is because usually the artificial regeneration starts with much lower sapling density than natural one (e.g. 8000-10000 vs. 10000-60000 item/ha) and there should be much taller saplings with more sprouts in elder sites than in younger ones.
We hypothesised less browsing impact on beech in areas with richer and more diverse food supply. It is based on our earlier results, that alternative woody browse supply available in an area can deprive browsing impact from main target tree species (e.g. beech) not preferred by ungulates (KATONA ET AL., 2011).

In this paper, therefore, we were looking for answers for questions below:
1.) Is there more beech saplings (as regeneration unit) and sprouts (as ungulate forage) in the natural beech regeneration sites than in the artifical ones?
2.) Is there richer forage supply (more beech sprouts) to ungulates in the elder than in younger sites?
3.) Is there less impact on beech by ungulate browsing in the natural regeneration sites than in the artifical ones?
4.) Is there any positive influence of more diverse species composition on level of browsing impact?

MATERIAL AND METHOD

The study area was located in the operating area of Mátrafüred Forestry of Egererdő joint-stock company (within 3,5 km radius from a centroid with coordinates: 47º89'N, 19º93'E). This company cultivates approx. 74000 ha state owned forest in Mátra and Bükk Mountains. Those woodlands are medium quality from an economical point of view, but ecologically these are very valuable habitats; 68% of their total range is under environmental protection. The three main forest types of these areas are sessile oak forests (3443 ha, 33,7%), beech forests (2633 ha, 25,8 %) and hornbeam- oak forests (2805 ha, 27,4%).
We designated six different beech regeneration sites of even-aged forestry system for comparison. We categorized those areas by its age since year of last total harvesting (1-2; 5-6; 8-10 years) of area and regeneration type (natural or artificial). These sites were situated from each other within a distance of between 0,5 and 7 kilometers. We tried to find areas with similar environmental conditions and representative for the general view of beech regeneration sites in their vegetation and management.
Ungulate density in the hunting area containing these sites was 0,07 individual per hectare in the studied year (2009). Estimated number of large game species is as follows: 730 individuals; in detail: 150 wild boars (*Sus scrofa*), 200 mouflons (*Ovis aries*), 130 roe deer (*Capreolus capreolus*) and 250 red deer (NATIONAL GAME MANAGEMENT DATABASE).
We collected seasonal field data four times (March, May, July, November) in 2009. For field sampling we followed our methods elaborated in our previous studies (KATONA ET AL., 2011; SZEMETHY ET AL., 2004). We designated transect lines with a total number of 25-50 sampling points by 5-10 meters distances in each sampling area.
Signs of ungulate presence (tracks, bed-sites, droppings) were recorded between sampling points. At the sampling points we counted the number of sprouts of all woody species available and accessible for large herbivores and that of browsed ones in the understory layer. We had four height categories: between 0 and 50, 50 and 100, 100 and 150, 150 and 200 cm from the ground surface. We estimated the number of sprouts available and

browsed in a sample unit of 50 x 50 cm in all vertical levels within a depth of 30 cm from the front side of the quadrant. We registered the fresh and elder damages caused by ungulates separately based on the shape, pattern and colour of the damaged plant surface. We were not able to distinguish which ungulate species caused the damage. However, the dominance of red deer in these areas suggests that this species was the main consumer.
We also counted the number of beech saplings at the sampling points in a quadrant of 2 m^2. However, we have no data on saplings from winter.
For comparison between natural and artificial regeneration sites within age classes in the same season Mann-Whitney U-tests were used after running Kolmogorov-Smirnov normality test. Age classes were compared within the type of regeneration by Kruskal-Wallis tests followed by post-hoc Dunn's multiple comparisons tests in all seasons.

RESULTS

Our results show that there were significantly more beech saplings in the natural sites than in artifical ones in most cases (except 5-year-old in summer and 10-year-old in autumn) (Mann-Whitney U-tests: $p<0,01$) *(Figure 1).*

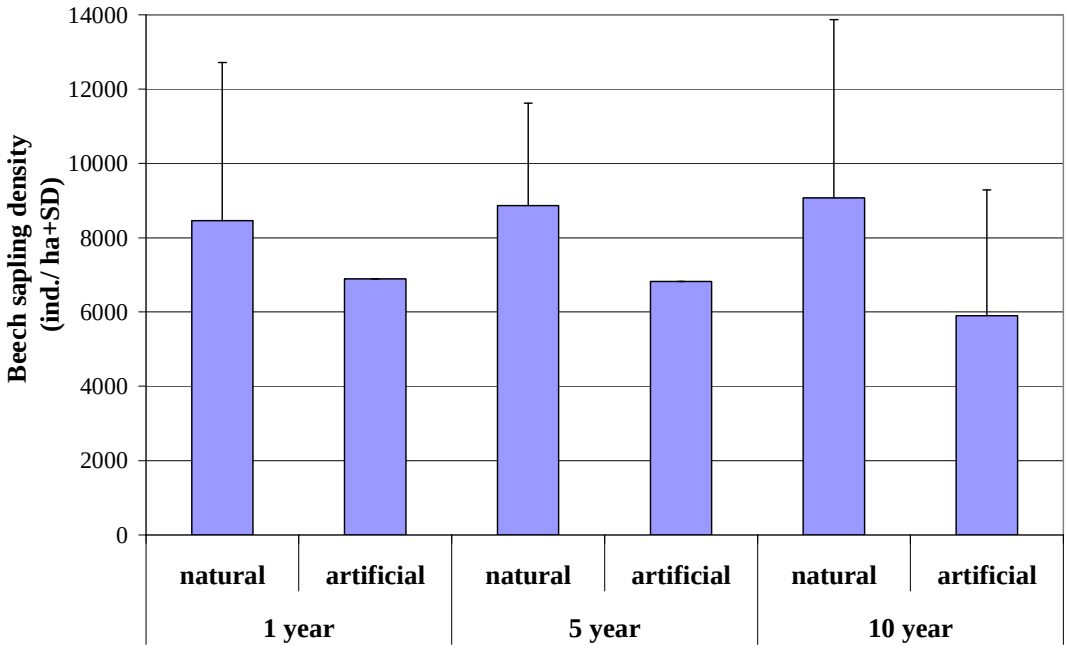

Figure 1. Density of beech saplings in natural and artificial regeneration sites of different ages

We revealed that there were significantly more beech sprouts as food supply in the natural sites than in artifical ones in most cases (except 5-year-old in summer and in winter) (Mann-Whitney U-tests: $p<0,05$) *(Figure 2).* Sprout density significantly increased with the age of the regeneration sites (Kruskal-Wallis-tests: $p<0,001$).

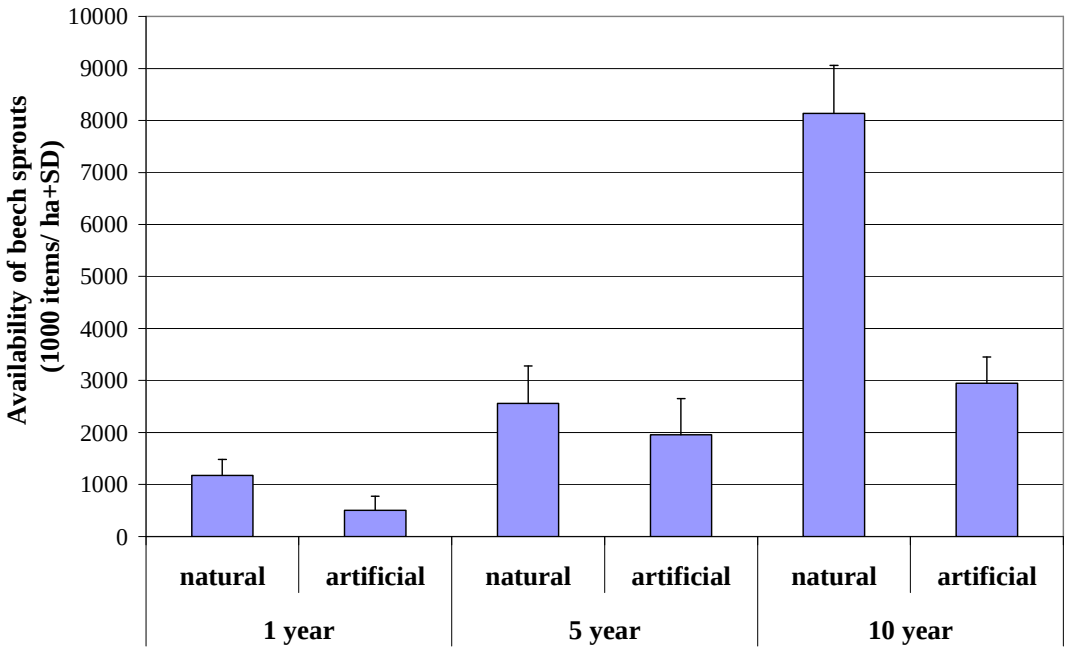

Figure 2. Availability of beech sprouts as food supply in natural and artificial regeneration sites of different ages

We found that the proportion of all (freshly and elderly) browsed beech sprouts to the total beech sprout number was significantly higher in the natural sites than in artifical ones in most cases (except 5-year old in spring and in summer and one-year old in winter) (Mann-Whitney U-tests: $p<0,05$) *(Figure3).*

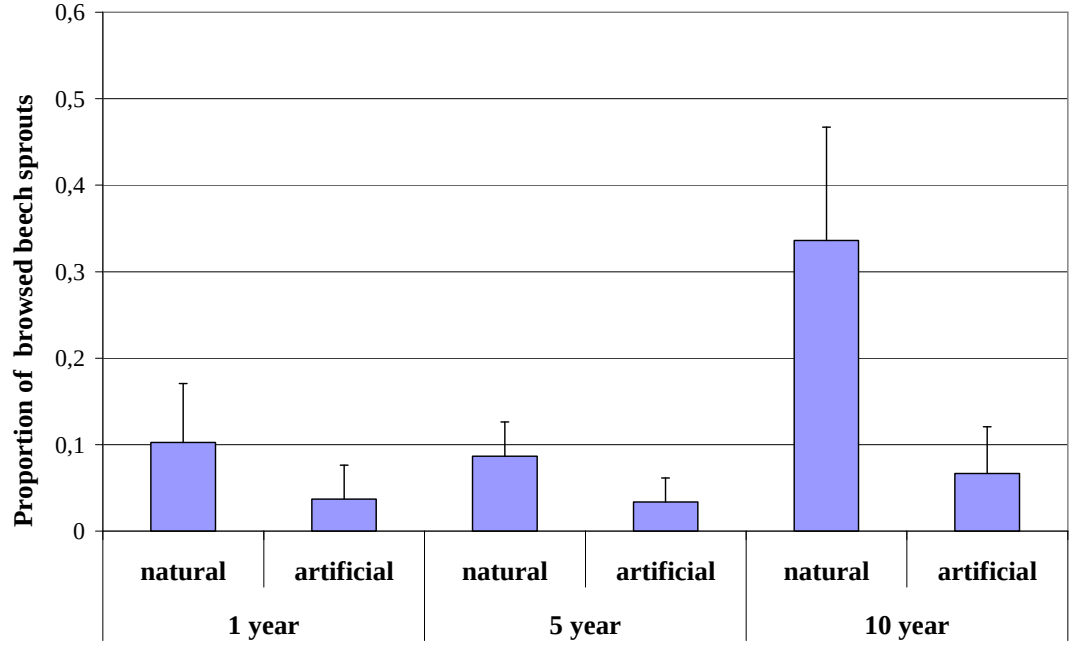

Figure 3. Browsing impact on beech in natural and artifical regeneration sites of different ages

There was no significantly strong relationship between the availability of alternative food supply (proportion of beech in the food supply) and browsing impact on beech (proportion of browsed beech sprouts) (Spearman-correlation: for all browsing: N=24, R=0,32 p=0,13; for fresh browsing: N=24, R=-0,15 p=0,49). However, in case of the highest browsing values found (more than 20%), the proportion of the alternative food supply was less than 10 % *(Figure 4).*

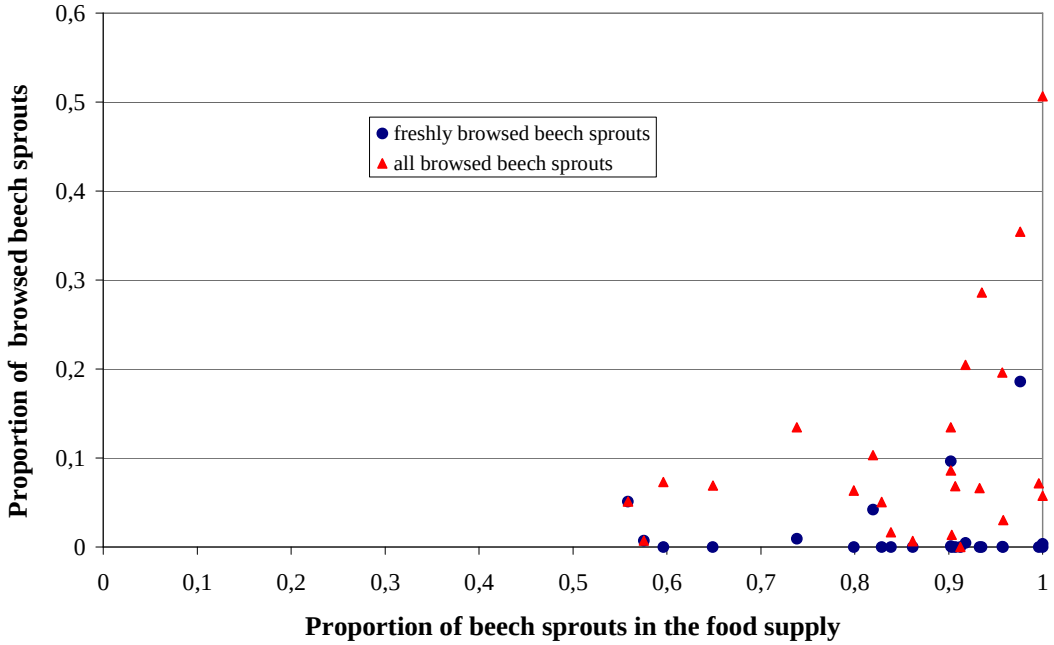

Figure 4. Relationship between availability of alternative food supply and browsing impact on target tree species (beech)

CONCLUSIONS

Our results revealed higher sapling density and sprout availability of main target tree species (beech) in natural than in artificial regeneration sites. It is not surpirsing, as the artificial regeneration starts with much lower sapling density than natural one because of the high costs of regeneration material and works. However, in this study the beech sapling density in the natural regeneration sites was not too high relative to another beech forest investigated in Pilis Mountains and managed by selection cutting system. There the density of beech saplings ranged within an interval of 29000 and 45000 saplings per hectare (KATONA ET AL., 2009).

Based on our earlier results (KATONA ET AL., 2011) we expected less browsing impact on beech in areas with greater and more diverse food supply (with more alternative food besides beech). We hypothesised more diverse woody species composition and less browsing effect in natural sites than in artifical ones, but we found the opposite. Availability of more various food supply in artifical sites could be a consequence of suboptimal environmental quality of those sites for beech resulting in the expansion of alternative woody species. In natural regeneration sites however, beech can benefit from the more advantageous habitat characteristics and could be able to suppress the growing of other woody species. As we found the highest browsing impact on beech in case of the highest beech proportion in the food supply, we propose to maintain natural species diversity in regeneration sites from the very first steps. It can give chance to ungulate

species not to choose our target tree species (beech) for consumption. Based on our results diverse woody vegetation can have a great importance not only in artificial monospecies beech regeneration sites, but even in case of natural beech regeneration.

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