Introduction to Trees and Accommodations prices in Paris

Nowadays, with global warming and constant ecological issues, it is more important than ever to build responsible and ecologically healthy cities. These Eco-Cities rely on four pillars: **Urban Design** (access to green spaces, basic urban services, and affordable housing), **Bio-Geo-Physical** (responsible management of resources and materials), **Socio-Cultural** (access to lifelong education), and **Ecological** (sustaining and restoring biodiversity of urban ecosystems). Trees and green areas are more than ever crucial for our communities, improving our quality of life both socially and for the mental and physical health of our citizens (1).

Unfortunately, with the constant expansion of cities in their surrounding territory called urban sprawling, natural green spaces are gradually eliminated from our landscape, leading to environmental issues such as heatwaves and bad air quality (1).

We need to ensure an adequate proportion of green networks in our urban landscape. To achieve that, we need to assess the relationship between tree locations and accommodation prices in the urban landscape. To better understand the distribution of accommodation prices in Paris, let us have a quick look at Paris district history!

Paris is divided into 20 districts called "arrondissements" (see fig. 1 below). This territorial division dates back to the French Revolution when, in 1795, the authorities decided to organize Paris into 12 arrondissements. The revolutions pushed the Parisian "elite" from the 3rd, 4th, and 5th districts to the 1st, 2nd, 6th, 7th, and 8th districts, leaving the area to a population of craftsmen and workers (2, 3). Then, in 1860, Paris incorporated its suburbs and created 8 new arrondissements (2, 3).

Nowadays, the older districts occupied by Paris "elite" in the past (1st, 2nd, 6th, 7th, 8th) tend to be the richer districts. Gentrification pushed the "new elite" of Paris to move to the 16th district, which is now known to be the richer areas of Paris, featuring some of the most expensive real estate in France. The northeast and southeast districts (9th to 20th except 16th) were historically hosting immigrants and working-class and are still nowadays poorer than the center and west of Paris (2, 3).

Because green areas improve the quality of life within a community, and because they are more and more scarce in the urban landscape, my hypothesis is that accommodation near green spaces should have a higher price. In other words, the richer neighborhoods of Paris (1st, 2nd, 6th, 7th, 8th, and 16th) should have more trees.
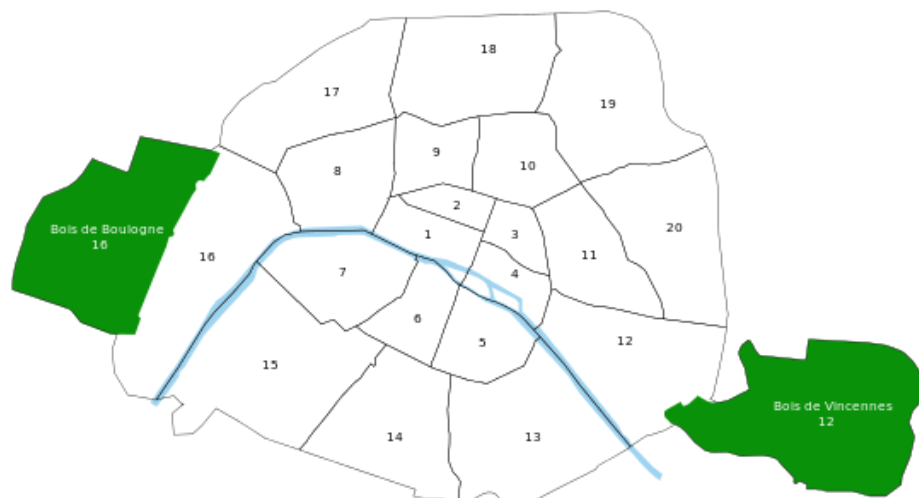

Figure 1: Map of Paris districts

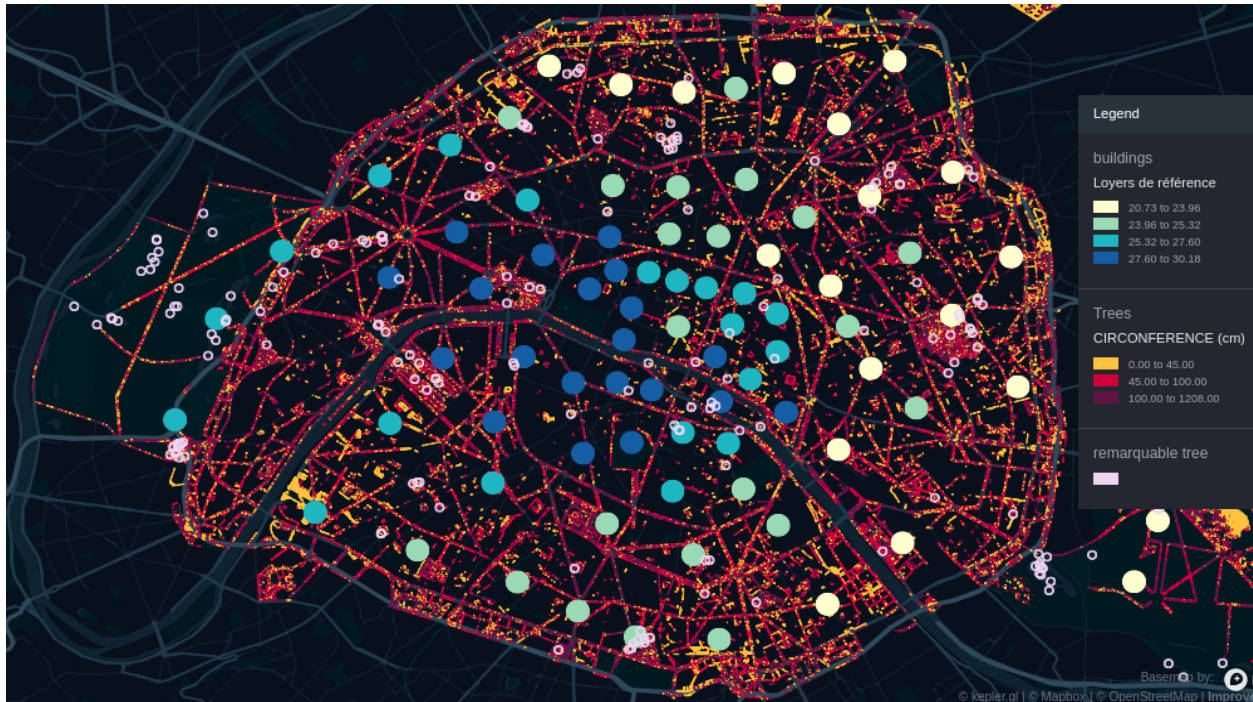# Discussion to Trees and Accomodations in Paris

Figure 2: Map of Paris showcasing localisation of every trees of the city with information on tree trunks' girth (yellow: younger tree, red & purple: older tree), showcasing accommodations prices per square meter of different neighborhood (blue: higher prices, light green and yellow: lower prices). Tree trunks' girth is used to asses the age of the tree, younger tree will have low girth, older trees will have wide girth. Remarquable trees are showcased by a white circle on the map.

To assess the relationship between tree locations and accommodation prices in the urban landscape, I used Google Colab to write and execute a python notebook through the browser. I used the Kepler.Gl library for base map and localisation plotting. I plotted the average price per square meter of accommodations per neighborhood (fig. 2 above). You can find the code and raw data on my GitHub here.

We see on figure 2 that historically richer neighborhoods of Paris (1st, 2nd, 6th, 7th, 8th, and 16th) have less trees, and more expensive accommodation prices than historically poorer areas (east districts). Compared to the east districts (9th to 20th), west districts have close to no young trees (small girth trees). Historically poorer areas have less expensive accommodation prices and more young and old trees, potentially meaning that historically, trees were not considered as a delicacy reserved for Paris "elite". The presence of young trees is probably due to gentrification of the historically poorer neighborhood, and the political values shared by its inhabitants. Political values in those areas are often centered on society/human equality and urban development, ecology. It makes sense for the *Mairies d'arrondissements* to keep preserving green areas and plant new trees for the ecological health of the neighborhood in order to please their inhabitants. Whereas political values of richer district are often more centered on capita and less on urban development and ecology, leading their *Mairies*

d'arrondissements to invest more time and money into keeping the street clean and secure, and less into preserving green areas and planting new trees, which might explain the disparity between the rich and poorer districts of Paris in terms of trees seniority and localization we observe.

We also notice that remarkable trees are more present in richer districts, where they are scattered in the street. Whereas in poorer areas they are concatenated around parks. This is another example of the disparity between Paris' districts.

The hypothesis appears to prove wrong, as the result showcases that trees are more scarce in richer neighborhoods, and poorer neighborhoods have on average way more young and old trees.

Although very interesting, these results are to be taken with hindsight.

First of all, the assessment of trees' seniority is not made by age of the trees or the date of the plantation, it was deduced by trees' girth. Because all tree species at maturity have different heights and girths, deducing the age of different species of tree by looking at the girth can be misleading in the case we are dealing with some species of trees with small girth. However, deducing the age of the tree by girth is still a well-known and functioning method (4). A more accurate conclusion of that study is that on average, poorer neighborhoods have way more big girth and small girth trees than richer neighborhoods.

Second of all, the accommodation and tree datasets were not shaped similarly. We had precise localization for each tree, and a precision of the arrondissement, but only an average localization of the neighborhood and no precise localization of each accommodation. Furthermore, accomodation dataset was preprocessed in a way to have equal proportions of accommodations in each neighborhood, meaning that we can not have any data or proportion of buildings in each neighborhood. The two datasets being not similarly shaped, they should not be used together to study their distribution.

Third of all, a map is not enough as a result to come to any conclusion. I would have needed to compute the distribution of the average accommodation prices per square meter of each district and the distribution of tree age, and calculate the robustness of the distribution. This way I could have concluded with stronger evidence that my hypothesis was wrong, and showcase this using the map visualisation on figure 2.

Fourthly, some trees are not encountered in the tree dataset. For example trees inside forests (Bois de Boulogne, Bois de Vincenne) are not present on the map, only the one present on the side of the road are. Furthermore, because this dataset is put together and shared by Ville de Paris, private trees and green spaces are not counted in the dataset. This obviously biases the accuracy of the dataset to acknowledge trees in Paris. But because the dataset comes from a reliable source with enough fundings (Paris state institution), we can consider the dataset well grounded.

Evaluated on:
- the choice of bias discussed
- the method proposed to prove there is a bias
- the anticipated consequence of the bias on your results
- recommendations proposed to mitigate the bias in future studies

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