The GLOBE Program

#LACTREES

Influence of trees on summer temperatures in Junín de los Andes, Patagonia, Argentina

Cahuin Baigorria, M. A., Melo, J., Revolero Rubilar, H. A., Morrone, F. N., Tallarico Esteve, A. M. and Prieto, A. B.

Science Club Huechulafquen, Argentina

Abstract

The impact of urban trees on temperature regulation is analyzed. The temperature, height, circumference and coverage of trees were recorded in different seasons of the year, finding an irregular distribution of trees and significant temperature differences between the seasons. A correlation was observed between tree cover and the reduction of surface temperature in summer, demonstrating the impact of urban trees on local thermal regulation.

Research Question

1) How much does surface temperature and air temperature change in the downtown area of the city of Junín de los Andes, in the different seasons of the year? 2) How does the distribution of trees vary on the sidewalks in the city center and in San Martín Square? 3) How does tree coverage influence: a) surface temperature and b) air temperature? 4) How does cloud type and coverage influence surface and air temperature?

Introduction

Trees play an important role in regulating surface temperature in cities through various mechanisms. Their shade reduces direct solar radiation and decreases heat absorption by urban surfaces. In addition, leaf evapotranspiration contributes to the cooling of the surrounding air, generating a cooling effect. Trees also improve air quality by capturing greenhouse gases and polluting particles, mitigating the urban heat island phenomenon and creating a healthier and more comfortable environment in cities.

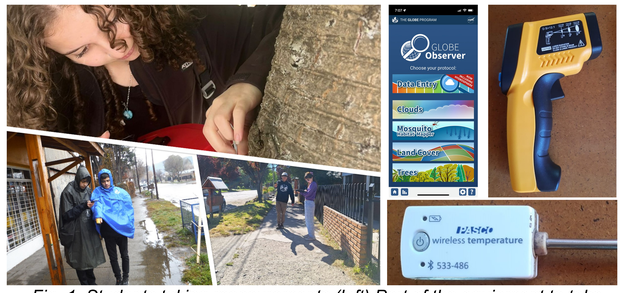

Fig. 1. Students taking measurements (left) Part of the equipment to take measurements (right)

Research Methods

The study was carried out in the center of the city of Junín de los Andes, Argentina, a small city with 16,580 inhabitants in 2022.

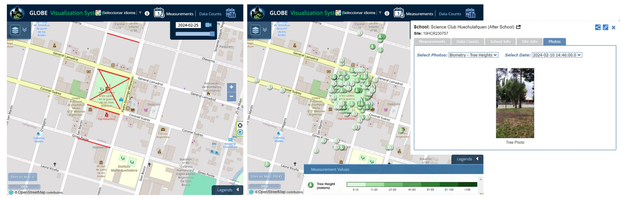

Fig. 2. Sampling site in the downtown area of the city of Junín de los Andes (left). Tree height and girth measurements (right)

The city is located in a premountain valley of the Andes, with predominant vegetation of steppe, riverine forest and forest. implanted. The climate is classified as Csb according to the Köppen-Geiger classification, with average maximum temperatures of 22ºC, average minimum temperatures of 0ºC and an average annual precipitation of 650 mm. The sampling site is the center of the city of Junín de los Andes, Argentina. Four blocks were selected from the center of the city and Plaza San Martín, which has a large number of trees. In the square, measurements were taken on both diagonals.

The GLOBE Observer app: Trees and Land Cover application was used to take tree height and land cover measurements and Clouds to record cloud type and cover. The circumference of the trees was measured with a 50m tape measure. The air temperature was recorded with the Wireless Temperature Sensor PS-3201, for the surface temperature an Infrared Thermometer GM320 was used. The following The GLOBE Program protocols were used to record: *Atmosphere:* a) Air temperature and b) Land surface temperatura c) Clouds. *Biosphere:* a) Land cover, b) Height of trees and c) Circumference of trees. The MUC classification system was used for land cover and percentages of tree cover were estimated with satellite images.

The data were processed with Microsoft Excel 2019 and Statistica 8. Significant differences between the data were analyzed and the Pearson correlation coefficient (r) was calculated to analyze the influence of tree cover on temperature.

Results

The selected blocks correspond to the center of the city of Junín de los Andes. Some of them have few trees, while the sector of Plaza San Martín has many trees whose shade extends beyond the street to the sidewalk in front.

The species are generally exotic plants, mostly ash trees (*Fraxinus excelsior*) and in Plaza San Martín native trees such as the araucaria (*Araucaria araucana*) predominate, although there are also other native and exotic species.

Land surface temperatures present greater variability in winter and spring. The highest temperatures were recorded on street 3. Surface temperatures in fall and winter are significantly lower than in spring and summer, according to the LSD test. Regarding air temperature, little variability is observed in each station, with significant differences between all stations. In the comparison of the streets and diagonals, significant differences were found between Street 3 and the others, as well as between Street 1 and Diagonal 2 in surface temperatures. However, the air temperature remains similar in all streets and diagonals. A significant correlation was found between land surface temperature in summer and the percentage of tree cover, indicating the positive influence of tree cover on thermal regulation during the summer.

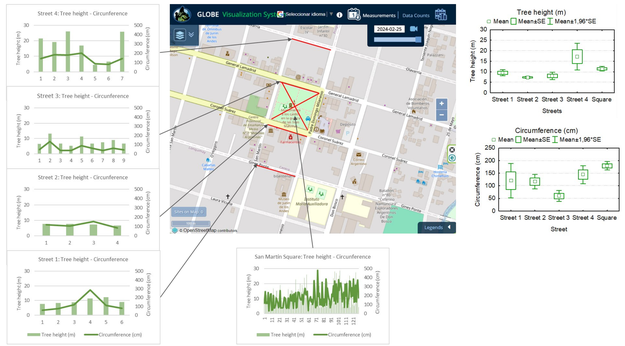

Fig. 3. Tree height and circumference. Source: GLOBE data visualization.

Fig. 4. % of tree cover and no tree cover on the sidewalks of the analyzed streets. Average MUC code of each sidewalk of the streets analyzed.

Discussion

Urbanization modifies the land cover, increasing the temperature. Urban trees can mitigate this effect. Studies in Argentina have shown that trees reduce air temperature in cities such as Mendoza, Bahía Blanca and northwest Argentina. This research in Northern Patagonia provides information on the impact of urban trees in a semi-arid environment.

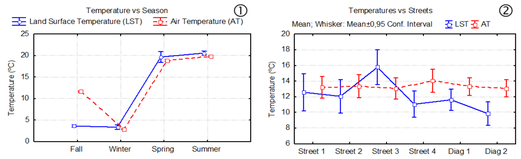

Fig. 5. Comparison of land surface temperature and air temperatures between: (1) seasons and (2) streets and diagonals.

For future research, it is recommended: a) intensify temperature measurements in spring and summer during the hours of greatest solar radiation, b) compare the impact of tree shade on cloudy and clear days, c) expand street sampling to analyze the relationship between tree height and temperature.

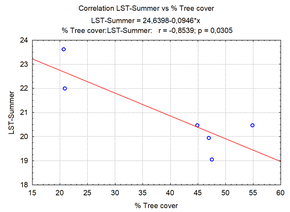

Fig. 6. Correlation between tree cover and land surface temperature in summer.

Conclusions

The trees are distributed irregularly on the sidewalks and the Plaza stands out with the greatest coverage. Significant temperature differences were detected between the stations. The data revealed a significant correlation between tree cover and the reduction of surface temperature in summer, demonstrating the impact of urban trees on the thermal regulation of the city center.

Bibliography

The GLOBE Program (2023). GLOBE Observer app. https://acortar.link/jFC727

The GLOBE Program (2023). The GLOBE Teacher's Guide. Atmosphere and biosphere protocols. https://www.globe.gov/es/do-globe/globe-teachers-guide

he GLOBE Program (2023). Trees *Around the GLOBE Student Research Campaign*. https://acortar.link/nifshT

The GLOBE Program (2023). *"Trees within LAC" Campaign.* RCO - LAC. https://acortar.link/8bTA26

The GLOBE Program (2023). *Urban Heat Island Effect.* https://acortar.link/S1AwmZ

Meeting sponsored by: NSF Supported by: NASA NOAA Implemented by: UCAR