

# COMPARATIVE ANALYSIS OF CARBON STORAGE IN THE TREES OF A SCHOOL PROPERTY (2024–2025)



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## SUMMARY

Carbon sequestration by trees is a key process for mitigating climate change, as forest ecosystems act as temporary reservoirs of atmospheric carbon. In this context, the present study aimed to analyze and compare the variation in carbon stored in the aboveground biomass of trees on a school property between 2024 and 2025, considering the dynamics of the tree system based on the growth of existing trees, the addition of new specimens, and tree loss between the two periods. The study was based on field measurements of the diameter at breast height (DBH) at 1.30 m and the height of the trees present on the school property. A total of 45 trees belonging to native and exotic species were analyzed. From these measurements, individual aboveground biomass and stored carbon were estimated using allometric equations specific to each species group, following the GLOBE Programme protocols. The analysis was based exclusively on an empirical comparison of data obtained in 2024 and 2025, without resorting to projection models. The results show that the carbon stored on the school grounds exhibits significant interannual variations associated with the structure and evolution of the tree population. Native trees, although less numerous, made significant contributions to total carbon when represented by large, mature specimens, such as the native willow. However, the loss of some of these trees between the two years resulted in an immediate decrease in stored carbon. Exotic species, represented by a greater number of trees, contributed steadily to the total carbon of the system, mainly through the growth of young trees and the addition of new individuals to the analysis in 2025. The comparison between 2024 and 2025 allowed for an understanding of carbon sequestration as a dynamic process, resulting from the balance between tree growth, addition, and loss, rather than as a fixed value. Furthermore, the study revealed that carbon storage capacity depends largely on the size and stage of development of the trees, regardless of whether they are native or exotic. Finally, this work highlights the value of continuous monitoring of school trees as a scientific and educational tool, consolidating the school grounds as a living laboratory for the study of the carbon cycle and the training of students in the analysis of real environmental problems.



**IBIRAPITÁ**



**TIMBÓ**



**FRESNOS Y PARAÍOS**

## RESEARCH QUESTION

How does the total carbon sequestration capacity of the school grounds vary between 2024 and 2025 based on the growth of existing trees, the addition of new specimens, and the loss of tree individuals?

## HYPOTHESIS

### Null hypothesis (H0)

There are no significant differences in the total amount of carbon stored and projected by the trees on the school grounds between 2024 and 2025, considering the growth, incorporation and loss of specimens.

### Alternative hypothesis (H1)

The total carbon sequestration capacity of the school grounds shows significant variations between 2024 and 2025 as a result of the growth of existing trees, the incorporation of new individuals into the system and the loss of specimens, particularly of native species, which modifies the carbon balance of the ecosystem.

### Complementary specific hypothesis

The loss of adult specimens of *Salix babylonica* generates a net decrease in stored carbon that is not fully compensated, in the short term, by the entry of young trees into the system.

## STUDY SITE

The chosen study site was Rural School No. 88 in Las Violetas, Canelones, Uruguay, located at -34.5668 latitude and -56.2975 longitude (Figure 1). This site covers an area of just over half a hectare. The vegetation surrounding the study area acts as a natural barrier against winds from the south and southwest, contributing to a higher surface and air temperature compared to areas lacking this type of vegetation cover. Furthermore, the area is surrounded by fields with natural vegetation, such as grasses, chilca (*Baccharis salicifolia*), and carqueja (*Baccharis trimera*).



## BIBLIOGRAFÍA

## METODOLOGÍA

The data were collected using the GLOBE Programme protocols, specifically those designed to measure tree biomass and estimate carbon storage. The protocols used were as follows:

- **Tree height protocol**
  - Measurement of the height of each of the 45 trees using a clinometer and the GLOBE Observer digital application. (<https://www.globe.gov/documents/355050/bcc8abd6-68c9-4c2c-9f0c-cc60c7141701>)
- **Tree trunk circumference protocol**
  - Measurement of trunk circumference at a height of 1.35 meters (DBH) using a measuring tape. (<https://www.globe.gov/documents/355050/3f715849-b7c0-4a39-92b7-3ab251a6dce7>)
- **Species identification :**
  - The species identification of each tree was done using the Guide to the Identification of Native Tree Species. Uruguay (2023 version)



## RESULTS

### SECUESTRO DE CARBONO

Table summarizing the tree data below	
	Total Aboveground
Plot Biomass (g/plot)	142.265.249
Plot Carbon Storage (g C/plot)	71.132.625
Biomass (g/m <sup>2</sup> )	25,885
Carbon Storage (g C/m <sup>2</sup> )	12,943

**CARBON STORED BY THE 45  
TREE SPECIMENS IN 2024**

Table summarizing the tree data below	
	Total Aboveground
Plot Biomass (g/plot)	142.265.249
Plot Carbon Storage (g C/plot)	71.132.625
Biomass (g/m <sup>2</sup> )	25,885
Carbon Storage (g C/m <sup>2</sup> )	12,943

**CARBON STORED BY THE 59  
TREE SPECIMENS IN 2025**

## CONCLUSIONS

The comparative analysis of data from 2024 and 2025 revealed that the carbon storage capacity of the school grounds is closely linked to the dynamics of the tree population and is not a fixed value. The variations observed between the two years reflect the combined effect of tree growth measured in both periods, the addition of new trees that reached the minimum measurement threshold, and the loss of trees.

In both years of the study, native trees made significant contributions to stored carbon when represented by large, mature specimens. In particular, native willows concentrated a significant proportion of the total carbon in the area, confirming the importance of mature native trees to the current carbon storage capacity. However, the loss of some of these trees between 2024 and 2025 highlighted that the disappearance of mature trees leads to an immediate reduction in stored carbon, underscoring the need for their conservation.

The comparison between 2024 and 2025 allowed students to understand carbon sequestration as a dynamic process, linked to real changes in the ecosystem, and not as a theoretical or static value. In this way, the study not only provided relevant empirical evidence for the analysis of carbon stored on the school grounds, but also strengthened students' scientific training and environmental awareness, consolidating the school grounds as a long-term learning and observation space.

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