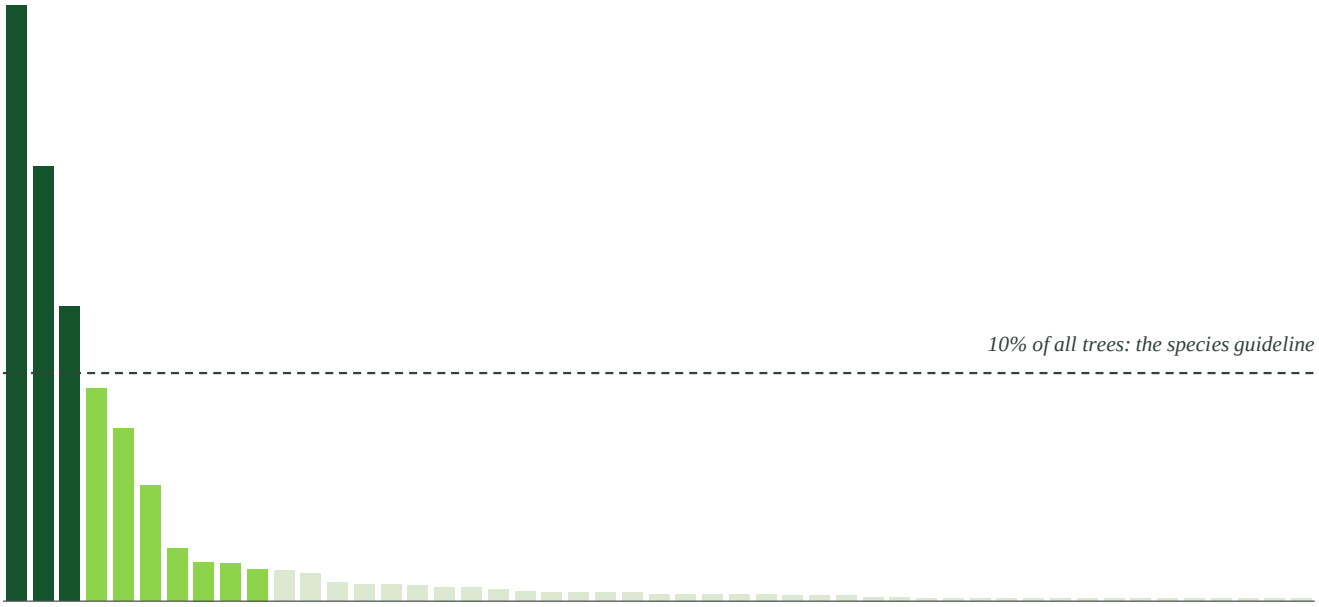
From Guide to Practice

How to read your FREE3 report and turn results into decisions

A practical companion to the FREE3 Tools User Guide for urban tree managers and municipal decision-makers.



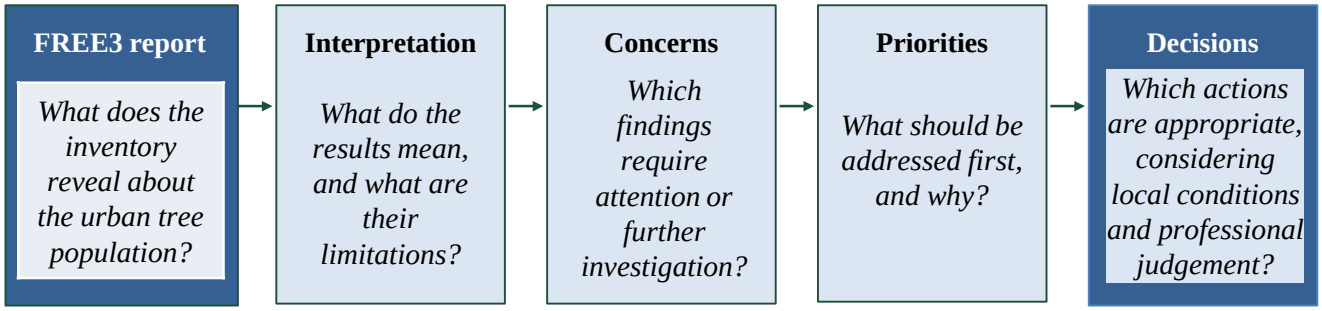
The chart illustrates the relative abundance of 49 recorded taxa in a tree inventory of 1,643 trees. Three taxa exceed the 10% species guideline, while the ten most abundant account for 87% of all recorded trees, indicating a strongly uneven distribution.

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From report to decision

What the FREE3 report provides, and how to use it well

The FREE3 tools transform municipal tree inventory data into a structured report. The QGIS plugin standardises tree species names and screens recorded taxa for associations with 11 regulated pests. The Shiny application analyses species composition, taxonomic diversity, tree size structure, basal area and pest–host associations, presenting the results in a Word report.While the FREE3 Tools User Guide explains how to produce the report, this companion guide focuses on interpreting its findings and identifying where further assessment or management action may be needed.



This guide deals with the three middle steps.

Who should use this guide

- Heads of municipal green space departments
- Urban tree managers and arborists
- Municipal planners and local authorities
- Teachers and students of urban forestry

No experience with GIS, statistics or plant pathology is needed, and you do not need to have run the tools yourself.

Before interpreting the results

Start with the data. The reliability of the results depends on the quality and completeness of the underlying tree inventory.
Consider the findings together. No single indicator provides a complete assessment of an urban tree population.
Distinguish results from recommendations. The diversity thresholds are guidelines rather than legal requirements. Management responses should also consider local site conditions, tree health and professional expertise.

How this guide is organised		*Section of the FREE3 report*
3	**Understanding your tree inventory**	*Dataset summary*
4	**Species frequency and the top 10**	*Species frequency, Top 10 species*
5	**The 10–20–30 rule**	*Compliance with species, genus and family rules*
6	**Melbourne diversity targets**	*Compliance tables; Recommendation*
7	**DBH distribution**	*DBH distribution by diameter classes*
8	**Basal area**	*Basal area*
9	**Pest–host screening**	*Pest–host risk by tree species and by pest*
10–12	**Combining results, priorities, checklist**	*Integrated interpretation of report findings*

About the worked example. The figures use aggregated data from the example inventory accompanying the FREE3 Tools User Guide. Results are taken from the FREE3 report or calculated from the same inventory, as indicated. The interpretations and management considerations illustrate possible applications of the findings and are not site-specific recommendations.

Understanding your tree inventory

Is the dataset complete and reliable enough to interpret?

What the analysis shows

The dataset summary provides an overview of the recorded tree population, including the total number of trees, the number of species, genera and families, and the mean basal area per tree. These figures provide the starting point for interpreting the rest of the report. However, their reliability depends on the completeness, consistency and taxonomic accuracy of the underlying inventory.

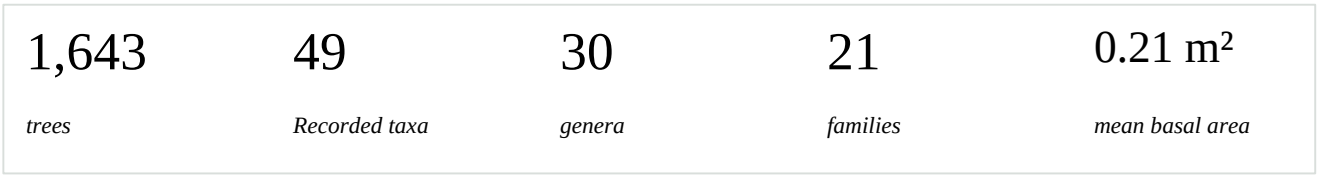


Figure 1. Dataset summary generated by the FREE3 Shiny application. Source: FREE3 report.

Checking the data: five questions to ask

Before interpreting the FREE3 report, check whether the underlying inventory is complete, consistent and suitable for the intended assessment. The following examples illustrate common data-quality issues and their implications.

What to check	Example from the inventory	Why it matters and what to do
Do the totals match?	Original inventory: 1,655 records; report: 1,643 trees.	Investigate differences and document excluded records.
Are trees identified to species?	374 trees (22.8%) are identified only to genus.	Improve identification for more reliable species-level analyses.
Are names consistent?	Some species and varieties are recorded separately.	Review names and apply consistent taxonomic rules.
Is DBH complete?	One missing value; minimum recorded DBH: 13 cm.	Check missing measurements and recording thresholds.
Is planting year known?	Planting years are unavailable.	Document limitations and record future planting dates.

Table 1. Illustrative data-quality checks using an inventory analysed with FREE3. Reported totals and original inventory records are compared where relevant.

Reading the result

These issues do not automatically invalidate the FREE3 report, but they affect how confidently its results can be interpreted. In the inventory examined, more than one fifth of the trees were not identified to species level, while planting dates were unavailable. Such limitations should be documented when presenting the findings and addressed in subsequent inventory updates.

Misreadings. "*A large number of recorded species means high tree diversity.*" Not necessarily. Species richness does not show how evenly trees are distributed. A small number of taxa may still account for most of the population (see page 4).

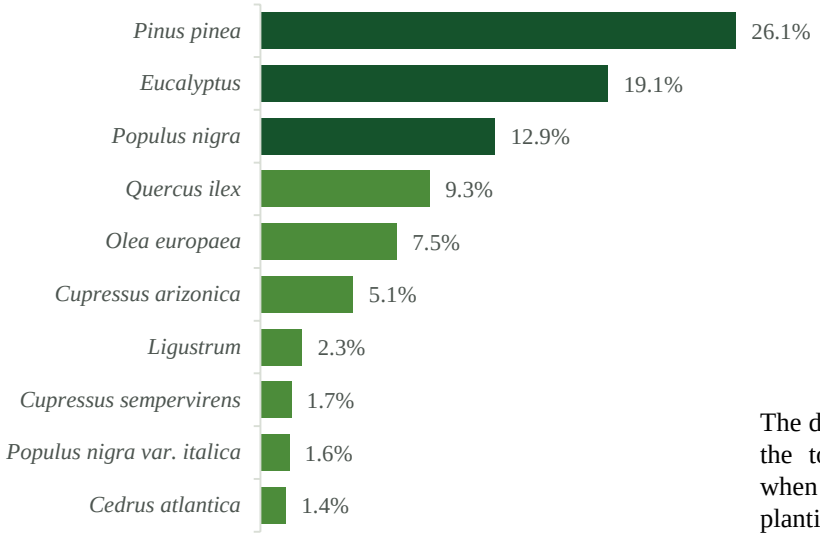
"*The report represents all trees in the city.*" Not necessarily. The results describe only the trees included in the analysed inventory. The geographical coverage and completeness of the data determine how broadly the findings can be applied.

Species frequency and the top 10

Which trees does the city have most of?

What the analysis shows

The FREE3 report provides a species frequency table and a chart of the ten most abundant taxa. Together, they show how trees are distributed among taxa and whether a small number dominate the inventory.



87.0%

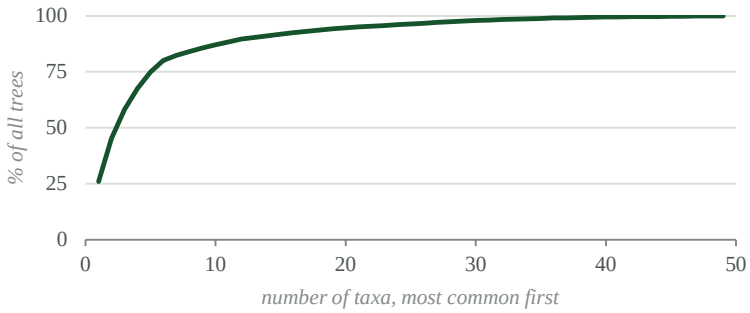
of recorded trees belong to the ten most abundant taxa, while the remaining 39 taxa account for only 13.0%.

58.1%

of all trees belong to just three taxa, indicating a strongly uneven distribution.

The dark green bars identify taxa exceeding 10% of the total tree population. These needs attention when reviewing species diversity and future planting choices.

Figure 2. Relative abundance of the ten most common taxa in the analysed tree inventory. Dark green indicates taxa exceeding 10% of all recorded trees.



Reading the curve. The curve shows the cumulative proportion of trees as taxa are added from most to least abundant. A steep initial rise indicates that a few taxa account for a large share of the population. A flatter section indicates that the remaining taxa contribute relatively few trees.

Figure 3. Cumulative proportion of recorded trees, with taxa ranked from most to least abundant.

Reading the result

The results show a strong concentration of trees in a small number of taxa. The three most abundant account for 58.1% of the inventory, while the ten most abundant represent 87%. This suggests that future planting choices should be reviewed to avoid reinforcing existing dominance.

What to look out for	What the city can do
A few taxa dominate the inventory.	Review future planting and favour suitable, less-represented taxa.
Dominant taxa are potential pest hosts.	Consider relevant pest surveillance alongside diversification.
Taxonomic records are inconsistent.	Verify identification and standardise names.

Misreadings. *"The dominant species should be reduced by removing trees."* Diversity is normally improved through future planting; felling healthy trees is rarely justified. *"A common species must be well suited to the city."* Frequency reflects past planting choices. It tells us little about current condition or suitability for a future climate.

The 10–20–30 rule

Does the urban tree population depend too heavily on a few taxonomic groups?

What the analysis shows

The 10–20–30 rule (Santamour, 1990) recommends that no single species should account for more than 10% of trees, no genus more than 20%, and no family more than 30%. The FREE3 report identifies taxa exceeding these thresholds, helping cities recognise excessive dependence on particular taxonomic groups.

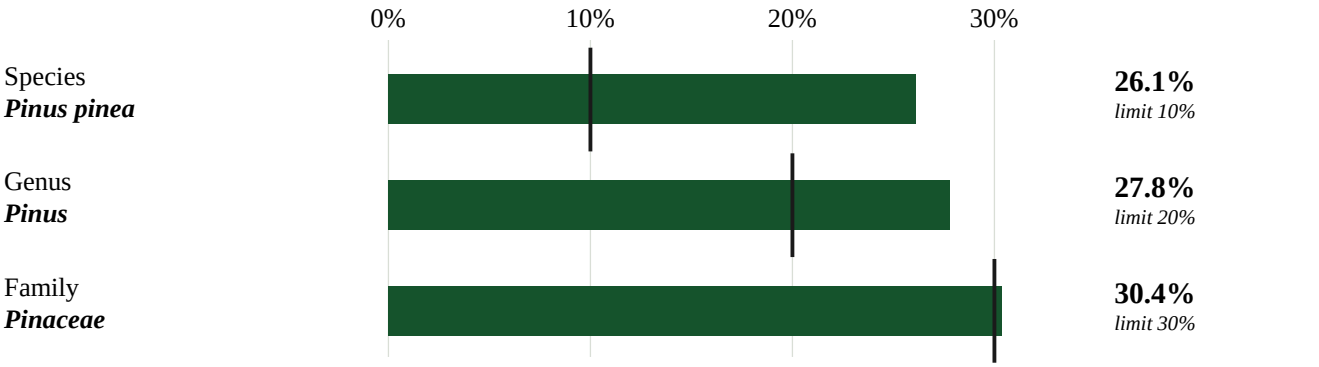


Figure 4. The most abundant species, genus and family compared with the 10–20–30 thresholds (vertical lines). Percentages represent their shares of the recorded tree population. Source: FREE3 report (Shiny application).

All exceedances in the report: species – *Pinus pinea* 26.1%, *Eucalyptus* 19.1%, *Populus nigra* 12.9%; genus – *Pinus* 27.8%; family – Pinaceae 30.4%.

Reading the result

The chart illustrates how taxonomic dominance may occur at several levels. The most abundant species represents 26.1% of recorded trees, its genus 27.8% and its family 30.4%. All three exceed their respective thresholds. Such concentrations may warrant greater diversification in future planting, particularly where related taxa share susceptibility to relevant pests or diseases. A guideline, not a guarantee of resilience. The 10–20–30 thresholds are rules of thumb, not scientifically established safety limits. Meeting them does not guarantee protection against pests, diseases or climate-related stresses.

What to look out for	What the city can do
A species, genus or family exceeds its limit.	Review planting plans and favour suitable, less-represented taxa.
Related taxa exceed limits at several levels.	Diversify across genera and families, not just species.
A taxon approaches its limit.	Monitor its share and set lower internal planting targets.
Species identification is incomplete.	Verify identification and interpret species-level results cautiously.

Misreadings. *"A taxon exceeds its limit, so trees must be removed."* Exceeding a threshold is not, by itself, a reason to remove healthy trees. Use the findings to guide future planting and gradual diversification. *"Meeting the limits means the tree population is resilient."* Taxonomic diversity is only one consideration. Tree condition, site suitability, spatial distribution and exposure to pests and environmental stresses also matter.

Melbourne diversity targets

How far is the city from a stricter diversity goal?

What the analysis shows

The City of Melbourne's Urban Forest Strategy (2012) established stricter diversity targets: no more than 5% of any species, 10% of any genus and 20% of any family. The FREE3 report compares these targets with the 10–20–30 rule, showing which taxa exceed one or both benchmarks.



Figure 5. Taxa exceeding the Melbourne diversity targets, grouped by species, genus and family. Dark green indicates exceedances of the 10–20–30 rule; light green indicates taxa exceeding only the Melbourne targets. Vertical lines show the corresponding thresholds. Source: FREE3 Shiny application.

Reading the result

The two benchmarks assess the same population against different diversity goals. While five taxa exceed the 10–20–30 thresholds, eleven exceed the stricter Melbourne targets. The additional six indicate opportunities for gradual diversification, even where the less restrictive guidelines are met.

What to look out for	What the city can do
Several taxa exceed Melbourne targets.	Favour suitable, less-represented taxa.
Dominant taxa remain in planting plans.	Review species selection and diversify gradually.
Little progress between inventories.	Set long-term targets and monitor trends.

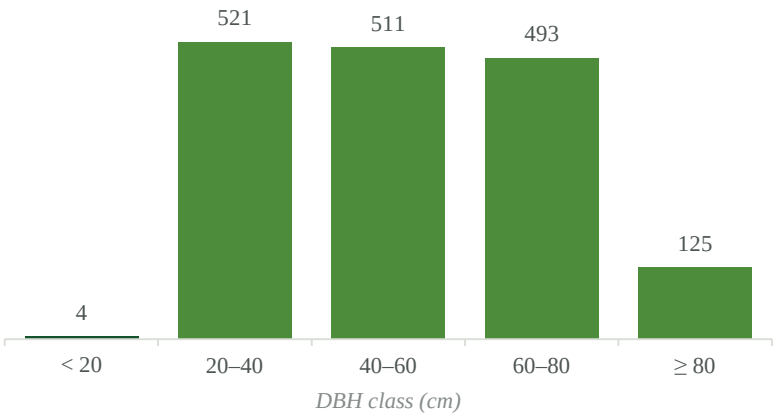
Misreadings. *"Exceeding Melbourne targets indicates poor management."* Not necessarily. These are ambitious long-term targets. Progress across successive inventories is more informative than a single assessment.

DBH distribution

What does the size structure reveal about the urban tree population?

What the analysis shows

DBH distribution helps cities identify potential gaps in tree size structure and anticipate future replacement needs. Interpret it alongside tree condition, species composition and inventory coverage before planning management actions.



4 trees

below 20 cm DBH (0.2%)

37.4%

of trees are 60 cm or more

Figure 6. Distribution of trees with available DBH measurements across diameter classes, calculated from the accompanying example inventory.

Reading the result

The distribution contains very few trees in the smallest diameter class, while 37.4% have a DBH of at least 60 cm. This may indicate a shortage of smaller trees or differences in inventory coverage. Before planning new planting or replacement, check whether recently planted trees were included and assess the condition of larger trees.

What to look out for	What the city can do
Few trees in smaller DBH classes.	Check inventory coverage and plan replacement planting where needed.
Large trees dominate the population.	Assess tree condition and plan for long-term succession.
DBH data are missing or incomplete.	Improve diameter records and document recording thresholds.

Misreadings. *"DBH tells us the age of a tree."* Growth differs widely between species and sites. A 60 cm poplar may be far younger than a 60 cm holm oak. *"No small trees means no planting."* Check first whether small trees were recorded at all.

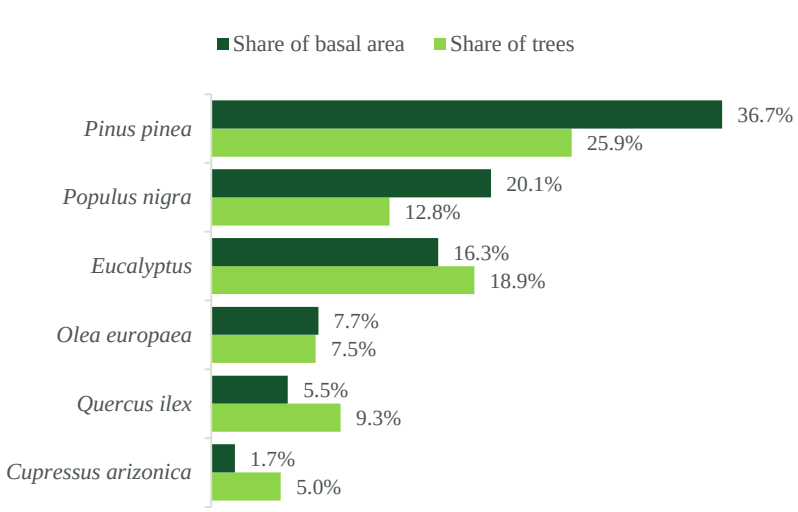
Basal area

Why does tree size matter as much as tree numbers?

What the analysis shows

Basal area is the cross-sectional area of a tree trunk, calculated from its diameter at breast height (DBH). The total basal area provides an indicator of the combined trunk size of recorded trees.Unlike tree counts, basal area gives greater weight to larger trees. Comparing the proportion of trees with their contribution to total basal area helps identify taxa that contribute disproportionately to the size structure of the urban tree population. Tree numbers alone do not describe the size structure of an urban tree population. Combining tree abundance with basal area helps identify the importance of large trees and supports long-term maintenance and replacement planning.

355.19 m²	0.21 m²	48.9 cm
total basal area	*mean per tree*	*mean DBH*



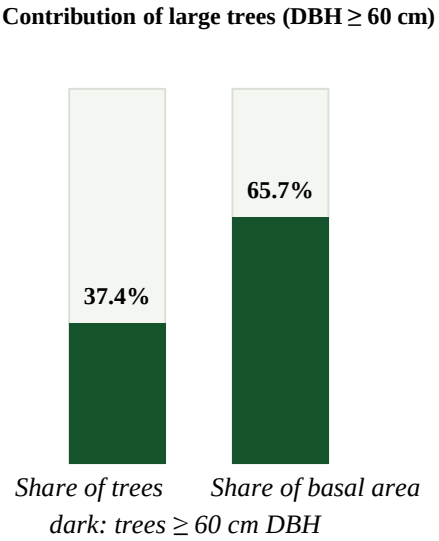


Figure 7. Share of recorded trees and total basal area by taxon.

Figure 8. Contribution of large trees (DBH ≥ 60 cm) to tree abundance and total basal area.

Reading the result

The charts show that tree abundance and basal area do not necessarily follow the same pattern. In the illustrated distribution, trees with DBH ≥ 60 cm represent 37.4% of recorded trees but contribute 65.7% of total basal area. This highlights the structural importance of large trees and supports planning for their care and eventual succession.

What to look out for	What the city can do
A few taxa dominate basal area.	Review diversity and future planting choices.
Large trees contribute most basal area.	Prioritise their care and log term protection.
Tree counts and basal area differ greatly.	Consider both indicators when setting management priorities.

Misreadings. "*More trees means greater basal area*." Not necessarily. A few large trees may contribute more basal area than many small trees."*Basal area measures canopy cover or tree health.*" It does not. Basal area describes trunk cross-sectional area and should be interpreted alongside canopy, condition and other inventory data.

Pest–host screening

Which trees are associated with regulated pests?

What the analysis shows

The FREE3 QGIS plugin screens harmonised tree names against a database covering 11 regulated pests. The report summarises known pest–host associations by tree taxon and by pest, including the number of potentially associated trees and their basal area. The screening identifies recorded pest–host associations, not pest presence, infection or the probability of an outbreak.

	share of all trees associated	*trees*	*basal area (m²)*
X. fastidiosa	43.0%	707	115.80
A. chinensis	24.3%	399	104.90
A. glabripennis	14.1%	231	73.44
P. ramorum	11.7%	192	23.50
P. japonica	3.0%	50	7.48
B. xylophilus	2.9%	48	7.13
A. bungii	1.2%	20	1.06
A. planipennis	0.6%	10	2.08
R. ferrugineus	0.2%	4	0.43

Figure 9. Proportion of recorded trees associated with each regulated pest, together with the corresponding tree counts and basal area. A tree may be associated with more than one pest; therefore, the percentages should not be added together. Only pests with recorded host associations in the analysed inventory are shown.

Reading the result

A high proportion of potential hosts indicates that a substantial part of the tree population may be relevant to a particular pest if it occurs locally. The findings should be interpreted alongside the pest's geographical distribution, host specificity and surveillance information. Genus-level matches may require further taxonomic identification. **“No known risk” does not mean safe.** The FREE3 screening covers 11 regulated pests only. Other pests and diseases are not assessed, and trees with unmatched scientific names may remain unscreened.

What to look out for	What the city can do
Many trees are associated with the same pest.	Check pest relevance with plant health authorities and prioritise surveillance where appropriate.
Dominant taxa are potential hosts.	Review host concentration when planning monitoring and future planting.
Uncertain host matches or unmatched names.	Verify identification and repeat screening where necessary.

Misreadings. *“A host association means the pest is present.”* It does not. Screening identifies known associations, not pest occurrence or infection.*“No known risk means the tree is safe.”* It only reflects the pests and host records included in the FREE3 database.

Reading the results together

How can different findings guide management priorities?

Combining the evidence

No single FREE3 analysis provides a complete basis for management decisions. Species abundance, basal area, DBH distribution and pest–host associations should be considered together. A taxon may warrant attention because it is highly abundant, contributes substantially to total basal area, consists predominantly of large trees or has recorded associations with regulated pests. The table illustrates how these findings can be combined to identify potential management priorities.

Taxon	*Trees (%)*	*Basal area (%)*	*Trees ≥ 45 cm†*	*Pest–host associations*	*Management considerations**
Pinus pinea	26.1%	36.7%	96%	none of the 11	Diversification; succession planning
Populus nigra‡	14.5%	21.6%	79%	*A. chinensis, A. glabripennis, P. japonica*	Succession planning; pest surveillance
Eucalyptus	19.1%	16.3%	52%	*X. fastidiosa (genus level)*	Species identification; diversification
Olea europaea	7.5%	7.7%	57%	*X. fastidiosa, A. chinensis*	Pest surveillance
Quercus ilex	9.3%	5.5%	33%	*X. fastidiosa, P. ramorum*	Pest surveillance; monitoring
Cupressus arizonica	5.1%	1.7%	12%	none of the 11	Monitor population structure

Table 2. Combined interpretation of tree abundance, basal area, size structure and pest–host associations. Management considerations are illustrative interpretations, not automated FREE3 outputs or formal risk assessments.
† Percentage of trees within the taxon with DBH ≥ 45 cm.
‡ Including Populus nigra var. italica.

Reading the combined results

Taxa may warrant attention for different reasons. High abundance and basal area may indicate structural importance and diversification needs, while a predominance of large trees may call for succession planning. Recorded pest–host associations may support targeted surveillance where the pests are locally relevant. These findings should be assessed together rather than interpreted in isolation.

Why the pest–host tables alone are not enough

A taxon without associations in the FREE3 database may still be structurally important or susceptible to other pests. Conversely, a recorded association does not establish pest presence or justify immediate intervention. Other analyses are needed to place pest–host screening in a broader management context.

From findings to decisions

FREE3 provides analytical results, not an overall ranking of management priorities. Decisions should be based on combined evidence, local conditions, tree health, pest occurrence and professional judgement. The management considerations presented here are illustrative, not automatic recommendations.

From findings to management priorities

How can FREE3 findings guide management priorities and long-term planting decisions?

The FREE3 report does not prescribe management actions. Instead, it provides evidence that cities can use to identify concerns and plan appropriate responses. The examples below illustrate how findings from different analyses may inform planting, monitoring, inspection and long-term management. They are options for consideration, not automatic recommendations.

Area	Finding	Possible response
Future planting	Taxa exceed diversity limits.	Favour suitable, less-represented taxa.
Diversification	A few taxa dominate the inventory.	Diversify across species, genera and families.
Monitoring	Large trees dominate basal area.	Assess condition and monitor regularly.
Pest inspection	Many trees have recorded pest–host associations.	Consult plant health authorities.
Inventory improvement	Identification or measurements are incomplete.	Improve data quality.
Spatial distribution*	Dominant taxa may be locally concentrated.	Check streets and neighbourhoods.
Long-term management	Few small trees or many large trees.	Plan gradual succession where needed.

**Spatial distribution may require additional analysis using georeferenced inventory data.*

A possible sequence

Now

Verify inventory data, identify concerns and consult relevant specialists.

Next planting season

Review species selection and introduce suitable, less-represented taxa.

Long term

Plan tree succession, monitor changes and update management priorities.

How much change is needed to meet diversity thresholds?

Taxon and limit	Current share (%)	Trees to add*	Trees to replace**
Pinaceae ≤ 30%	30.4	21	7
Pinus ≤ 20%	27.8	642	129
Populus nigra ≤ 10%	12.9	477	48
Eucalyptus ≤ 10%†	19.1	1,487	149
Pinus pinea ≤ 10%	26.1	2,647	265

Table 3. llustrative calculations based on 1,643 recorded trees. Trees to add: additional trees from outside the assessed taxonomic group, with all existing trees retained. Trees to replace: gradual replacement by other taxa, keeping the total number of trees constant. Calculations do not imply removal of healthy trees.
† Eucalyptus is identified only to genus level; the species-level calculation requires verification.

A note of caution. No single FREE3 result justifies removing or replacing trees. Decisions concerning individual trees require professional assessment of their condition, safety, site suitability, legal protection and value to the community.

Before you act: checklist and limitations

Questions to answer before results become decisions

Data

- ☐ Does the inventory cover the area being managed, and is it up to date?
- ☐ Are tree species correctly identified and names matched?
- ☐ Are missing records, measurements and inventory limitations documented?

Diversity

- ☐ Which taxa exceed or approach the 10–20–30 limits?
- ☐ Which taxa exceed the Melbourne targets?
- ☐ Will proposed planting improve diversity at species, genus and family levels?
- ☐ Are dominant taxa concentrated in particular areas, where location data are available?

Tree structure and pests

- ☐ Does the DBH distribution suggest gaps in tree size structure?
- ☐ Which taxa contribute most to total basal area?
- ☐ Are dominant taxa associated with regulated pests?
- ☐ Are those pests locally relevant, and what is known about tree condition?

Management decisions

- ☐ Have arborists and plant health specialists been consulted where relevant?
- ☐ Are proposed actions suitable for local conditions, future climate and available resources?
- ☐ Have report findings been distinguished from professional interpretations?
- ☐ Who will implement the actions, and when will progress be reviewed?

Limitations of the FREE3 analysis

FREE3 results depend on the quality, coverage and date of the underlying inventory. The 10–20–30 rule and Melbourne targets are diversity guidelines, not guarantees of resilience. Pest–host screening covers 11 regulated pests and identifies recorded host associations, not pest presence or outbreak probability.
DBH and basal area describe tree structure but do not directly measure age, health or ecosystem services. Site suitability, future climate, tree condition and safety, costs and local expertise must also inform management decisions.

References

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Data: Aggregated results from the example inventory accompanying the FREE3 Tools User Guide. Figures were generated using FREE3 tools or calculated from the accompanying inventory, as indicated. The original inventory is not reproduced.

FREE3 supports informed decisions: effective urban tree management also requires local expertise, clear responsibilities and long-term monitoring.