Urban Orchards and Different Fruitification Seasons: Observations to Create a Calendar.

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Abstract. Some species used in urban tree planting may have different fruiting seasons. For twelve months, monitoring and recording was carried out in a neighborhood of Porto Alegre, Rio Grande do Sul, Brazil, to produce a fruiting calendar. Pitango tree (*Eugenia uniflora* L.), red guava (*Psidium guajava* L.) and jaboticaba tree (*Plinia cauliflora* (Mart.) Kausel) showed greater asynchrony in relation to the phenological stages for different individuals, in the same space-time section. Specimens were observed in the vegetative, flowering, early fruiting, and ripe fruit stages, as well as a reduction in the variety and quantity of fruit available during the colder months.

Keywords. green urban areas, landscaping, environmental analysis.

1. Introduction

The choice of plant species for urban green areas should ideally take into account certain technical criteria, such as crown architecture, root system structure, maximum growth height, conflict with external wiring, resistance to wind gusts, flower production and aesthetic effect, among others [1][2].

Ecological variables, however, are increasingly being taken into account when selecting species suitable for urban tree planting [3]. An example of this is the choice of native seedlings capable of connecting remaining forest fragments, as well as producing fruit that can be consumed by both humans and urban fauna [4] [5].

In this respect, the city of Porto Alegre, capital of the state of Rio Grande do Sul, in the far south of Brazil, has been a highlight in recent decades [6]. Considered one of the cities with the most scattered trees in its urban fabric, among those with more than one million inhabitants, the public administration has encouraged the planting of fruit-bearing species, whether native to the Atlantic Forest Biome or exotic, rather than using only trees that bring aesthetic value to the landscape [7].

The scientific question that this research sought to answer was whether trees of the same species have a simultaneous fruiting season, within the time frame considered, based on a similar environmental context.

The goal is to produce a calendar that could serve as a guide do the public administration and comunity.

2. Method

2.1 Spatial cut-out

The study area selected was the Jardim Lindóia neighborhood, located in the north of the city of Porto Alegre. With a spatial dimension of 32 hectares, the neighborhood began to show accelerated real estate development from the 1970s onwards, and was originally part of a dairy farm.

The neighborhood's public squares were located using georeferencing software and validated by technical field visits. All the fruit species were then identified, so that the frequency and period of monitoring could be defined. Fruit trees located on sidewalks were also considered in this work - Figure 1.

Fig. 1 – An example of butia (*Butia capitata*) located in an public square. It is a very important native species from Pampa Biome. Image source: Vieira, C.L. (2022).

2.2 Data collection

Over the course of twelve months, February 2022 and January 2023, daily inspections were carried out in all the areas of interest in the neighborhood, with the aim of checking fruit production and flowering in the species listed above. The photographic record was organized in a digital collection, containing written specifications of the species, so that a spreadsheet could be drawn up with the monthly fruiting calendar, containing the exact location of each seedling.

In addition, information was recorded on the orientation and incidence of solar radiation, topography, population access, soil cover and consumption by animals.

2.3 Study area

The Jardim Lindóia neighborhood is located in the North Zone of Porto Alegre, close to Salgado Filho International Airport, bordered by two important avenues, Assis Brasil and Sertório. It has five public squares, as well as several other green areas, such as central avenue beds and tree-lined easements - Figure 2.

Fig. 2 – Localization of the study area, highlighting the delimitation of Jardim Lindóia neighborhood. Image source: Google Earth Pro. Author: Vieira, C.L. (2024)

3. Results

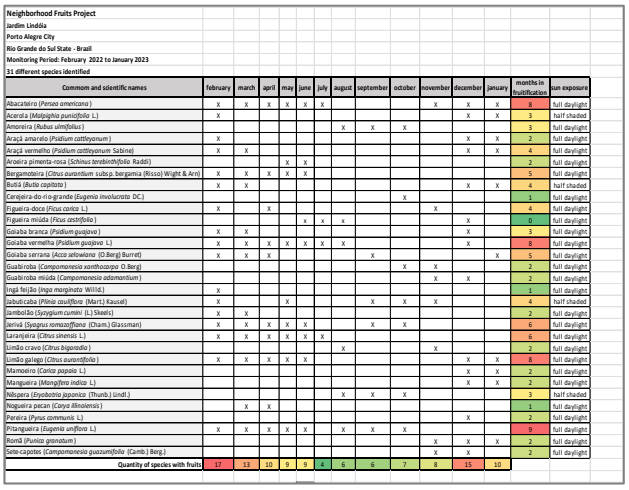
A total of 31 species of fruit trees were monitored, with emphasis on species native to the Atlantic Forest Biome and Pampa Biome: mountain guava (*Acca selowiana* (O.Berg) Burret), guabiroba (*Campomanesia xanthocarpa* O.Berg), red guava (*Psidium guajava* L.), butia (*Butia capitata*), jaboticaba tree (*Plinia cauliflora* (Mart.) Kausel), red araça (*Psidium cattleyanum* Sabine), yellow araça (*Psidium cattleyanum*), pitango tree (*Eugenia uniflora* L.), big river cherry (*Eugenia involucrata* DC.), jeriva, (*Syagrus romazoffiana* (Cham.) Glassman), seven cloacks (*Campomanesia guazumifolia* (Camb.) Berg.), small fig tree (*Ficus cestrifolia*), inga beans (*Inga marginata* Willd.), and red mastic tree (*Schinus terebinthifolia* Raddi).

The months with the highest number of fruiting species were: february (17), march (13), april (10) and december 2022 (15), in addition to january 2023 (10). The average for the months with the least fruiting, may to november, was 8,1 with the median 9,0 for the 31 species considered.

The species with the highest frequency of fruiting, i.e. months of the year with the presence of fruit, were: pitango tree[a] (*Eugenia uniflora* L.), followed by avocado tree[b] (*Persea americana*), Galician lemon[b] (*Citrus aurantifolia*), and red guava[b] (*Psidium guajava* L.), with nine[a] and eight[b] months, respectively.

The fruit-bearing trees with the shortest fruiting time over the time monitored were big river cherry (*Eugenia involucrata* DC.), inga beans (*Inga marginata* Willd.), and pecan walnut (*Carya illinoiensis*), in only one month of the year. Next up, the species yellow araça (*Psidium cattleyanum*), red mastic tree (*Schinus terebinthifolia* Raddi), guabiroba (*Campomanesia xanthocarpa* O. Berg), small guabiroba (*Campomanesia adamantium*), jambolan (*Syzygium cumini* (L.) Skeels), clove lemon (*Citrus bigaradia*), papaya (*Carica papaia* L.), mango tree (*Mangifera indica* L.), pear tree (*Pyrus communis* L.), romã (*Punica granatum*), and seven cloacks (*Campomanesia guazumifolia* (Camb.) Berg), with only two months of fruiting.

As a summary product, a fruiting calendar was produced for the tree species monitored in the Jardim Lindóia neighborhood - Figure 3.



Neighborhood Fruits Project
Jardim Lindóia
Porto Alegre City
Rio Grande do Sul State - Brazil
Monitoring Period: February 2022 to January 2023
31 different species identified

Common and scientific names	february	march	april	may	june	july	august	september	october	november	december	january	months in fruitification	sun exposure
Abacateiro (*Persea americana*)	x	x	x	x	x	x				x	x	x	8	full daylight
Acerola (*Malpighia punicifolia* L.)	x										x	x	3	half shaded
Amoreira (*Rubus ulmifolius*)						x	x	x					3	full daylight
Araçá amarelo (*Psidium cattleyanum*)	x										x	x	2	full daylight
Araçá vermelho (*Psidium cattleyanum* Sabine)	x	x									x	x	4	full daylight
Aroeira pimenta-rosa (*Schinus terebinthifolia* Raddi)			x	x									2	full daylight
Bergamoteira (*Citrus aurantium* subs.p. bergamia (Risso) Wight & Arn)	x	x	x	x	x								5	full daylight
Butiá (*Butia capitata*)	x	x									x	x	4	half shaded
Cerejeira-do-rio-grande (*Eugenia involucrata* DC.)									x				1	full daylight
Figueira-doce (*Ficus cotica* L.)	x		x							x			4	full daylight
Figueira miúda (*Ficus cestrifolia*)					x	x	x				x		6	full daylight
Goiaba branca (*Psidium guajava*)	x	x									x		3	full daylight
Goiaba vermelha (*Psidium guajava* L.)	x	x	x	x	x	x	x				x		8	full daylight
Goiaba serrana (*Acca selowiana* (O.Berg) Burret)	x	x	x					x				x	5	full daylight
Guabiroba (*Campomanesia xanthocarpa* O.Berg)									x	x			2	full daylight
Guabiroba miúda (*Campomanesia adamantium*)										x	x		2	full daylight
Ingá feijão (*Inga marginata* Willd.)	x												1	full daylight
Jaboticaba (*Plinia cauliflora* (Mart.) Kausel)	x			x				x	x	x			4	half shaded
Jambolão (*Syzygium cumini* (L) Skeels)	x	x											2	full daylight
Jerivá (*Syagrus romazoffiana* (Cham.) Glassman)	x	x	x	x				x	x				6	full daylight
Laranjeira (*Citrus sinensis* L.)	x	x	x	x	x	x							6	full daylight
Limão cravo (*Citrus bigaradia*)						x				x			2	full daylight
Limão galego (*Citrus aurantifolia*)	x	x	x	x	x						x	x	8	full daylight
Mamoeiro (*Carica papaia* L.)											x	x	2	full daylight
Mangueira (*Mangifera indica* L.)											x	x	2	full daylight
Nêspera (*Eryobotria japonica* (Thunb.) Lindl.)						x	x	x					3	half shaded
Nogueira pecan (*Carya illinoiensis*)		x	x										1	full daylight
Pereira (*Pyrus communis* L.)											x		2	full daylight
Pitangueira (*Eugenia uniflora* L.)	x	x	x	x	x		x	x	x				9	full daylight
Romã (*Punica granatum*)										x	x	x	3	full daylight
Sete-capotes (*Campomanesia guazumifolia* (Camb.) Berg.)										x	x		2	full daylight
Quantity of species with fruits	17	13	10	9	9	6	6	6	7	8	15	10		

Fig. 3 – Fruitification chart containing the 31 identified species and months of production using the software Microsoft Word Excel 365. Author: Vieira, C.L. (2023).

3.1 Discussion

The Jardim Lindóia neighborhood has an altimetric difference of 21 meters, with the lowest areas adjacent to Sertório Avenue, approximately seven meters above sea level. The highest areas are near Paulo Bento Lobato Street, and towards Assis Brasil Avenue, about 28 meters above base level.

Analyzing the differences in the occurrence of fruiting, it was possible to notice, firstly, important phenological asynchronies. Specimens of the same species with similar physiological maturity often had fruitless individuals, individuals with flowers only and individuals with mature fruit in close proximity

to each other, on the same day that the photographs were taken.

The presence of fruit trees among residential areas can play a fundamental role in preserving cultural knowledge and offering supplement feeding option to the urban fauna [8] and for the population, especially the poorest [9]. However, it is important to highlight that some species have potential to cause allergies or even act as inhibitor to the growing of other species [10].

Taking the red araça species (*Psidium cattleyanum* Sabine) as an example, in February 2022 individuals with fruit were recorded in five locations throughout the neighborhood, both in the higher and lower areas. In March 2022, specimens with fruit were only recorded in one location, near Sertório Avenue, a lower altitude area. A similar reductive behavior occurred with the pitango tree (*Eugenia uniflora* L.), with specimens with fruit recorded in seven locations scattered throughout the neighborhood in February 2022, while in March 2022, individuals with fruit were recorded in only three locations, near Assis Brasil Avenue, the highest altitude area. Both were located in the open and predominantly on sidewalks.

This pattern of reduction in the number of sites was repeated for most of the species that showed fruiting in both February and March 2022. This may be related to the decline in the rate of incident solar radiation due to the seasonal transition from summer to fall or even to another factor impacting the trees development [11].

In April, May and June, it is possible to notice the fruiting of species that traditionally have a productive stage in the months with lower temperatures, such as the Galician lemon (*Citrus aurantifolia*), the orange (*Citrus sinensis* L.) and the bergamot (*Citrus aurantium* subsp. bergamia (Risso) Wight & Arn), although they are located in only a few spots in the neighborhood, in one or two places.

Although these citrus trees are exotic plants, they may be closely related to the previous use of the land as a dairy farm, having lots of fruits and vegetables [12].

The month of July 2022 presented a void in terms of fruiting, with only one or two sites in the vicinity for the species red guava (*Psidium guajava* L.), orange (*Citrus sinensis* L.) and avocado (*Persea americana*).

As of August 2022, there was a 100% increase in the number of fruiting species compared to the previous month, with small increases in October and November of the same year, consistent with the end of winter and beginning of spring. The month of December has almost twice as many species producing fruit as the month of November and, together with the month of February, represents the apex in terms of diversity of fruiting species at the same time.

In other words, the summer season has a greater number of species capable of bearing fruit, which could be an indication when planning urban tree planting for the city.

Covering urban surfaces with trees promotes not only benefits regarding to feeding but it also could be used as a strategy to help reducing impacts derived from climate changes like heat islands, and microclimate balance [13], [14].

During the period in which I carried out this research, many people stopped me asking about the plants I was recording, specially when I was eating some fruits from native species. They often were curious about the nutritional potential, about the plant, and it became clear that a significant part of the population just doesn't know about native trees, and thinks that the fruits are poison.

Promoting a multifunctional context in urban and peri-urban areas is an emerging paradigm worldwide as a response to growing urbanization and loss of natural areas [15]. Bringing the population together through public information can be a good strategy as urban green areas affects quality of life [16], [17].

4. Conclusion

There is a need to incorporate more species with the possibility of fruiting in the low temperature months, fall and winter, to contribute to a greater supply of food for urban fauna and reduce their nutritional deficit.

In relation to our scientific question, it was evident that the species fruit in different places and at different times, with a longer fruiting period for the same species throughout the year, unlike the behavior observed in commercial monocultures, where there is a standardization of flowering and fruiting periods. This is beneficial for urban fauna, food, and ecological relationships such as pollination.

We hope that this work will inspire the development of an open-access manual for identifying and locating fruit species, indicating their ecological role, nutritional value, and medicinal properties. This will certainly contribute to the environmental education of the population.

5. Acknowledgement

I would like to thank the Federal University of Juiz de Fora, Minas Gerais, Brazil, especially the coordinator of the geography course, who gave me the opportunity to resume my academic career through this new degree.

This whole article in english version was translated with ww.DeepL.com/Translator (free version).

6. References

[1] de Oliveira Boeni, B., Silveira, D. Diagnóstico da arborização urbana em bairros do município de Porto Alegre, RS, Brasil. *Revista da Sociedade*

Brasileira de Arborização Urbana, 2011; 6(3): 189-206.

[2] Mascaro, J. J. Significado ambiental-energético da arborização urbana. RUA: *Revista de urbanismo e arquitetura*. 2006; 7(1): 32 – 37.

[3] Schütt, A., Becker, J. N., Gröngröft, A., Schaaf-Titel, S., Eschenbach, A. Soil water stress at young urban street-tree sites in response to meteorology and site parameters. *Urban Forestry & Urban Greening*, 75, 127692, 2022; 13 p.

[4] Rada, P., Halda, J. P., Holuša, J., Maliňáková, K., Horák, J. Urban fruit orchards: Biodiversity and management restoration effects in the context of land use. *Urban Forestry & Urban Greening.* 2022; 75, 127686.

[5] Kowalski, J. M., & Conway, T. M. The routes to fruit: Governance of urban food trees in Canada. *Urban Forestry & Urban Greening*. 2023; 86, 128045.

[6] Tomasini, S. L. V., Cassol, B., Oliveira, F. B., Puente, A. D. Arborização urbana: paisagem cultural de Porto Alegre? In *Congresso Brasileiro de Arborização Urbana* (24.: 2022: Campo Grande, MS). A floresta urbana viva [recurso eletrônico]. Campo Grande: SBAU, ISA, UFMS. 2022; 202-207.

[7] da Silva, V., Gonçalves, R. P. B., Cortez, L. S. R. *Educação Ambiental como ferramenta para a manutenção da arborização urbana de Porto Alegre-RS*. 2008; 5 p.

[8] Silva, P. A., Silva, L. L., Brito, L. Using bird-flower interactions to select native tree resources for urban afforestation: the case of Erythrina velutina. *Urban forestry & urban greening*. 2020; 51, 126677; 51 p.

[9] Sartori, R. A., Martins, G. A. C., Zaú, A. S., Brasil, L. S. C. Urban afforestation and favela: a study in a community of Rio de Janeiro, Brazil. *Urban forestry & urban greening.* 2019; 40, 84-92.

[10] Lima Nogueira, M., Alves Campos, N., dos Santos, S. C., Beijo, L. A., Barbosa, S. The species used in urban afforestation can present phytotoxicity-a case of study of Schinus molle L. *Ciência Florestal.* 2021; (01039954), 31(1).

[11] Paiva, P. D. D. O., Reis, M. V. D., Sousa, R. D. B., Ferraz, R. M., & Salgado, M. D. C. R. Performance of native species in urban afforestation of public pathways in Lavras-MG, Brazil. *Ornamental Horticulture*. 2022; 28, 161-171.

[12] Biasi, R., Brunori, E. Agrobiodiversity-Based Landscape Design in Urban Areas. *Plants*. 2023; 12(24), 4121, 24 p.

[13] Chakraborty, T., Biswas, T., Campbell, L. S., Franklin, B., Parker, S. S., Tukman, M. Feasibility of afforestation as an equitable nature-based solution in urban areas. *Sustainable Cities and Society*, 2022; 81, 103826, 81 p.

[14] Oldfield, E. E., Warren, R. J., Felson, A. J., Bradford, M. A. Challenges and future directions in urban afforestation. *Journal of Applied Ecology*, 2013; 50(5), 1169-1177.

[15] Rothwell, A., Ridoutt, B., Page, G., Bellotti, W. Feeding and housing the urban population: Environmental impacts at the peri-urban interface under different land-use scenarios. *Land Use Policy*, 2015; 48, 377-388. 48 p.

[16] Myers, N. The world's forests and human populations: The environmental interconnections. *Population and Development Review*, 1990; 16, 237-251.

[17] Jones, B. A. Planting urban trees to improve quality of life? The life satisfaction impacts of urban afforestation. *Forest Policy and Economics*, 2021; 125, 102408. 125 p.