NATIONAL PARKS
DEVELOPMENT COMMITTEE

A Narrative Report of the
Distribution and Thematic Mapping in the
Internship undertaken at the National Parks Development
Committee

NPDC Offices at The Old Planetarium

Rizal Park, Luneta

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BRIEF INTRODUCTION

Inventory, distribution, and thematic maps are crucial in urban parks, such as the Rizal Park Luneta, as these would serve as the basis for the overall management of green spaces in urban areas in terms of landscaping maintenance and tending operations. In this report, the generated inventory maps, distribution maps, and thematic maps by the UPLB student interns will be featured and discussed in detail. Specifically, the student interns created inventory maps for areas/gardens that were not included in the 2023 Inventory. This includes the left side of the Rizal monument consisting of the following areas: Gubat sa syudad, The Martyrdom of Dr. Jose Rizal, The Gallery, Chinese Garden, Luneta Bark Rangers Headquarters, Open-Air Auditorium, NPDC Office at the Old Planetarium, Chess Plaza, and Japanese Garden. Aside from these, the central promenade and the areas on the right side (Aguinaldo House and the Garden for the Elderly) were included since some other areas were covered by the interns last year, such as the Kanlungan ng Sining, Bachelors Garden, and Noli Me Tangere Garden, and as well as the Western section of the Rizal Park Luneta.

OVERVIEW

A. Overall Distribution of Fruit-Bearing Trees

Distribution maps of fruit-bearing trees were produced by identifying the fruit-bearing trees from the inventory data and importing them into QGIS. The fruit-bearing tree species extracted from the inventory data yield fruits used and consumed by humans or animals. A total of 16 maps were created. Fourteen maps showed the location of fruit-bearing trees in different gardens and areas of Rizal Park Luneta, one map for the entire Rizal Park, and one for Paco Park. Noli Me Tangere Garden and the Luneta Bark Rangers Headquarters were omitted because these areas do not have fruit-bearing trees.

Referring to **Figure 1**, the areas were colored based on the number of fruit-bearing trees. Red is for areas having 0 to 11 fruit trees; these include Gubat sa Syudad, The Martyrdom of Dr. Jose Rizal, The Gallery, Luneta Bark Rangers, Planetarium, Open-Air Auditorium, Chess Plaza, Central Promenade, Aguinaldo House, Garden for the Elderly, Kanlungan ng Sining, Bachelors, and Noli Me Tangere Garden. Light blue is for areas with 24 to 35 fruit trees, used only for the Chinese Garden. Blue is for areas with 36 to 47 fruit-bearing trees, such as the Western Section and Japanese Garden.
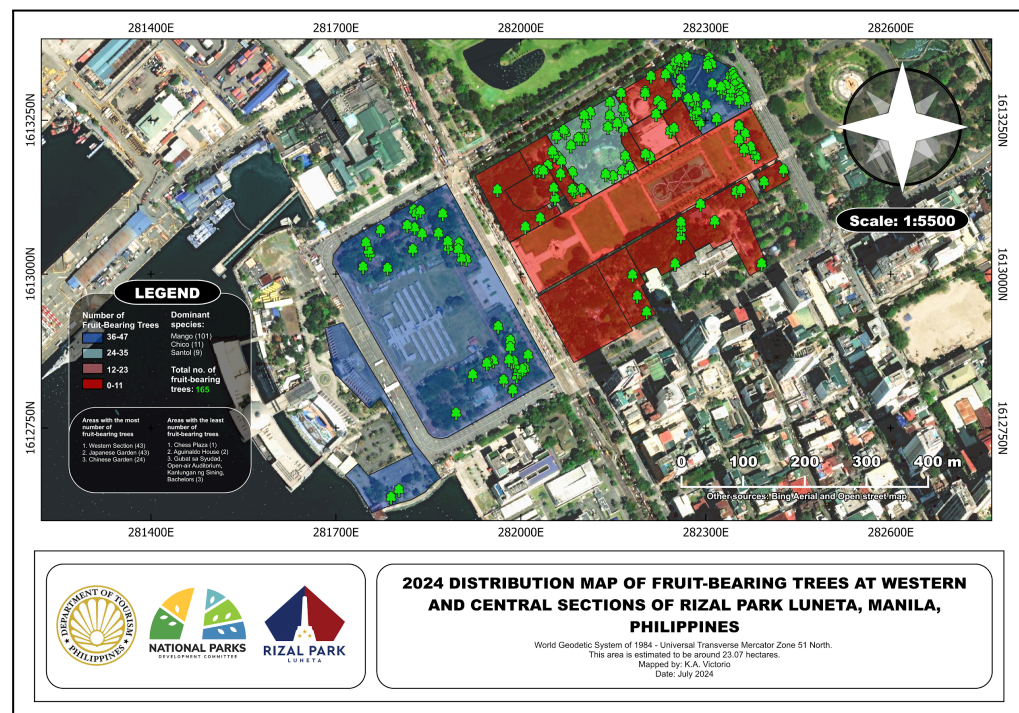
Figure 1. Distribution map of fruit-bearing trees at Rizal Park Luneta.

As shown in **Table 1**, there are a total of 165 fruit-bearing trees at Rizal Park Luneta, which include 19 species: Avocado, Balimbing, Bignay, Caimito, Chico, Durian, Guyabano, Kalamansi, Kamagong, Kamias, Langka, Lychee, Makopa, Mango, Rambutan, Santol, Bitter Orange, Suha, and Tamarind. The areas with the highest distribution of fruit-bearing trees are at Western Section (43 trees) and the Japanese Garden (43 trees), followed by the Chinese Garden (24 trees).

Table 1. The number of fruit-bearing trees in areas within Rizal Park Luneta.

| Area	Trees
Western section	43
Gubat sa Syudad	3
The Martyrdom of Dr. Jose Rizal	3
The Gallery	9
Chinese Garden	24
Planetarium	11
Open-Air Auditorium	**3**
Chess Plaza	1
Japanese Garden	43
Central Promenade	9
Aguinaldo House	2
Garden for the Elderly	6
Kanlungan ng Sining	3
Bachelors	3
Total	**165**

With the data gathered above, it was concluded that the three (3) fruit-bearing tree species with the most number of individuals in Rizal Park Luneta are: Mango (101), Chico (11), and Santol (9) (**Figure 3**).
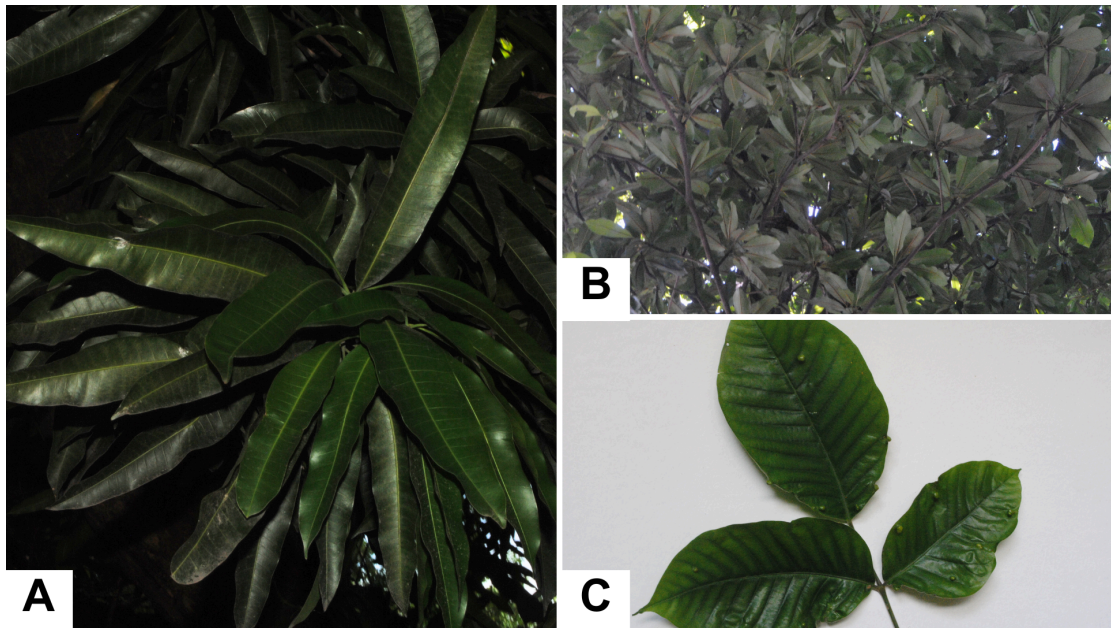
Figure 3. Top three dominant fruit-bearing tree species in Rizal Park Luneta: (A) Mango, (B) Chico, and (C) Santol.

B. Overall Distribution of Native Trees

For the native species, a total of 17 distribution maps were generated, including one general map for the whole of Rizal Park Luneta, one for Paco Park, and the rest for different areas within Rizal Park Luneta. The presentation of the distribution maps focused on the general map of Rizal Park Luneta. Color coding was applied on the map for the whole of Rizal Park Luneta to represent areas with varying numbers of native species to easily identify areas with high and low concentrations of native individuals (**Figure 4**). For Rizal Park Luneta, the color-coded classifications are as follows: areas with 373 to 75 native individuals are represented by dark blue, areas with 74 to 43 native individuals are represented by light blue, and areas with 42 to 24 native individuals are represented by dark red. These color schemes were agreed upon by the adviser and the person working on the distribution maps for native trees and palms.
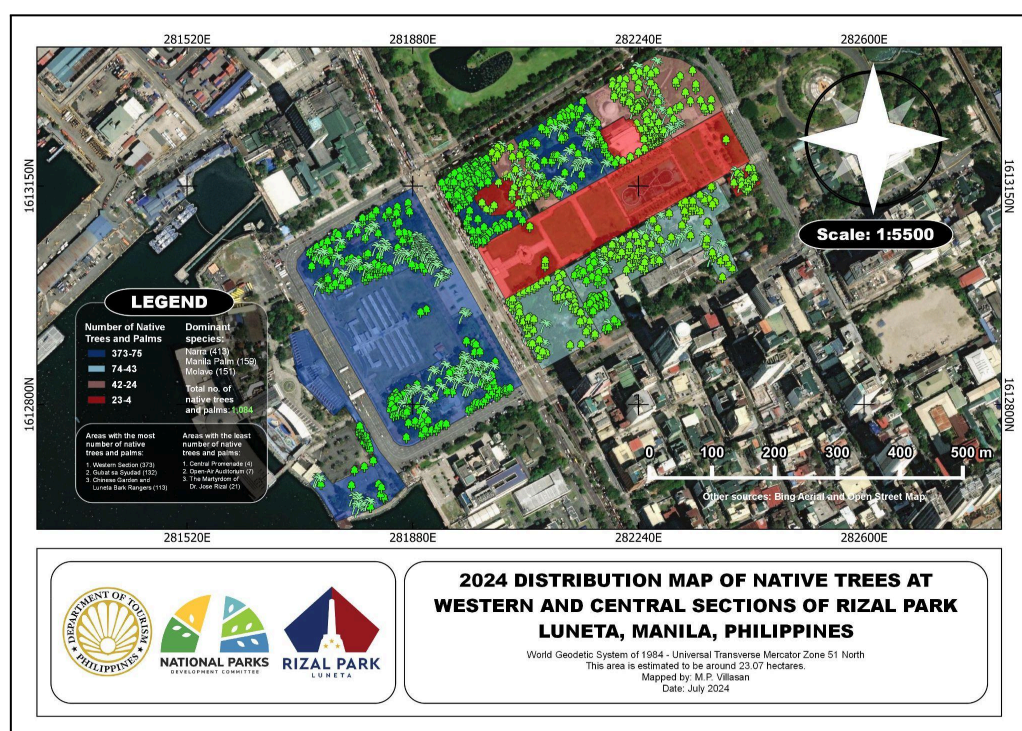
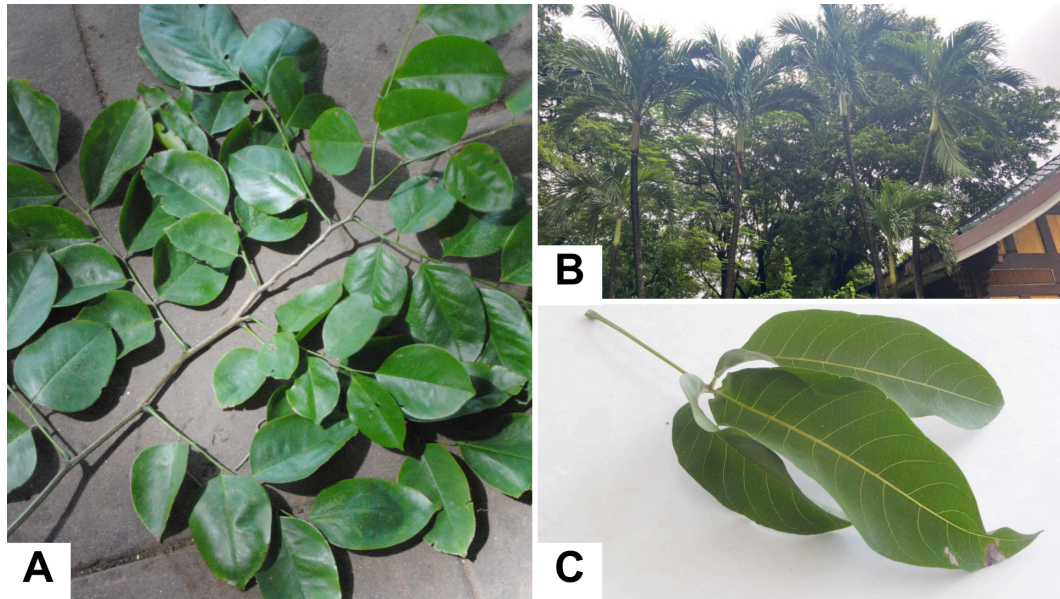**Figure 4.** Distribution map of native species at Rizal Park Luneta.

Furthermore, the number of trees and palms in each area within Rizal Park Luneta is shown in descending order in the table below.

Table 2. Number of native trees and palms in areas within Rizal Park Luneta

Area	Native Trees	Native Palms	Total
Western Section	237	136	373
Gubat sa Syudad	132	0	132
Chinese Garden and Luneta Bark Rangers	94	19	113
Noli Me Tangere Garden	70	4	74
Bachelor's Garden	54	9	63
Kanlungan ng Sining	48	8	56
Garden of the Elderly	40	16	56
Chess Plaza	42	0	42
Japanese Garden	25	14	39
Planetarium	38	2	40
The Gallery	27	14	41
Aguinaldo	21	2	23
The Martyrdom	21	0	21
Open-air auditorium	7	0	7
Central promenade	4	0	4

Figure 5 exhibits the top 3 dominant native species namely Narra (413 individuals), Manila Palm (159 individuals), and Molave (151).


Figure 5. Top 3 dominant native species found in Rizal Park Luneta: (A) Narra, (B) Manila Palm, and (C) Molave.

C. Overall Distribution of Exotic Trees

Distribution maps for exotic trees and palms in Rizal Park Luneta and Paco Park use a color-coded system across 17 maps. The Western section is highlighted in dark red for its diversity. At the same time, areas like Aguinaldo, Bachelor, Chess, Gallery, Japanese, Martyrdom, Open-air, and Planetarium are dark blue, indicating lower species concentrations. Central, Gubat, Kanlungan, and the Chinese Garden with Bark Rangers Headquarters are light blue, showing moderate concentrations. Noli Me Tangere Garden is light red, reflecting specific species concentration. These are further exhibited in **Figure 6**.
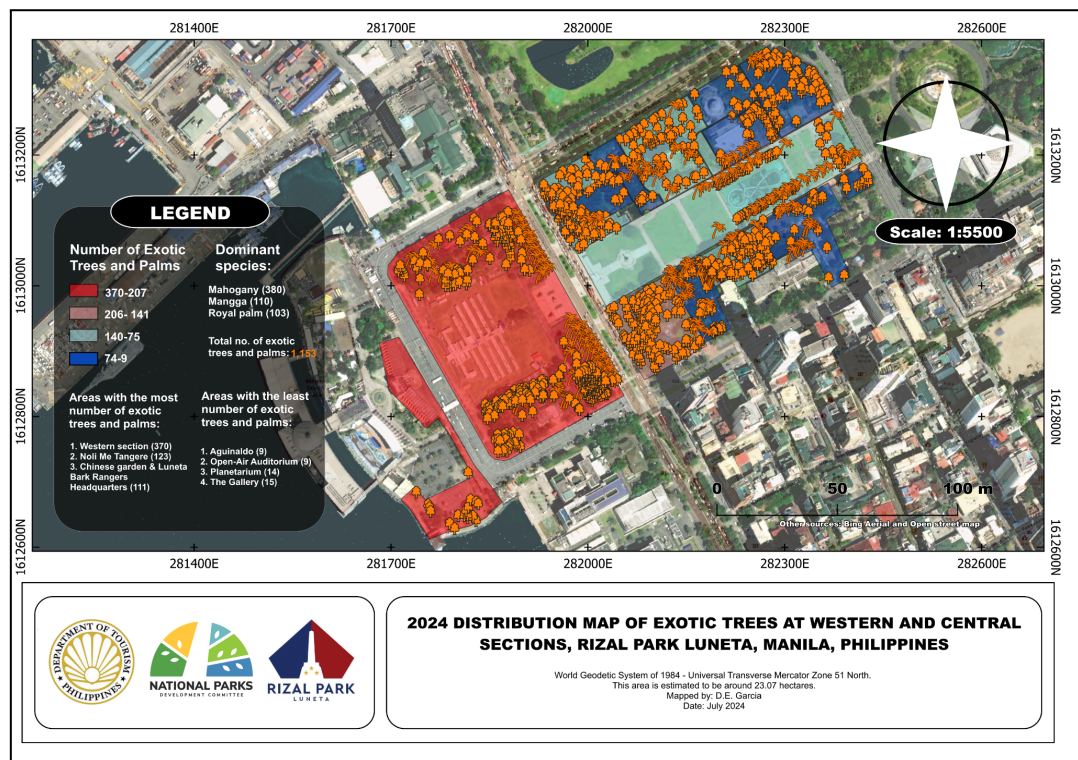
**Figure 6.** Distribution map of exotic species at Rizal Park Luneta.

With the maps generated, results suggest that the Western section of Rizal Park Luneta has the highest diversity with 370 species, followed by Noli Me Tangere Garden with 123 species, and Chinese Garden and Bark Rangers Headquarters with 111 species each. **Table 3** shows the number of exotic tree and palm species found in all the areas in Rizal Park Luneta.

Table 3. Number of exotic trees and palms in areas within Rizal Park Luneta.

| Area	Exotic Trees	Exotic Palms	Total
Western Section	321	41	362
Gubat sa Syudad	80	2	82
Chinese Garden and Luneta Bark Rangers	103	8	111
Noli Me Tangere Garden	123	0	123
Bachelor's Garden	34	20	54
Kanlungan ng Sining	75	31	106
Garden of the Elderly	30	15	45
Chess Plaza	25	0	25
Japanese Garden	67	2	69
Planetarium	14	0	14
The Gallery	11	4	15
Aguinaldo	9	0	9
The Martyrdom	21	0	21
Open-air auditorium	4	5	9
Central promenade	67	23	90

With this, it was found that the key exotic species include Mahogany (380), Mango (110), and Royal palm (103) (**Figure 7**).
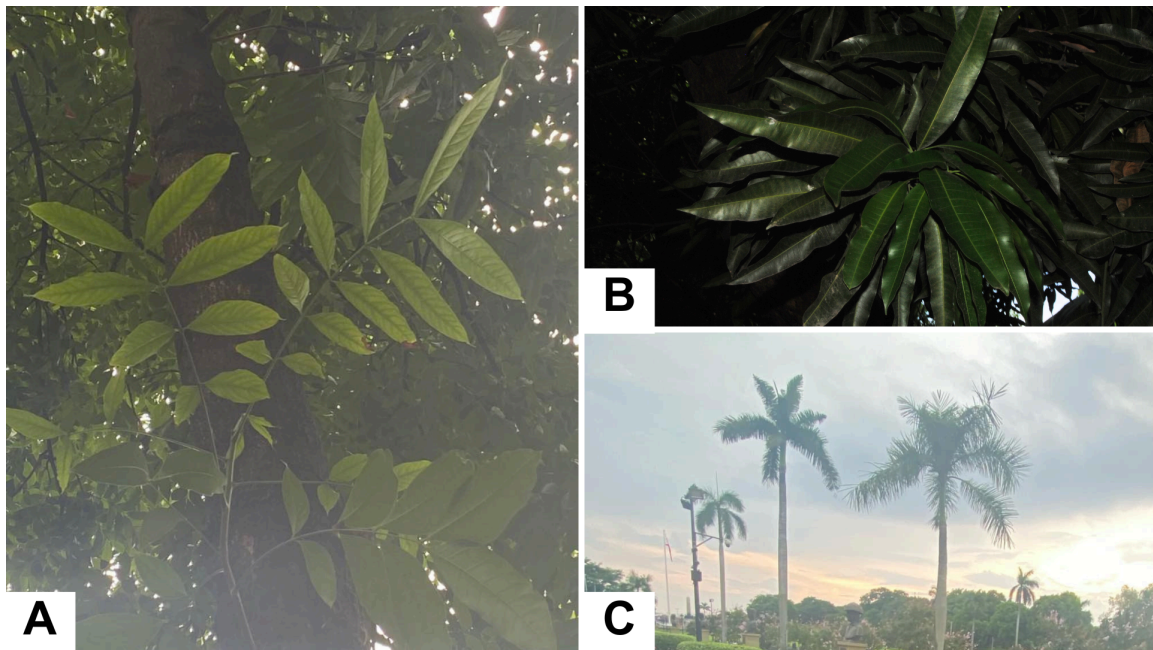
Figure 7. Key exotic species in Rizal Park Luneta: (A) Mahogany, (B) Mango, (C) Royal Palm.

D. Thematic Map of Tree Risk Rating

The thematic mapping was accomplished by putting the data into the QGIS and categorizing the symbol by emphasizing the risk rating levels of the trees inside the park. Similar to the distribution maps, the construction of the thematic map of the whole park utilized the data acquired from the inventory conducted in 2023 and 2024. Overall, there were a total of 17 thematic maps created including 14 separate areas or gardens, 1 map for the Chinese Garden and Luneta Bark Rangers Headquarters, 1 map for the whole Rizal Park Luneta, and 1 map for Paco Park. With the generated maps, it was found that the top 3 areas with low risk include the Western Section (634), Noli Me Tangere Garden (169), and Kanlungan ng Sining (150). As for the top 3 areas with moderate-risk ratings, results suggest that these consist of the following: Gubat sa Syudad (73), Western Section (66), and Chinese Garden (55). On the other hand, the top 3 high-risk ratings include the Western Section (44), Japanese Garden (28), and Chinese Garden (25). In line with this, the areas with extreme ratings involve the Garden for the Elderly (4), Chinese Garden (3), Gubat sa Syudad (1), and Japanese Garden (1).
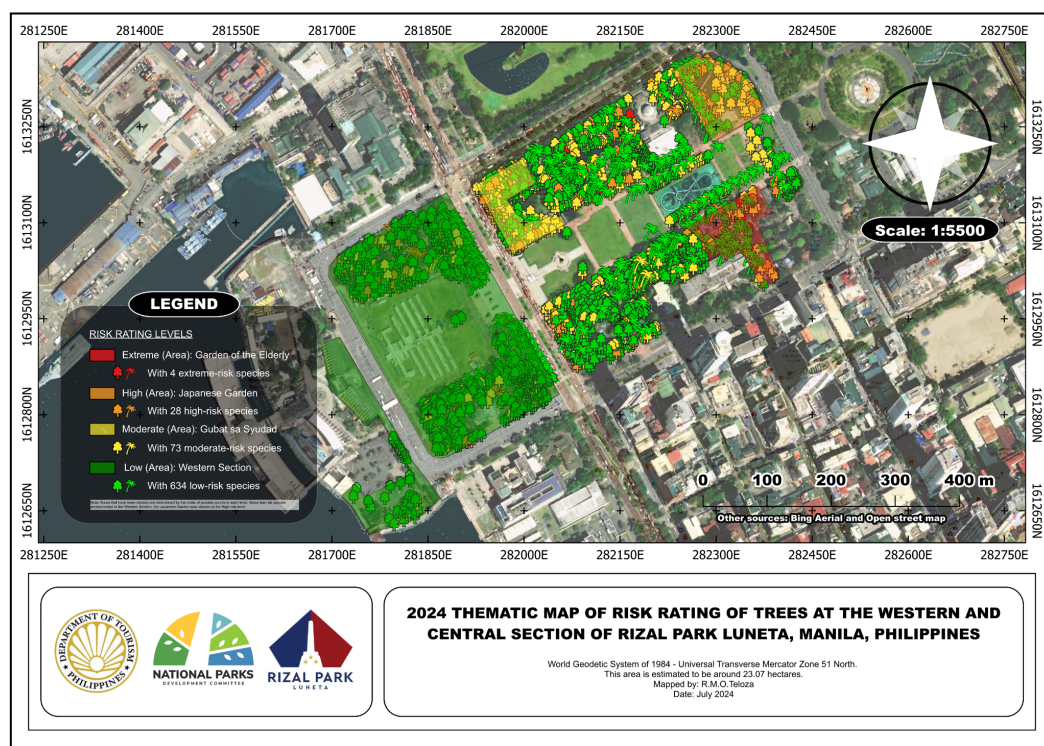
Figure 8. Thematic Map of Risk Rating of Species at Rizal Park Luneta.

To further visualize the aforementioned results, **Table 4** exhibits the risk rating levels of species in Rizal Park Luneta.

Table 4. Risk Rating Levels of Species in Areas within Rizal Park Luneta

Area	Low	Moderate	High	Extreme	Unknown	Total
Western Section	634	66	44	0	21	**765**
Gubat sa Syudad	129	73	25	1	0	**228**
Luneta Bark Rangers	40	6	0	0	0	**46**
Chinese Garden	106	55	14	3	0	**178**
Noli Me Tangere Garden	169	37	16	0	0	**222**
Bachelor's Garden	103	17	6	0	0	**126**
Kanlungan ng Sining	150	21	9	0	0	**180**
Garden of the Elderly	57	30	10	4	0	**101**
Chess Plaza	47	18	2	0	0	**67**
Japanese Garden	38	42	28	1	0	**109**
Planetarium	18	31	5	0	0	**54**
The Gallery	45	6	4	0	0	**55**
Aguinaldo	25	3	4	0	0	**32**
The Martyrdom	25	15	2	0	0	**42**
Open-air auditorium	16	0	0	0	0	**16**
Central promenade	61	33	0	0	0	**94**
Total	**1663**	**453**	**169**	**9**	**21**	**2315**

Table 5 shows the summarized data in line with the ranked areas based on risk rating level. It can be seen that the top 3 areas with low risk include the Western Section (634), Noli Me Tangere Garden (169), and Kanlungan ng Sining (150). As for the top 3 areas with moderate-risk ratings, it was observed that these consist of the following: Gubat sa syudad (73), Western Section (66), and Chinese Garden (55). On the other hand, the top 3 high-risk ratings include the Western Section (44), Japanese Garden (28), and Chinese Garden (25). In line with this, the areas with extreme ratings involve the Garden for the Elderly (4), Chinese Garden (3), Gubat sa syudad (1), and Japanese Garden (1).

Table 5. Summary of the ranked areas based on risk rating level.

Risk Rating Level	First	Second	Third
Low	Western Section	Noli Me Tangere Garden	Kanlungan ng Sining
Moderate	Gubat sa Syudad	Western Section	Chinese Garden
High	Western Section	Japanese Garden	Gubat sa Syudad
Extreme	Garden of the Elderly	Chinese Garden	Gubat sa Syudad and Japanese Garden

Note: Refer to Figure B.1 in the APPENDIX B Section to see the complete tabular data.

Observations from the Maps

- **Based on the current distribution maps, Rizal Park is predominantly composed of exotic species.** This trend is likely due to anthropogenic factors, such as human planting preferences and landscaping practices as well as the history of the site. Sir Beo Bensurto mentioned that during the late Marcos regime, the planting of exotic species such as mahogany was prevalent in Rizal Park Luneta due to their fast-growing characteristics. Although this contributed to rapid greening efforts, it also had repercussions on local biodiversity, as these exotic species potentially outcompeted native flora. Areas with higher numbers of exotic species compared to native species include the Central Promenade, Japanese Garden, Kanlungan ng Sining, Noli Me Tangere Garden, and the Open-air Auditorium (**Table 6**). The prominent exotic species in these areas are mahogany and mango. Out of the 15 areas in Rizal Park Luneta, 10 areas are predominantly composed of native trees and palms.

Table 6. Comparison of the number of native and exotic species.

Areas with the higher number of exotic species	Number of native trees and palms	Number of exotic trees and palms
Central Promenade	4 (4.26%)	90 (95.75%)
Japanese Garden	39 (35.78%)	69 (63.30%)
Kanlungan ng Sining	56 (31.11%)	107 (59.44%)
Noli Me Tangere Garden	74 (33.33%)	123 (55.41%)
Open-air Auditorium	7 (43.75%)	9 (56.25%)

In the current inventory, there are 78 individuals with unknown classification. Among the aforementioned areas, Japanese Garden, Kanlungan ng Sining, and Noli Me Tangere Garden have species with unknown classifications. Moreover, considering that there is only a small difference between the percentage of native and exotic species, further assessment and confirmation is needed before concluding that exotics dominate the Rizal Park Luneta.

- **Number of flora in an area influences the percentage distribution.** In areas with a high number of plant species, the percentage distribution of native and exotic flora may reflect the overall plant diversity. High-density areas may have more opportunities for both native and exotic species to coexist, and the relative proportion

of each type may be influenced by which species are more competitive or better adapted to the environment. Hence, as seen from the distribution maps of the whole of Rizal Park Luneta, the Western Section has the most number of native as well as exotic trees and palms because this is also the area with the most number of trees and palms.

- **Fruit-bearing trees constitute a small portion.** There are just 165 fruit-bearing trees in Rizal Park Luneta, which is 8.54% of all the trees in the park. Because of variations in the environmental conditions and resources they require, they are also randomly distributed, occurring at varying distances and locations. Furthermore, fruit-bearing trees are not recommended in public parks because they need to be maintained frequently, their fruits can attract pests, and they may not fit in with the park's aesthetic. Falling fruits can also cause physical harm or have adverse health effects when consumed.

- **Species and levels of risk are almost indirectly proportional to one another.** The thematic map of Rizal Park Luneta's western and central sections indicates that the number of trees decreases as risk increases. The Elderly Garden had four extreme risk-level trees, whereas the Japanese Garden had approximately 28 high-risk trees. There were also 73 species classified as moderate-risk on the Gubat sa Syudad and 634 low-risk trees in the park's western section. It suggests that there might be a connection between the risk level and the location of particular gardens to the tree condition.

Recommendations

- **Designation of conservation zones.** Since areas where native species are dominant have been identified, it is beneficial to designate these areas as conservation zones to protect and preserve the native flora. When establishing conservation zones, it is important to ensure that the habitats of native species are undisturbed. Trees provide numerous ecosystem services. Therefore, through the establishment of conservation zones for native species, we can amplify these benefits. The areas should be thoroughly assessed first before designating them as conservation zones. The assessment may include biodiversity surveys such as the use of diversity indices to identify how diverse species are in the area. The current state of the environment and the threats and pressure on the native flora may also be assessed. These assessments shall be the basis when defining the goals of the conservation and creating management plans.

- **Studies on environmental conditions.** The current inventory data only provides an overview of the present distribution, and it does not indicate the underlying reasons for these patterns. Therefore, conducting studies on the environmental conditions of each area within Rizal Park Luneta is needed to understand the factors that may have influenced the distribution of native and exotic flora. This will aid in making informed decisions about where to focus conservation efforts to protect native species.

- **Use of interactive maps.** Interactive maps that showcase the distribution of native, exotic, and fruit-bearing species, as well as those showing the level of risk each area poses, can be integrated into the official NPDC website. This can be attained through the use of data-driven graphics such as charts, graphs, and maps per se. Interactive in this sense refers to the manipulation of these data-driven graphics without triggering a page load. The integration of interactive maps and other data-driven graphics aims to foster public appreciation, raise awareness, and maximize the use of current technologies.

- **Thorough risk assessment.** In addition to applying the approach we have used, a more comprehensive assessment of tree risk needs to be done to better analyze other factors and bases for determining the trees' risk rating. Because what we used was based solely on how we observed the trees, there may have been instances where we did not observe all of the trees' features due to their location and

conditions, so the risk assessment may have been inaccurate, in addition to the lack of detailed information of the trees from the inventory such as from the last year's.

- **Utilization of remote sensing techniques.** Remote sensing techniques, in addition to utilizing QGIS as it is, could be more helpful in understanding the temporal and spatial variations in park conditions. This can broaden the scope of the data and provide a better understanding of the area's state, which will aid in monitoring and planning.

- **Use of the right and accurate instruments.** There were some difficulties because of the unstable and imprecise instruments, like the GPS and the alternative, the phone application. As a result, it took longer to adjust the tree coordinates, which had an impact on tasking productivity and efficiency. So it is suggested that stable instruments should be secured before any activities.

Learnings

- **Tree mapping is a valuable tool for decision-making and planning efforts.** The information it provides about the health, distribution, and risk levels of trees that affect the landscape can be used to preserve an urban green space. It can serve as a guide to identify which trees require maintenance and monitoring to avoid problems that may compromise the safety of stakeholders.

- **Importance of data quality.** One of the challenges encountered by the GIS group is the wrong coordinate readings. Hence, it is crucial to emphasize the importance of data quality in GIS mapping in having an accurate representation of flora distribution.

- **Use of technology.** It reduces errors in data visualization, determines the relationship between features, and helps create more accurate maps. The ability to present, edit, and analyze spatial data—such as tree distribution—makes mapping software like QGIS useful. It is also user-friendly, accessible, and capable of handling various kinds of data.

- **Rizal Park Luneta is a good example of an Urban area that should always be managed while considering the people or tourists.** There has been a comparison of the management of urban areas from a forestry perspective. As we processed the knowledge, skills, and experiences we had gained throughout the internship, this idea occurred to us. In particular, for example, since we had to assign a risk rating based on the observation, visitors or tourists should also be considered.

Application of Internship

- **Enhance technical skills.** Since this internship particularly focused on GIS mapping within an urban park, it provided hands-on experience that enhanced several technical skills essential for a career in GIS and urban forestry management. Specifically, it enhanced our skills in spatial analysis and data management.

- **Maps are an effective way of communication.** Maps are relevant in urban green spaces as they are an effective way to communicate the present condition and distribution of flora in urban spaces to stakeholders. Inventory data is usually complicated and technical. Therefore, transforming these data into maps that are digestible and accessible to the public is important.

- **Utilization for thesis or other educational purposes as Forestry Students.** The learnings, activities, data, and even experiences from the internship period led us to believe that all of these could be useful for the thesis and other educational purposes. As we are students studying forestry, the tasks or activities that were given to us matched our existing knowledge and abilities with those that are being developed further.

Challenges Encountered

- **Getting wrong coordinates readings due to inaccurate apps and insufficient GPS instruments.** Only two GPS tools are available for the three groups during the inventory. One group had to use a smartphone app called GPS Essentials to get the coordinates of trees. Nevertheless, the app's readings were not positioned correctly on the map, which resulted in multiple coordinate adjustments that prolonged the mapping process.

- **Difficulty in performing tasks in QGIS.** The laptops' capacity to process the data gives rise to this issue. Students encountered problems due to unexpected software crashes while modifying coordinates or adding files to change point symbols.

- **Inadequate information from last year's tree inventory.** The information gathered by 2023 interns lacked specific details, like endemism and tree risk levels. This particular information was crucial since our group was assigned to make the distribution of native and exotic trees and a thematic map of tree risks. There are also many unidentified trees in their datasheet.

- **Weather conditions affect efficiency and productivity while performing tasks.** Rainy and sunny days arrived, which had an impact on how we completed the mapping activities and the inventory. The convenience of mapping activities and the amount of time allocated for inventory data correction were impacted.

Appendices

APPENDIX A
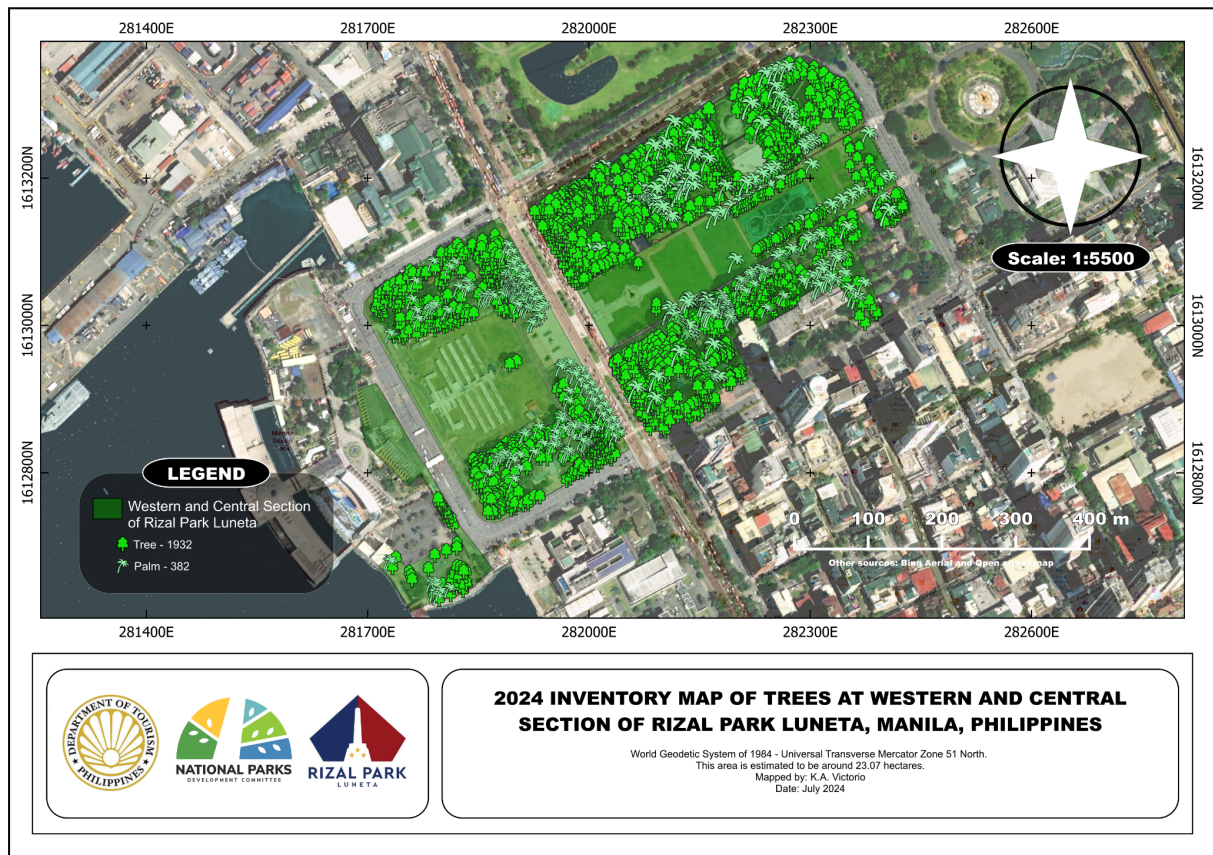
Figure A.1. Inventory Map of Rizal Park Luneta showing the Western and Central Section.

APPENDIX B

LOW	no.	%	MODERATE	no.	%	HIGH	no.	%	EXTREME	no.	%
WESTERN SECTION	634	38.12	GUBAT	73	16.11	WESTERN SECTION	44	26.04	SENIOR GARDEN	4	44.44
NOLI	169	10.16	WESTERN SECTION	66	14.57	JAPANESE	28	16.57	CHINESE	3	33.33
KANLUNGAN	150	9.02	CHINESE	55	12.14	GUBAT	25	14.79	GUBAT	1	11.11
GUBAT	129	7.76	JAPANESE	42	9.27	NOLI	16	9.47	JAPANESE	1	11.11
CHINESE	106	6.37	NOLI	37	8.17	CHINESE	14	8.28	AGUINALDO	0	0.00
BACHELOR	103	6.19	CENTRAL	33	7.28	SENIOR GARDEN	10	5.92	BACHELOR	0	0.00
CENTRAL	61	3.67	PLANETARIUM	31	6.84	KANLUNGAN	9	5.33	CENTRAL	0	0.00
SENIOR GARDEN	57	3.43	SENIOR GARDEN	30	6.62	BACHELOR	6	3.55	CHESS	0	0.00
CHESS	47	2.83	KANLUNGAN	21	4.64	PLANETARIUM	5	2.96	GALLERY	0	0.00
GALLERY	45	2.71	CHESS	18	3.97	AGUINALDO	4	2.37	KANLUNGAN	0	0.00
BARK	40	2.41	BACHELOR	17	3.75	GALLERY	4	2.37	BARK	0	0.00
JAPANESE	38	2.29	MARTYRDOM	15	3.31	CHESS	2	1.18	MARTYRDOM	0	0.00
AGUINALDO	25	1.50	GALLERY	6	1.32	MARTYRDOM	2	1.18	NOLI	0	0.00
MARTYRDOM	25	1.50	BARK	6	1.32	CENTRAL	0	0.00	OPEN-AIR	0	0.00
PLANETARIUM	18	1.08	AGUINALDO	3	0.66	BARK	0	0.00	PLANETARIUM	0	0.00
OPEN-AIR	16	0.96	OPEN-AIR	0	0.00	OPEN-AIR	0	0.00	WESTERN SECTION	0	0.00
	1,663	100.00		453	100.00		169	100.00		9	100.00

Figure B.1. Complete tabular data of the ranked areas based on risk rating level.