Hungarian University of Agriculture and Life Sciences

BSc in Wildlife Management Engineering

Characteristics of the level of disturbance of soil surface by rooting of wild boar *Sus scrofa* at Jane Goodall Tanösvény open ground in Hungary

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This study aimed to determine the Characteristics of the level of disturbance of soil surface by rooting of wild boar *Sus scrofa* the objective of this study was to govern the total size of the disturbed soil surface in the study area. How many rooted patches are included? What is the size distribution of those patches? How far those patches are from each other?

methodology. By recording the coordinates of the rooted area's entry point and exit point in a single direction parallel to the transect, we were able to measure the length of each rooted patch. This allowed us to create a line segment that would give the rooted area's length in meters (m). A Garmin GPS unit captured the location points. To ensure accuracy in sampling the rooting within each cell, a 20m string with a nail attached to it was used. The nail was. pinned to the very beginning of the middle transect line and the string was pulled over it and laid on the ground to sign the overlapping edge of the two neighboring cells. After finishing data collection in the two cells, this procedure was repeated passing along the transect. ensuring cell separation.

Results and discussion

What is the total size of the disturbed surface?

Compared to our estimation, the study revealed that the total area affected was calculated to be 1565.2 m2 out of the whole area. The measured area covered a total of 50,000 m2. The undisturbed area included 48,434.2 m2, which represents a small proportion of the total area, We observed that the percentage of disturbed regions appears to be lower than expected. This could be due to insufficient sunshine or incorrect watering may also lead to the tiny size of the wild boar rooting area in cells. Low nutrients in the soil might be the cause of the rooting area's small size. Furthermore, competition from other species or human activity may limit the boars' access to broader places for consumption. This is similar to Pitta-Osses et al. (2022) reported an increase in rooting activity throughout the autumn and winter months, followed by a progressive decline in rooting activity in the spring and summer. This might be related to a decrease in the availability of green vegetation throughout the winter, as well as the necessity to seek acorns, seeds, and roots underground. As a result, wild boar eating habits vary with time and place, but it may be viewed as a continual disturbance component in forest soil.

How many rooted patches are included?

The findings indicate that deep, shallow, or even partial rootings were present in at least 90% of the grid cells. Of 125 total cells, 120 were rooted, while only 5 were left undisturbed. There might be other causes for this. This involves the presence of obstacles that hinder the establishment of roots in particular areas. The availability of trails for human use may potentially play a role in promoting or inhibiting root development in particular regions. To identify the exact reasons behind the absence of roots in these particular cells, more investigation is required.

3 What is the size distribution of those patches?

The results of the study were analyzed and calculated using Excel by computing the standard deviation and mean. The average area of 12.6 m2 was calculated by dividing the entire sum of areas for all rooting points (1565.2 m2) by the number of rooting points (124). The standard deviation was 17.3m2 this was calculated using the STDEV() function in Excel. The area is commonly conceptualized as a circular zone, and its size is determined using the formula $\pi r2$, where r denotes the radius of the affected surface (d/2). After calculating each grid cell, the value of r was converted into square meters,

The study discovered that the area of soil disturbed by wild boar was relatively small, This accounts for less than 3% of the total area and suggests that the impact is limited. Moreover,

due to the predominantly shallow nature of roots, the impact of wild boars on the soil may be swamped by other variables. It is worth mentioning that the amount of soil moved by wild boar can have lasting impacts on soil properties. Hancock et al. (2016) recognize that wild boar rooting leads to permanent problems for forest ecosystems. It becomes clear that the dispersed and changing distribution of the rooted areas would eventually cover most of the ground in a relatively short period, playing a vital role in the processes that contribute to soil formation. Our findings are in line with those of Bradley & Lockaby (2021) exhibiting a seasonal pattern that is consistent with our observation, more marked from mid-autumn to spring. In the areas where the wild boar has been introduced, where the ecosystems may be less resistant to its impacts, some writers documented that more substantial disruptions were caused by the soil being redistributed by the animals' rooting formation

How far the rooted patches are from each other?
The minimum, maximum, and average distances were calculated as shown in Figure 8. for all rooting points. For example, for rooting point R1, its exit coordinate points (longitude and latitude) were used to calculate the distance with all other 123 entry rooting points and the calculations continued for R2 up to R124 as shown in Annex 1, using the equation (i). Then the MIN, MAX, and AVERAGE functions were used to calculate the minimum, maximum, and average distance as shown in Figure 8. a Figure 8. b, and Figure 8. c, respectively. Subsequently, the data were examined to ascertain the comprehensive distribution of distances as shown in Appendix 2. The results exhibited a Gaussian distribution of distances. The roots were near one other. Initially, at the start of the transect, the distances were rather consistent. However, as the transect progressed, the distances started to exhibit greater variability,

The minimum outcome indicates that the first portion of the transect exhibited extensive root growth, as seen in Figure 8. a, whereas the latter portion had noticeably reduced root development. This disparity may be attributed to human activities in the vicinity. Activities as hiking, dog work, riding, and other recreational activities are comparable to the study conducted by Sütő et al. (2020) who examined the quality and utilization of habitat patches by wild boar over an urban gradient and revealed similar findings.
Our findings indicate that the area with a high concentration of roots was near human habitation. This may be attributed to the dietary choice of wild boars. The proximity of food supplies to human settlements likely enticed the wild boar population to the densely vegetated region. This proximity to human settlement might potentially enhance the probability of human-wildlife confrontations. Wild boars in built-up areas of Hungary primarily consume natural food sources and show a lower dependence on human-made food sources, as observed in studies by Katona et al. (2018), but differs from other places where leftovers are the main food source for wild boars as reported by Stillfred et al. (2017b). In addition to providing protection sufficient native flora in urban areas is the preferred food source, to which wild boars have adapted through their foraging habits and digestive systems

5. Conclusions and Recommendations
Management of recreational and protected natural areas should balance the need between outdoor pleasure, sustainable usage, and conservation. Decades of study have proven that outdoor activity, such as hiking, cross-country skiing, and riding vehicles, may be harmful to animals. The most obvious indicators are behavioral changes: animals may flee from approaching humans, feed less frequently, and leave nests or dens.
Other impacts are less visible, but they can have major ramifications for the health and survival of animals. When wild animals recognize people, they may undergo physiological changes such as higher heart rates and stress hormone levels. to protect these areas
Management of such areas should invest in creating awareness for the animals on the hiking

and nature trails, for example, suggesting that cyclists should ride at a minimum speed of 5km/hr limitations and visitor management may be put in place to allow minimal disturbance of wild animals on nature trails.

Furthermore, man-made structures such as trails near the area being studied may have an even bigger impact on the alterations in soil characteristics compared to the impacts caused by wild boar. Human-made infrastructure can cause soil compaction, pollution from automobile emissions, and disruption of natural vegetation. These variables have the potential to modify the arrangement of soil particles, the concentration of nutrients, and the activity of microorganisms, eventually impacting the overall well-being and productivity of the soil. Therefore, land managers need to consider the impacts of both human activities and wildlife when assessing and managing soil health in a given area.

According to our investigation, the study area lacked water supplies for wild animals, which could have contributed movement of wild animals toward human settlement. The presence of wild animals near human settlements can increase the risk of conflicts and potential dangers for both humans and animals. Finding sustainable solutions to provide water sources for wildlife in the area could help mitigate these issues and create a more harmonious coexistence between humans and wildlife. Either lack of water sources may have also impacted the overall ecosystem in the region, as animals would have been forced to travel further distances in search of water. We expect that these approaches will enhance our understanding of the impacts and behaviors of wild boar rooting in forests, as well as enable us to discover the beneficial patterns of wild boar disturbances in ecosystems. By 21comprehending the behaviors and implications of wild boars, we may formulate more efficient management measures that minimize their adverse effects on the forest ecosystem.