

ARE WILD BOARS A FUTURE THREAT TO THE SWEDISH FLORA?

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Abstract: The degradation of natural communities as a result of pig rooting, trampling and damage to different agricultural crops has been noted in numerous publications, but there is seldom mention of the animals' positive effect on flora and fauna. Exceptions are mainly collected from silviculture, where wild boars effectively locate areas with large numbers of pest species for consumption and with increased growth of different tree species, presumably caused by enhanced nutrient mobilization as a result of the animals rooting activity. The purpose of this study was to document the rooting effect of Wild boar and compare the vascular flora of different rooted and undisturbed vegetational types in the part of Sweden with the densest population of wild boars. The result was an increase in species number in all six vegetational types studied. The average number of total species found in rooted areas was 61.6 ± 36.5 , to be compared with 39.2 ± 25.8 species (n for rooted sites is 288, n for control sites is 232). The largest difference was found in alder marshes with a total of 115 species to be compared with 66. Species found in rooted areas were not always found in control areas but species found in control areas were most often found in the rooted areas. Species found in rooted sites and not otherwise were mainly species with low competition ability and field weeds.

Keywords: Wild boar, *Sus scrofa*, Suidae, Rooting, Species diversity, Plant diversity, Sweden, Europe.

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1. Introduction

The degradation of natural communities and damage to agricultural crops as a result of pig rooting has been documented in numerous publications (Mackin, 1970; Vassant *et al.*, 1992; Vtorov, 1993 etc.). Reports on the positive effect of the animal on flora and fauna are more seldom found. Exceptions are mainly concerned with silviculture where wild boars effectively locate areas with large numbers of insects for consumption or increased forest growth induced by a higher rate of mineralization after the earth has been rooted.

The rooting behaviour of Wild boar creates patches of bare soil which are subsequently colonized by plants. While rooting they also consume plant parts like bulbs, rhizomes etc. The question of interest is whether the creation of patches by wild boars has any effect on plant species diversity.

From a theoretical point of view it is expected that the highest species diversity is maintained at an intermediate level of disturbance (Connell, 1978). This is because of the fact that if disturbances are too infrequent, local competition will proceed to equilibrium and fugitive species will be eliminated. If disturbance is too frequent, it will eliminate fugitive and equilibrium species alike. At intermediate frequencies, the combination of fugitive species and equilibrium species produces a maximum

diversity of species (Caswell & Cohen, 1991). In this communication I have restricted the question to the following problem. Since rooting is a disturbance to an existing plant community, my question is: do patches rooted by Wild boar show any changes in plant species richness as compared with untouched ground? For this purpose three wet plant communities and three dry plant communities were used.

2. Study area and methods

The study area was Tullgarn nature reserve area situated approximately 70 kilometres south of Stockholm along the Swedish east coast. The landscape is a mixture of fields, pastures, exposed bedrock and forests. Wild boars first reached during the end of the 1970s the area which is now considered to harbour the densest population in Sweden. Local sportsmen estimate the population to be between 5-10 animals/100 ha.

During June and July 1993 a number of different vegetational types were randomly surveyed for rooted sites. Rooted as well as unrooted patches were censused for vascular plants. An undisturbed reference site was chosen as near as possible. The distance between the rooted and unrooted sites was usually only a couple of meters apart for all vegetational types except alder marshes, alder shores and reeds "without wild boars". Alder marshes and alder shores were so heavily used by the wild boars that no

ground in the vicinity could be considered undisturbed. For alder marshes and alder shores, reference sites were therefore located approximately between 20 to 30 kilometres further to the south. Reeds "without wild boars" are, however, from the area with wild boars but in the vicinity of buildings and landing-stages which apparently keep wild boars at a distance.

The size of the censused patch was 1 m², with the exception of alder marshes, alder shores and reeds. For alder marshes and alder shores, 100 m² were used because of the heavy utilization by wild boars. In the reeds, the whole disturbed patch was inventoried with a reference patch of equal size surrounding the disturbed patch. The reason for this was the high heterogeneity of both the size and plant composition of the disturbed patch.

Since there was no way of determining the age of the rooted patches, no consideration was taken to this factor except for the fact that there was at least some vegetation to be censused. In practise, this means that in open areas the disturbed patches could be less than a year old while in areas with a closed canopy they were most certainly more than one year old.

3. Results

All vegetational types showed an increased number of species on disturbed ground in comparison with undisturbed. The most striking difference was found in reeds and alder marshes. Of the six different vegetational types, four showed significant differences in the mean number of species (Tab. 1). Exceptions were alder shores and young, recently thinned pine forests already being disturbed by man. The amount of species in common as well as species unique to disturbed or reference patches varies considerably (Tab. 1). The difference in species composition is significant for all vegetational types except for the recently thinned pine forest. It is of great interest that species unique to reference areas are all considered as common species. A few species unique to disturbed patches are classified as uncommon.

4. Discussion

During ecological time, species diversity is likely to be maximized when the disturbance pattern resembles historical characteristics of the community. However, locally or during a short period of time, disturbance may reduce single-species dominance and free resources to be divided among other species. During longer

periods of time, disturbance is an important selective factor affecting the evolution of species (Denslow, 1985). In a situation where disturbance regimes are only slightly different from the historical one, the consequence for community composition may only be a shift in the relative abundance rather than a loss of species (Denslow, *op.cit.*).

My results that rooted patches enhance plant species diversity are in agreement with several other studies. Jonsson and Esseen (1990) found the number of bryophyte species as well as their diversity to increase in places where the soil had been disturbed by uprooting in comparison with the surrounding undisturbed forest floor in a boreal spruce forest. They found the number of species to be 112 as compared with 56 on disturbed and undisturbed ground, respectively; 67 species appeared exclusively in disturbed patches and only 11 on undisturbed ground.

Danell (1977) found an increase in diversity with muskrats as a disturbance factor. Hobbs *et al.* (1988) and Tilman (1983) showed that plant diversity has a clear tendency to increase with the activities of pocket gophers.

The historical background in Sweden shows that wild boars disappeared during the 17th century. However, the disturbance regime was not lost because of farmers letting domestic pigs forage freely in the forests. On the contrary, the disturbance was probably increased by the large numbers of pigs. From historical notes and old maps of forests in the southern part of Sweden, we can roughly estimate pig density around 1650 to be at least four domestic pigs per hectare (Andersson, 1991). High densities of pigs were most certainly not only located in the southern parts of Sweden but were a rather common phenomenon. Species sensitive to foraging behaviour of domestic pigs or wild boars should, therefore, already have been lost historically while species still existing should be tolerant. The result indicates that the effects of wild boars lead to changes in species composition as well as in frequency.

Since no consideration has been taken to the age of the disturbed patches, the mean number of species (as shown in table 1) from the different vegetational types is based on a mixture of very new (species-poor) and older (species-rich) patches. Because of the increased difficulty to distinguish between rooted patches and the surroundings with increasing age, probably only a few very old patches were included in the data set.

Table 1. Ratios (disturbed/reference) between disturbed and reference patches in different vegetational types.

Reeds 1 shows the difference between patches in reeds with wild boars; **Reeds 2** shows the difference between patches in reeds with or without wild boars; **Alder shores, Alder marshes, Older pine forest, Young pine forest and Calcareous bedrock** shows the difference between patches in alder shores, alder marshes, older pine forest, recently thinned young pine forest and calcareous bedrock respectively. **Species No.** gives the total number of species found in all patches of a certain vegetational type. **Mean** gives the average number of species per patch among the inventoried patches in a certain vegetational type. **Min.** gives the minimum number of species found in a single patch. **Max.** gives the maximum of species found in a single patch.

	Reeds 1	Reeds 2	Alder shores	Alder marshes	Older pine forest	Young pine forest	Calcareous bedrock
No. of patches	44/44	44/13	21/8	49/36	53/53	22/22	45/46
Species No.	69/21	69/15	90/63	115/66	40/29	21/18	98/80
Mean	8.1/3.9	8.1/2.5	19.0/21.1	19.4/10.4	5.9/4.5	5.8/6.6	19.0/10.8
Min.	1/1	1/1	10/15	2/2	1/1	3/2	9/7
Max.	29/11	29/8	28/30	35/20	15/12	8/9	30/19
Std	7.28/2.28	7.28/1.98	4.77/5.26	6.40/4.60	3.22/2.14	1.62/1.65	4.55/2.63
Mann-Whitney test	***	***	n.s.	***	*	n.s.	***
Species in common	20	13	41	59	27	16	74
Unique species	49/1	56/2	49/22	56/7	13/2	5/2	24/6
McNemar's test	***	***	***	***	***	n.s.	***

5. Conclusion

The reintroduction of wild boars in Sweden has merely recreated a formerly common disturbance regime that most certainly has been an important aspect to which many plant species have become adapted. This and other natural disturbance regimes play an important role on a landscape level which must be considered when, for instance, creating nature reserves as well as conservation plans for both plant communities and individual plant species depending on disturbances of the soil. To conclude, there is no doubt about the effects of wild boars disturbance to the flora; plant species richness is enhanced.

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