Grading of Parameters for Urban Tree Inventories by City Officials, Arborists and Academics Using the Delphi Method

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Tree inventories are expensive to conduct and update, so every inventory carried out must be maximized. However, increasing the number of constituent parameters increases the cost of performing and updating the inventory, illustrating the need for careful parameter selection. This paper reports the results of a systematic expert rating of tree inventories aiming to quantify the relative importance of each parameter. Using the Delphi method, panels comprising city officials, arborists and academics rated a total of 148 parameters. In order of total mean score, the top ranking parameters, which can serve as a guide for decision-making at practical level and for standardization of tree inventories, were: *Scientific name of the tree species and genera*, *Vitality*, *Coordinates*, *Hazard class* and *Identification number.*

The study also examined whether the different responsibilities and usage of urban tree databases among organizations and people engaged in urban tree inventories affected their prioritization. Among the individual parameters included in the overall top 25 list, some noticeable differences in ratings were observed between the panels. In the mean overall ranking by the three panels, *Year of planting* was ranked in place 19, but the panel of city officials ranked it 5, the academics 27, and the arborists 99. The three parameters *Date of registration in the database*, *Date of update in the database*, and *Date of latest inventory*, belonging to the group *Database*, were also rated very low by the arborists, 105, 69, and 50, respectively, compared with 25, 20, and 7 as the overall for the three panels. The *Street or park tree* parameter and *Stem circumference at 1 meter height at planting* deviated. The *Street or park tree* parameter was ranked in place 7 by the city officials, 29 by the academics, and 40 by the arborists. *Stem circumference at 1 meter height at planting* deviated in a similar way, being placed 8 by the city officials, 51 by the academics, and 24 by the arborists. The city officials also deviated from the two other panels when it came to the parameter *Free text (on hazard and damage),* which they placed at 54, compared with 6 for the academics and 10 for the arborists (Table 1).

Table 1. The parameters listed and their mean ranking. Codes in brackets indicate membership of one of six different groups of parameters (**A** = Descriptive inventory parameters, **B** = Vitality and safety, **C** = Tree values, **D** = Measures and maintenance, **E** = Database metadata, **F** = Documentation of management). After the mean overall ranking for all parameters, the ranking of the parameter by the three panels (**CO** =City officials, **AC**= Academics, **AR**= Arborists) is given in brackets. All parameters are listed in order of prioritization by the three panels.

Parameter placement for the different panels	**Parameter according to mean value**	**Mean rating and placement in the individual panels**	**City officials**	**Mean**	**Academics**	**Mean**	**Arborists**	**Mean**
1	Scientific name of the tree species and genera (A)	10.0 (CO:1 AC:1 AR:1)	Scientific name of the tree species and genera (A)	10.0	Scientific name of the tree species and genera (A)	10.0	Scientific name of the tree species and genera (A)	10.0
2	Vitality (B)	9.8 (CO:3 AC:5 AR:2)	Coordinates (A)	10.0	Identification number (E)	10.0	Vitality (B)	9.8
3	Coordinates (A)	9.6 (CO:2 AC:9 AR:11)	Vitality (B)	9.8	Date of latest inventory (E)	10.0	Identification number (E)	9.8
4	Hazard class (B)	9.4 (CO:4 AC:19 AR:6)	Hazard class (B)	9.5	Date of first inventory (E)	10.0	Name of disease or pest (B)	9.7
5	Identification number (E)	9.2 (CO:26 AC:2 AR:3)	Year of planting (A)	9.4	Vitality (A)	9.9	Free text concerning the time factor for the maintenance and operations (D)	9.7
6	Presence of fruit bodies (B)	9.0 (CO:17 AC:11 AR:7)	Date of latest inventory (E)	9.0	Free text on hazard and damage (B)	9.9	Hazard class (B)	9.6
7	Date of latest inventory (E)	9.0(CO:6 AC:3 AR:50)	Street or park trees (A)	9.0	Date of registration in the database (E)	9.9	Presence of fruit bodies (B)	9.6
8	Category of care (D)	9.0(CO:11 AC:12 AR:23)	Stem circumference at 1 metre height at planting (A)	8.9	Free text on diseases and pests (B)	9.9	Free text on new planting of trees (F)	9.4
9	Conservation value (C)	9.0(CO:12 AC:20 AR:13)	Type of planting pit (A)	8.9	Coordinates (A)	9.7	Free text on the cultural value of the tree (C)	9.3
10	Street or park trees (A)	8.8(CO:7 AC:29 AR:40)	Protection value (C)	8.8	Damage class (B)	9.7	Proposed measures (D)	9.2
11	Age class (A)	8.7(CO:21 AC:21 AR:14)	Category of care (D)	8.6	Presence of fruit bodies (B)	9.6	Coordinates (A)	9.1
12	Stem circumference at 1 meter height at planting (A)	8.7(CO:8 AC:51 AR:24)	Conservation value (C)	8.6	Category of care (D)	9.6	Establishment pruning (F)	9.1
13	Date of planting (F)	8.6(CO:16 AC:22 AR:30)	Type of constructed planting site (F)	8.4	Free text on tree damage (B)	9.6	Conservation value (C)	9.0

14	Name of disease or pest (B)	8.5(CO:33 AC:52 AR:4)	Proposed measures (D)	8.3	Free text on tree conservation value (C)	9.4	Age class (A)	9.0
15	Reason of felling (E)	8.5(CO:18 AC:30 AR:36)	Date of registration in the database (E)	8.3	Free text concerning the time factor for the maintenance and operations (D)	9.4	Ground coverage under the tree crown (A)	9.0
16	Type of constructed planting site (F)	8.4(CO:13 AC:48 AR:43)	Date of planting (F)	8.1	Free text on inventory information (A)	9.4	Name of fungi (B)	9.0
17	Proposed measures (D)	8.3(CO:14 AC:72 AR:10)	Presence of fruit bodies (B)	8.0	Free text on tree management (D)	9.4	Protected by law (C)	9.0
18	Street address (A)	8.3(CO:29 AC:45 AR:33)	Reason of felling (E)	8.0	Free text concerning the identification and local (A)	9.4	Damage class, detailed (B)	9.0
19	Year of planting (A)	8.2(CO:5 AC:37 AR:99)	Date of update in the database (E)	8.0	Hazard class (B)	9.3	Free text on hazard and damage (B)	8.8
20	Date of update in the database (E)	8.2(CO:19 AC:23 AR:69)	Proposals for action, time (D)	8.0	Conservation value (C)	9.3	Proposals for action, time (D)	8.8
21	Presence of stem protection (A)	8.2(CO:22 AC:31 AR:61)	Age class (A)	7.9	Age class (A)	9.3	Free text on tree vitality (A)	8.8
22	Soil protection around the tree (A)	8.1(CO:32 AC:38 AR:44)	Presence of stem protection (A)	7.9	Date of planting (F)	9.3	Free text on diseases and pests (B)	8.8
23	Free text on hazard and damages (B)	8.1(CO:54 AC:6 AR:19)	Irrigation programme for trees (F)	7.9	Date of update in the database (E)	9.3	Category of care (D)	8.7
24	Owner(E)	8.1(CO:28 AC:58 AR:29)	Contractor for planting (F)	7.8	Free text on cultural value of the trees (C)	9.3	Stem circumference at 1 metre height at planting (A)	8.7
25	Date of registration in the database (E)	8.1(CO:15 AC:7 AR:105)	Identification number (E)	7.8	Free text on tree aesthetics (C)	9.3	Pruning (D)	8.7
	Mean	**8.7**	**Mean**	**8.4**	**Mean**	**9.2**	**Mean**	**8.6**

The study revealed distinct dissimilarities in the ranking of parameters between city officials, arborists, and academics. Keeping in mind the differences in responsibility for, and use of, urban tree databases, these dissimilarities are understandable, but problems can arise if the gap between the groups becomes too wide. In relation to this, the differences identified and the indicative explanations given improve our ability to capture the divergent agendas within urban forestry more fully. Broadly speaking, the results emphasize the need for collaboration between the research community and those commissioning, conducting, and managing inventories. Only by applying a transdisciplinary approach to the selection of parameters can urban tree inventories can be strengthened and made more relevant. We propose that the agenda be broadened to related disciplines and research agendas, so as to maximize the usability of urban tree inventories as data sources for assessment of the many ecosystem services provided by urban forests.

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