UNIVERSITÀ DEGLI STUDI DI MILANO
FACOLTÀ DI SCIENZE AGRARIE E ALIMENTARI

ECOSYSTEM SERVICES PROVIDED BY LIVESTOCK ACTIVITIES

IMPACTING ON PLANT BIODIVERSITY

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Humans are part of this planet, living closely with it since time immemorial, taking advantage of its benefits. That is why we call **ecosystem services the components that are consumed or enjoyed that originate from a set of organisms, abiotic conditions and interactions between them** (from there the word ecosystem). All of these services, as tangible or intangible benefits, are what have sustained the human community as we are linked to it, whether by **provisioning** (food, primary materials, medicinal resources or potable water), **regulating** (air quality, climate regulation, water regulation, regulation of erosion, water control, pests, diseases, pollination or moderation of extreme events), **sustaining** (soil formation, photosynthesis or nutrient cycling) or **cultural** (spiritual, religious, aesthetic, recreational, ecotourism or physical and mental health values) (figure 1). Much has been studied about the type of services received from urban zones, forests, wetlands, or rivers, but less consideration is given to the variety of services that can be obtained from an anthropogenic environment, an area treated by humans such as agriculture.

Figure 1: *Ecosystem services* [Picture] Depositphotos. https://sp.depositphotos.com/vector-images/servicios-ecosist%C3%A9micos.html

In this study one of the different services (biodiversity) is valuated on three different farms.

Biodiversity reflects the diversity of plant species on each farm. Plant biodiversity is important because it is closely connected to ecosystem services, as it influences food variety, climate regulation, water cycling, soil conservation, pollination and more. Also, having a high diversity of plant species increases the ability to adapt to ecosystem disturbances, and improves people's quality of life.

To give a numerical value to this factor, a procedure is used.

First, a count of species is made using one square metre of land. In particular, were considered: the meadows in the riparian belts, the margins of the fields and the ditches, in these areas the assessment of the different herbaceous species was carried out in

three squares of one meter by one meter and were counted trees present; in the forests were considered two squares of ten meters by ten meters in which trees were counted while within three squares of one meter by one meter were counted herbaceous species metre by one metre are made. After having the species noted and the approximate number of individuals, the values are transformed according to the Shannon index, in which first the number of individuals of each species is divided by the total number of individuals found, this number is multiplied by the neperian logarithm of the same number, and finally all these values are added up with the minus in front. The result of this procedure will give a number from which we can catalogue the plant biodiversity of the area.

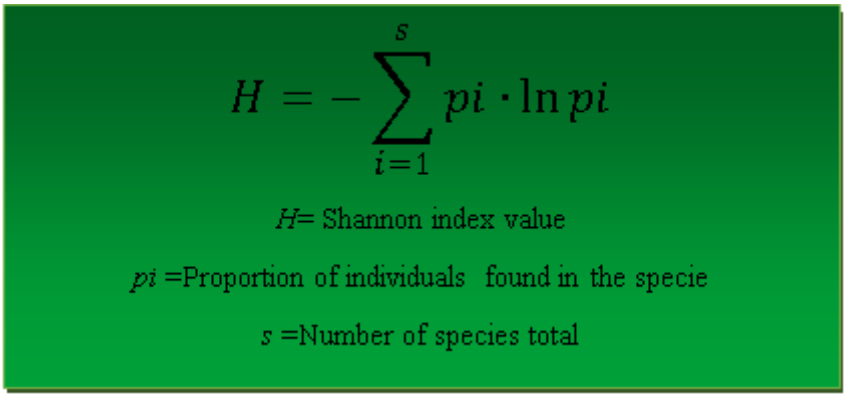

Figure 2: *Shannon Index Equation* [Equation] Author's elaboration.

In this article, the focus is on the different species in each sampling area. As can be observed in figure 3, Farm 1 has 61 plant species while Farm 2 has the lowest number with 29 species, then Farm 3 has 50 species. So, we can say that **Farm 1 has the most biodiversity** of the areas in question. Another topic that the project wants to look at is the number of species found only in that area, hence figure 4, where we see the percentages of plants in common in the three farms, plants that only appear in Farms 1 and 2, in Farms 2 and 3, in Farms 1 and 3, and the plants that are found only in the territory in question. **The highest percentage of plant species native to the farm is in Farm 1 with a percentage of 45.90%**, which indicates that approximately half of the biodiversity of the area is native to the farm. Then we see that Farm 3 has 34% of its own plants and Farm 2 24.14%, which indicates that it would be the area with the least biodiversity of its own. It can also be seen that Farm 2 has the highest percentage of plant species in common with all the farms, 41.38%, which could be explained by the fact that it is the area with the fewest species in general.

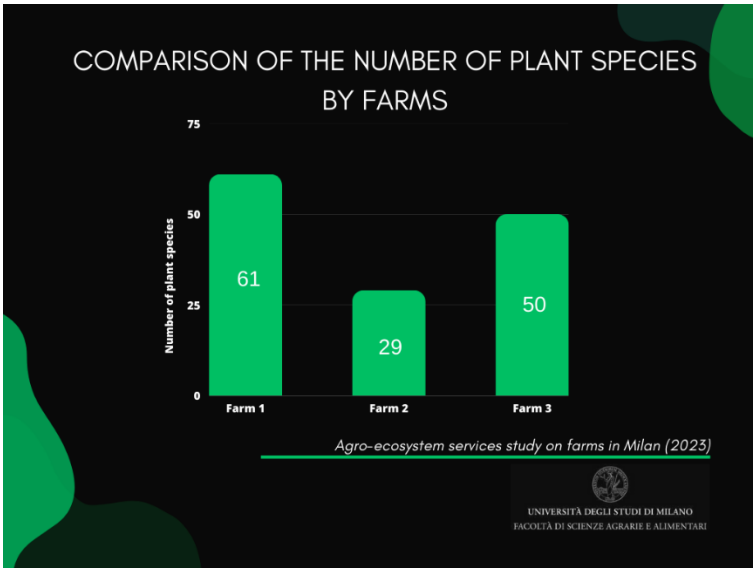

Figure 3: *Number of species found in each territory* [Graphic] Author's elaboration.

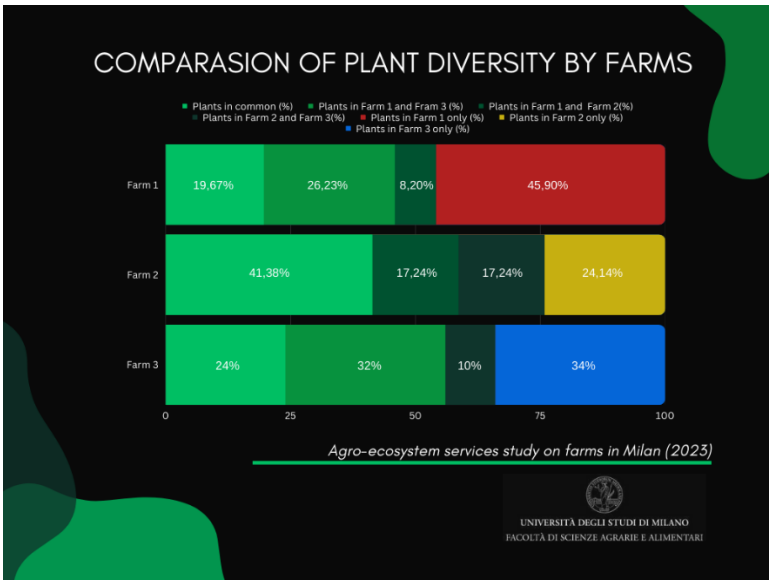

Figure 4: *Comparison of species encountered* [Graphic] Author's elaboration.

One of the most important factors that could be considered to understand these results is the farming management applied. The Farm 1 is an organic livestock farming, which means that the livestock is fed on organic feed (no chemicals, no pesticides...). This livestock farming is based on creating a sustainable agro-ecological system in line with reducing pollution and the loss of nutrients. In contrast, Farm 2 is based on intensive conventional farming, where livestock are fed with homegrown forages, maize and processed feeds, and where space is limited, and the number of individuals is large. This type of livestock farming generates a higher environmental impact in processing, transport, and even other polluting effects such as the accumulation of slurry. Farm 3 is characterized by the fact that it is an intensive farm but keep natural areas such as the strips of crop fields and forest.

If we compare the composition of each of the territories according to their total area, we can observe that Farms 1 and 2 have a grassland composition of 64% and 41% respectively, and that the forest and natural areas constitute a very low proportion of the land. In contrast, Farm 3 has 91% of the land used for cultivation, but it is the one with

the highest proportion of forest and natural areas as opposed to the others. Therefore, when we look at the relation between the number of species found and the total area we can see that the highest ratio is for Farm 3, which is due to the fact that numerous species have been found in the limited territory available.

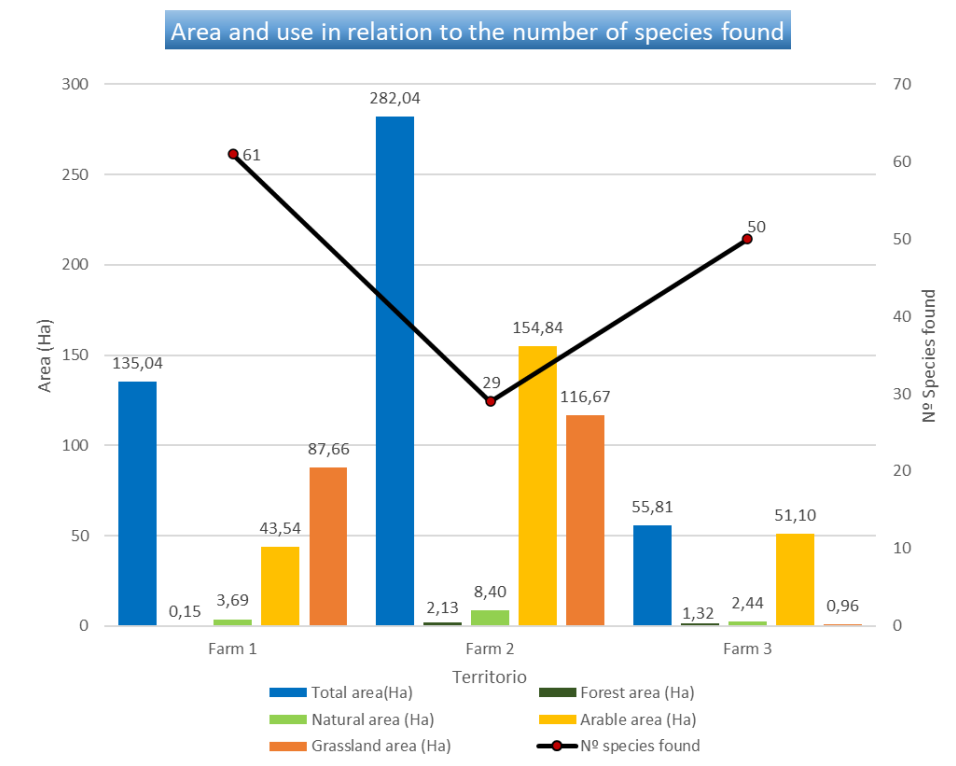

Figure 5: *Area and use in relation to the number of species found* [Graphic] Author's elaboration.

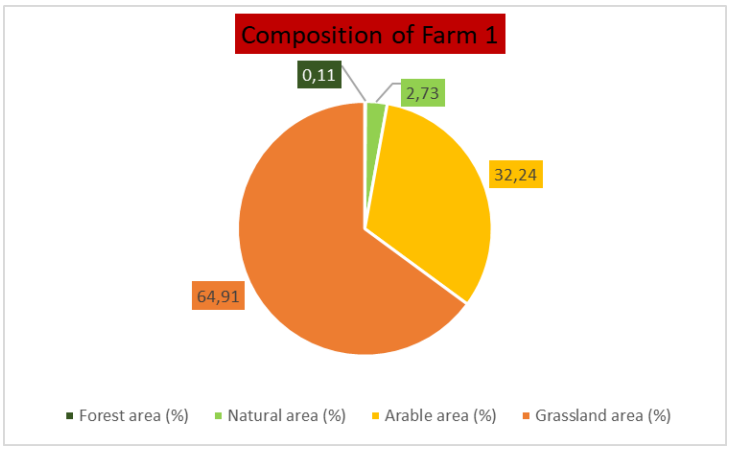

Figure 6: *Composition of the territory of Farm 1* [Graphic] Author's elaboration.

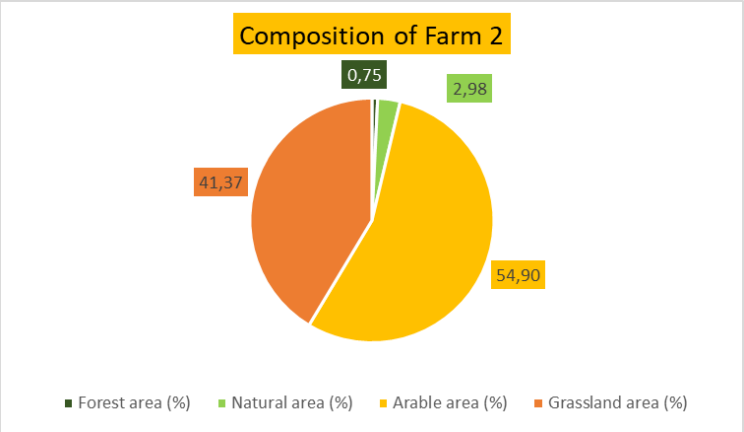

Figure 7: *Composition of the territory of Farm 2* [Graphic] Author's elaboration.

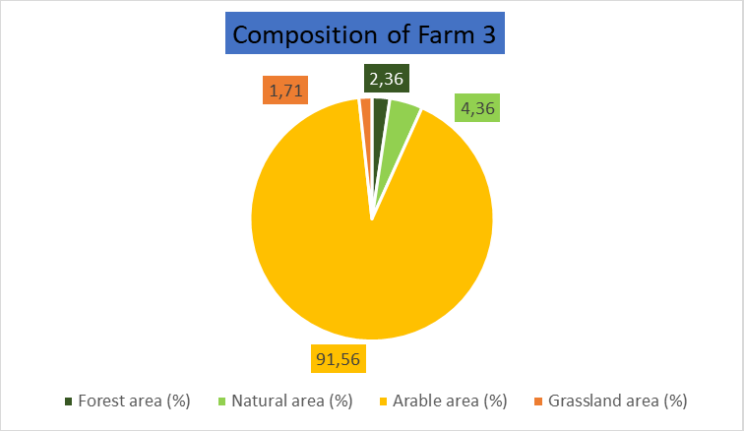

Figure 8: *Composition of the territory of Farm 3* [Graphic] Author's elaboration.

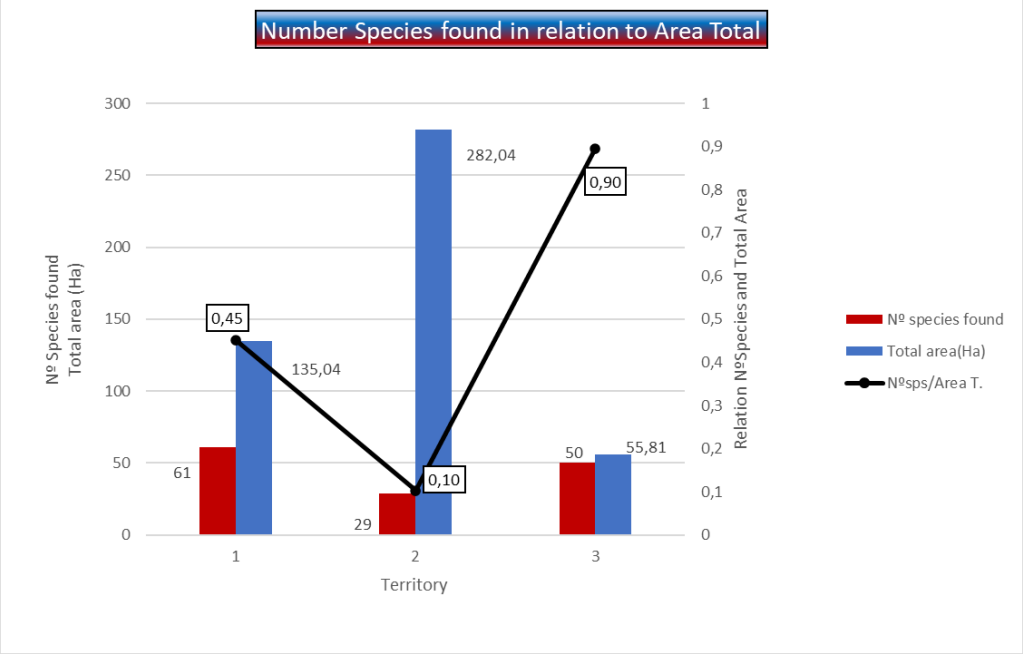

Figure 9: *Number Species found in relation to area total* [Graphic] Author's elaboration.

The objective of this project was to give a quantitative value to the ecosystem services of three different farms, giving relevance to the count of plant biodiversity as it is a factor that influences these services. After counting the plant species, it can be said that the

number of species found is not an isolated factor, but it is necessary to relate it to the area to put in evidence the species richness, the Farm 3 resulted the one that have many species in its limited area. This could be due to the techniques employed, as they insisted on the conservation of natural areas in contrast to the other farms. Clearly there are different variables that influence the results such as season of the evaluation, farming techniques, human error... but despite these limitations, the project has been able to quantify the plant biodiversity of the territories and give a numerical value to one of the ecosystem services.

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