biology and life sciences forum

MDPI

Proceeding Paper

Native People's Perception of Trees in the Urban Landscape of the Bay of Naples †

Adriano Stinca [1,*], Luigi Marfella [2] and Assunta Esposito [1]

[1] Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, University of Campania Luigi Vanvitelli, Via Vivaldi 43, 81100 Caserta, Italy; assunta.esposito@unicampania.it

[2] School of Geography, Geology and the Environment, Keele University, Staffordshire ST5 5BG, UK; l.marfella@keele.ac.uk

* Correspondence: adriano.stinca@unicampania.it; Tel.: +39-0823-274544

† Presented at the 1st International Electronic Conference on Biological Diversity, Ecology and Evolution, 15–31 March 2021; Available online: https://bdee2021.sciforum.net/.

Abstract: In urban areas, trees play a crucial role as providers of ecosystem services, which enhance the well-being of humans directly and indirectly. Research on trees and humans generally depict a complex system of historical, cultural and natural values. However, urban changes can modify historic landscapes by causing the loss of cultural and environmental values. In this study, we assessed native people's perception of trees in the urban landscape of the Bay of Naples (Italy) with the main goals of: (i) highlighting the tree species historically characteristic of the urban landscape; and (ii) evaluating the quantitative changes and the related causes that have affected trees in the last twenty years. To these aims, we conducted a completely anonymous online survey using the Google Forms application. *Pinus pinea* L. (Pinaceae) showed the highest scores as a species that historically characterized the study area, but also with a strong reduction, while *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae) showed an increase in the last twenty years. The results of this study will support decision making in urban landscape planning in the Bay of Naples. Furthermore, the proposed survey method can be tested and applied to other urban areas of the world.

Keywords: tree diversity; urban trees; online surveys; public perceptions; ecosystem services

Citation: Stinca, A.; Marfella, L.; Esposito, A. Native People's Perception of Trees in the Urban Landscape of the Bay of Naples. *Biol. Life Sci. Forum* **2021**, *2*, 2. https://doi.org/10.3390/BDEE2021-09446

Academic Editor: Mario A. Pagnotta

Published: 15 March 2021

1. Introduction

In urban areas, trees play a crucial role as providers of ecosystem services, such as the mitigation of the urban heat island effect, the regulation of microclimate and hydrology, the provision of leisure spaces, the mitigation of air pollution and the sequestration of carbon dioxide, which are services likely to become more important when considering the predicted increase in climate change [1–6]. Research on trees and humans generally depict a complex system of historical, cultural and natural values. However, urban changes can modify historic landscapes by causing the loss of cultural and environmental values. In addition to producing an increase in the density of people and related social relationships, urbanization implies many problems related to spatial planning. To support decision making in urban landscape planning, many surveys regarding public perception were conducted [7–9]. Indeed, the evaluation of public opinion allows one to make decisions influenced by the communities of people, also accounting for the peculiar ways in which community characteristics contribute to attitudes toward urban trees. However, no studies regarding citizens' perception of trees in urban landscapes subject to high urban pressure were conducted. This is particularly relevant and useful in those territories where humans have been present since very ancient times, such as the coastal metropolitan areas of the Mediterranean basin.

In this study, we assessed native people's perception of trees in the urban landscape of the Bay of Naples (Italy) using an online survey. The main goals of the research were: (i) to highlight the tree species historically characteristic of the urban landscape; and (ii) to evaluate the quantitative changes and the related causes affecting trees in the last twenty years.

2. Experiments

2.1. Study Area

Study was carried out in the urban and suburban area of the Bay of Naples in southern Italy (Figure 1A). The area included 92 municipalities of the entire Metropolitan City of Naples, which covers approximately 1171 km^2 and hosts about 3 million inhabitants.

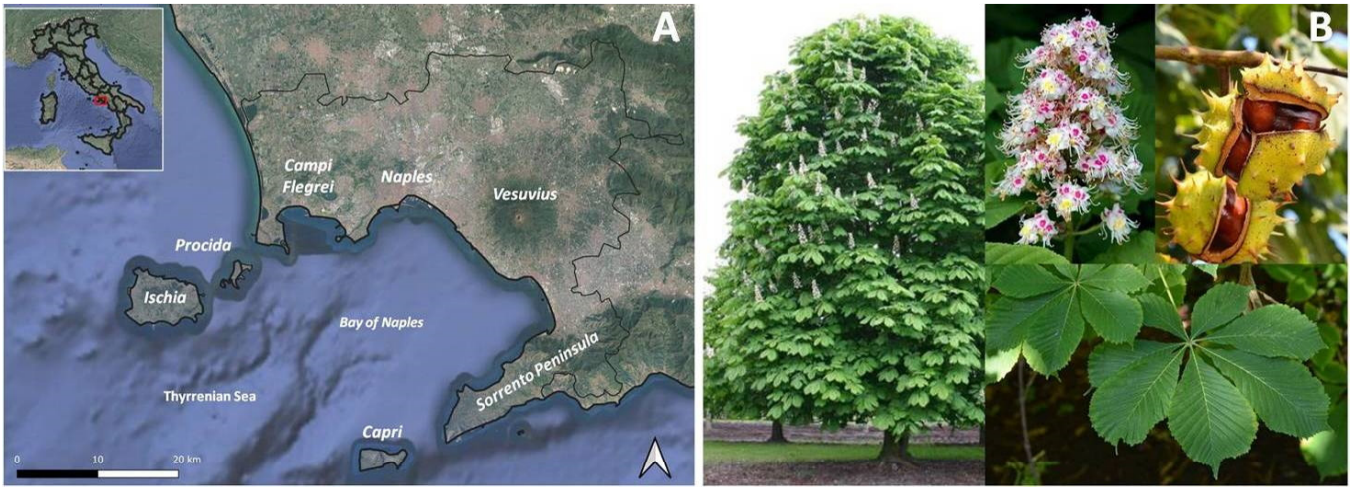

Figure 1. (**A**) Location and an aerial view of the study area. (**B**) Example of panel figures with morphological details of *Aesculus hippocastanum* L.

Within the study area, artificial surfaces cover about 20% of the surface, while agricultural areas, shrubs and herbaceous vegetation represents more than 60% of the total surface [10]. The climate is Mediterranean, with a total yearly rainfall of 929 mm and a mean monthly temperature ranging from 11 °C in January to 26.4 °C in August [11].

2.2. Data Collection

Data were collected using a completely anonymous online survey using the Google Forms application (https://www.google.it/intl/it/forms/about/ (accessed on 10 December 2020)). The questionnaire, which took about 15 min to complete, in addition to some socio-demographic data of the respondents (e.g., age and level of education), included some questions on tree characteristics.

We selected 50 native and exotic tree species generally cultivated along the roads and in the green sites of the urban area around the Bay of Naples (A. Stinca, personal observations). To facilitate the identification of species for a wider audience, in addition to the scientific name, we provided some common names and a photographic report for each tree (Figure 1B). Participants (botanists, agronomists, citizens nonprofessionals, etc.) were asked to state their opinions according to rating scales.

2.3. Data Analysis

One-way analysis of variance (ANOVA) was applied to test the effect of tree origin status (T*os*, i.e., indigenous or exotic in the study area) and tree type with regard to the leaf persistence (T*l*, i.e., evergreen or deciduous) on the perception of respondents, i.e., on the average values assigned to the trees when evaluating their historical role in the urban landscape (TP*ul*) and the quantitative changes in the last twenty years (TP*qc*). The

significance was assessed at $p < 0.05$ using Tukey's HSD test. Furthermore, Pearson's correlation analysis was employed to identify the relationship between the TP*ul* and TP*qc* values ($p < 0.05$).

3. Results

A total of 169 questionnaires were collected. The observations of the respondents were mainly based on the municipalities of Naples, Portici and Sorrento. Most of the respondents were male (62.1%), over 40 years old (66.2%), and in possession of a university degree (81.1%).

Pinus pinea L. (Pinaceae) showed the highest average scores (4.77 ± 0.68) as a species historically characterizing the urban area of Bay of Naples, followed by *Quercus ilex* L. subsp. *ilex* (Fagaceae; 4.39 ± 0.98). Regarding the quantitative changes of trees in the study area, the interviewees indicated that *Ailanthus altissima* (Mill.) Swingle (Simaroubaceae) showed an increase (0.64 ± 1.9) in the last twenty years. Instead, a reduction in the abundance of all other trees was perceived, especially pines (i.e., *Pinus pinea*, −1.48 ± 1.44).

The tree landscape value perceived by respondents (TP*ul*) was significantly affected by the tree origin status (T*os*) (ANOVA, Tukey's HSD test $p = 0.001444$) and by the tree type (T*l*) (ANOVA, Tukey's HSD test $p = 0.004154$). Likewise, the tree quantitative changes in the last twenty years perceived by respondents were not significantly affected by the tree origin status (ANOVA, Tukey's HSD test $p = 0.4545$) and by the leaf type (ANOVA, Tukey's HSD test $p = 0.145346$). Pearson's correlation analysis highlighted a weak negative correlation between the TP*ul* and TP*qc* values ($r = -0.4373$, $p = 0.001508$) (Figure 2).

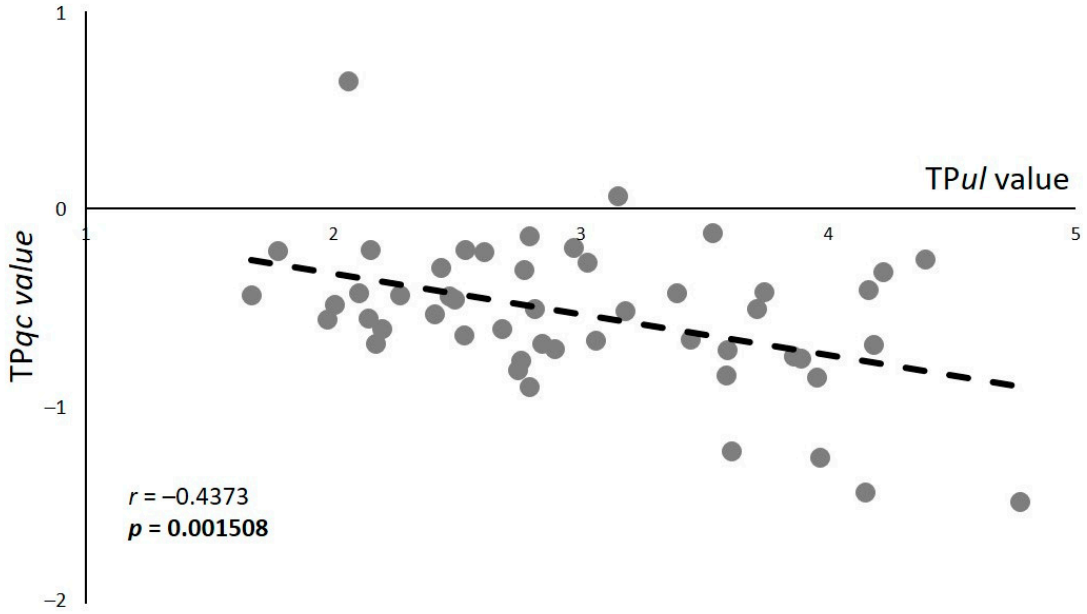

Figure 2. Correlation (Pearson's *r* coefficient and associated *p* value) between tree landscape (TP*ul*) and tree quantitative change (TP*qc*) values perceived by respondents (average values).

The respondents' answers, "inadequate green area planning tools" and "urban transformations and/or land use changes" were highlighted as the factors that most significantly affected the numerical reduction in trees in the study area. On the contrary, an "increased availability of trees on the plant nursery market" produced an increase in the abundance of trees in the last twenty years.

4. Discussion

Most of the native people perceived *Pinus pinea* as a typical tree of the urban landscape of the Bay of Naples. Indeed, this species is very widespread along the streets and within public and private parks of the study area. Nowadays, *P. pinea* (also known as "stone pine")

is widely distributed throughout the Mediterranean basin, where, as a dominant species, it covers more than 700,000 hectares. However, its natural range is difficult to determine, since it has been widely expanded in the last centuries [12]. Due to its ability to grow over dry and sandy soils, stone pine was also introduced in the Bay of Naples both for afforestation and as an ornamental plant. Here, it is undoubtedly an alien plant even if it mainly characterizes the lava slopes of Vesuvius [13]. Especially in the past, it was highly appreciated for the production of edible seeds named "pine nuts". In addition, *P. pinea*, with its typical umbrella shape, is represented in decorative arts, such as in the famous postcard of Naples, which testifies to the strong symbolism of this plant both for natives and visitors of the Bay of Naples.

With the exception of *Ailanthus altissima* and *Robinia pseudoacacia*, the reduction in the abundance of all trees perceived by respondents can be generally related to the "inadequate green area planning tools" and to the "urban transformations and/or land use changes". The first factor also includes the management of adversities affecting trees. In addition to pests and pathogens, trees in urban areas face multiple anthropogenic stress factors, such as high pollution levels, a lack of soil for to anchor root systems and incorrect pruning. Additionally, the maintenance of road pavement and underground systems (e.g., water and electrical systems) causes severe stress and physical damage to tree roots. Overall, urban biotic and abiotic stresses limit tree growth and development, as well as the phytosanitary and static conditions.

As *P. pinea* was perceived by the citizens as an important element of cultural heritage in the Neapolitan area, its death caused a great change in the traditional landscape [14] and a loss of cultural and environmental values.

Changes in the urban landscape of the Bay of Naples were also caused by the quantitative increase in *Ailanthus altissima* and *Robinia pseudoacacia* in the last twenty years (native to South East Asia and North America, respectively) perceived by the respondents. These are very invasive exotic species in Italy [15], which quickly spread both by seeds and by suckers [16,17]. Both propagation mechanisms enable the rapid consolidation of these plants in new areas and justify the responses of our survey respondents.

5. Conclusions

The management and conservation of trees in urban areas require a holistic approach aimed at historical and cultural landscape conservation. In the present study, it was highlighted that people's perceptions can support decision making in urban landscape planning in the Bay of Naples, one of the most densely populated and urbanized areas in Europe. Furthermore, the proposed survey method can be tested and applied to other urban areas of the world.

Supplementary Materials: The poster presentation is available online at https://www.mdpi.com/article/10.3390/BDEE2021-09446/s1.

Author Contributions: A.S. conceived, designed and coordinated the study; A.S. analyzed the data; A.S. writing—original draft preparation; A.S., L.M. and A.E. writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors are very grateful to the survey respondents for providing valuable information.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Akbari, H.; Pomerantz, M.; Taha, H. Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. *Sol. Energy* **2001**, *70*, 295–310. [CrossRef]
2. Nowak, D.J.; Crane, D.E.; Stevens, J.C. Air pollution removal by urban trees and shrubs in the United States. *Urban For. Urban Green.* **2006**, *4*, 115–123. [CrossRef]
3. Georgi, N.J.; Zafiriadis, K. The impact of park trees on microclimate in urban areas. *Urban Ecosyst.* **2006**, *9*, 195–209. [CrossRef]
4. Berlanda, A.; Shiflettb, S.A.; Shusterc, W.D.; Garmestanic, A.S.; Goddardc, H.C.; Herrmannd, D.L.; Hoptonc, M.E. The role of trees in urban stormwater management. *Landscape Urban Plan.* **2017**, *162*, 167–177. [CrossRef]
5. Ferrini, F.; Fini, A.; Mori, J.; Gori, A. Role of vegetation as a mitigating factor in the urban context. *Sustainability* **2020**, *12*, 4247. [CrossRef]
6. Ossola, A.; Jenerette, J.D.; McGrath, A.; Chow, W.; Hughes, L.; Leishman, M.R. Small vegetated patches greatly reduce urban surface temperature during a summer heatwave in Adelaide, Australia. *Landsc. Urban Plan.* **2021**, *209*, 104046. [CrossRef]
7. Schroeder, H.; Flannigan, J.; Coles, R. Residents' attitudes toward street trees in the UK and U.S. communities. *Arboric. Urban For.* **2006**, *32*, 236–246.
8. Wang, Y.-C.; Lin, J.-C.; Liu, W.-Y.; Lin, C.-C.; Ko, S.-H. Investigation of visitors' motivation, satisfaction and cognition on urban forest parks in Taiwan. *J. For. Res.* **2016**, *21*, 261–270. [CrossRef]
9. Japelj, A.; Mavsar, R.; Hodges, D.; Kovač, M.; Juvančič, L. Latent preferences of residents regarding an urban forest recreation setting in Ljubljana, Slovenia. *For. Policy Econ.* **2016**, *71*, 71–79. [CrossRef]
10. Sebastiani, A.; Buonocore, E.; Franzese, P.P.; Riccio, A.; Chianese, E.; Nardella, L.; Manes, F. Modeling air quality regulation by green infrastructure in a Mediterranean coastal urban area: The removal of PM10 in the Metropolitan City of Naples (Italy). *Ecol. Modell.* **2021**, *440*, 109383. [CrossRef]
11. Stinca, A.; Motti, R. The vascular flora of the Royal Park of Portici (Naples, Italy). *Webbia* **2009**, *64*, 235–266. [CrossRef]
12. Mutke, S.; Calama, R.; González-Martinez, S.; Montero, G.; Gordo, J.; Bono, D.; Gil, L. Mediterranean stone pine: Botany and horticulture. *Hortic. Rev.* **2012**, *39*, 153–202.
13. Ricciardi, M.; Motti, R.; Stinca, A. *Flora illustrata del Vesuvio. Storia, paesaggi, vegetazione*; Doppiavoce: Napoli, Italy, 2016; p. 197.
14. Manachini, B.; Billeci, N.; Palla, F. Exotic insect pests: The impact of the Red Palm Weevil on natural and cultural heritage in Palermo (Italy). *J. Cul. Herit.* **2013**, *14*, e177–e182. [CrossRef]
15. Galasso, G.; Conti, F.; Peruzzi, L.; Ardenghi, N.M.G.; Banfi, E.; Celesti-Grapow, L.; Albano, A.; Alessandrini, A.; Bacchetta, G.; Ballelli, S.; et al. An updated checklist of the vascular flora alien to Italy. *Plant Biosyst.* **2018**, *152*, 556–592. [CrossRef]
16. Kowarik, I.; Säumel, I. Biological flora of Central Europe: *Ailanthus altissima* (Mill.) Swingle. *Perspect. Plant Ecol. Evol.* **2007**, *8*, 207–237. [CrossRef]
17. Nicolescu, V.-N.; Rédei, K.; Mason, W.L.; Vor, T.; Pöetzelsberger, E.; Bastien, J.-C.; Brus, R.; Benčať, T.; Đodan, M.; Cvjetkovic, B.; et al. Ecology, growth and management of black locust (*Robinia pseudoacacia* L.), a non-native species integrated into European forests. *J. For. Res.* **2020**, *31*, 1081–1101. [CrossRef]