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A MODEL FOR URBAN FOREST MANAGEMENT PLANNING: ISTANBUL CASE STUDY

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Abstract

Urban forests have become important elements of cities' green fabric providing many ecosystem services including recreation. In this study, we proposed a model for urban forest management planning in the example of Istanbul, where urban sprawl has transformed the green infrastructure of the city dramatically. To this purpose, a total of 201 surveys were conducted through face-to-face interviews including those working as managers and technical staff in the forestry organization in Istanbul, academicians and NGOs. Subjects to be surveyed were determined according to the layered-simple random sampling method. The data were evaluated by descriptive statistics based on a variety of opinions about urban forest management planning in Turkey along with various socio-economic variables (gender, profession and experience). Whether there was any statistically significant difference between the groups was determined by Kruskal-Wallis H-Test. In case a difference was found, Duncan's Multiple Range Test was applied to detect the group(s) significantly different from each other. The results revealed that mainly males agreed on the purpose of urban forests as addressing recreational and social needs. All groups highlighted the lack of coordination and poor management system as main problems, while experienced and male subjects addressed that a new urban forest law is necessary. Mainly academicians and representatives of NGO's and related institutions suggested redefining the concept and restructuring the legislation concerning urban forests. In terms of activities, the majority favored *hiking and sightseeing activities (51%), photography (42%),* and *extreme sports (37%)*. There was an emphasis on the need for sufficient number of *hiking, climbing and cycling trails and botanical gardens.* As a result, a model plan based on sustainable resource management ensuring multi-purpose utilization was proposed.

Key words: multi-purpose use, sustainability, urban forest governance, urban forest management planning, urban forestry

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1. Introduction

As urbanization increases rapidly, the majority of the world's population now lives in cities and towns. The proportion of the world population living in urban areas was 9% in 1900, while this figure had increased to 40% by 1980 and 50% by 2000, and it is expected to increase to 60% by 2025 (Konijnendijk, 2003; McIntyre et al., 2000). Thus, there is an urgent need for urban living spaces to be examined for ensuring a healthy environmental standard in this increasingly urbanized world (Botkin and Beveridge, 1997). As the natural and socio-cultural services that can be provided by forests become better understood,

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society's expectations will increase and diversify. However, many studies have emphasized that these expectations can lead to both negative and positive results. Therefore, environmental, educational and especially recreational aspects of forests, and their planning and sustainable management are of increasing importance (Elands et al., 2004; Konijnendijk, 2001). As a natural result of rapid urbanization, the interaction between people and the urban environment or the forests has increased. This interaction, which manifests itself mainly by recreational demands, has led to the development of a new resource enterprise and management model shaped by service production and recreational utilization. In the early 1960s, the concept of urban forestry emerged in an attempt to ensure the orderly and planned development of cities that is compatible with the natural environment (Atay, 1988; Grey and Deneke, 1986).

In parallel with the trend worldwide, the urban population of Turkey began to increase in the 1950s. Today 92.1% of the country's population lives in metropolitan areas, cities and towns (Atmis et al., 2017). In order to prevent the rapid increase of built-up areas in urban environments, the concept of urban forestry was introduced in developed countries in the 1960s, but began to find support in Turkey after the 1980s. It was 2003 when the first countrywide "urban forest project" was implemented by the General Directorate of Forestry and it has been succeeded in establishing 137 urban forests (OGM, 2019), taking advantage of the majority of the forests owned and administered by the government. However, the project was quickly initiated by practicing traditional understanding of forestry due to the unrealistic targets and demands of the central government for the rapid establishment of urban forests. As a result, problems arising from inadequate and poor planning and management of urban forests, such as random site selection and recruitment of personnel and inadequate funding, did not coincide with the overall objectives and goals of urban forestry (Atmis et al., 2017; Bekiroglu et al., 2015; Elvan and Velioglu, 2004). Furthermore, including the range of different stakeholders and jurisdictions to the decision-making processes is recommended for widening the planning approach from an ecological and silvicultural perspective towards a systems understanding of social impact of management practices and ecosystem services they provide (Teobaldelli et al., 2020). Since there are not enough studies on the subject in Turkey, the criteria for establishing urban forests are insufficient, while the basic needs and demands of the city dwellers have not been taken into consideration. In fact, most research on urban forests does not include generally accepted practical indicators and criteria or other policy and management tools. Thus, urban forests in Istanbul, which has the most and largest urban forests in number and area in Turkey, were selected as the sample for this study in order to propose a model for urban forest management planning.

2. Material and methods

2.1. Study area

The study area of Istanbul is located in northwestern Turkey, with a total forest area of 258 767 ha, covering approximately 48% of the city's total area (531,300 ha) forest (Köse, 2013). With a population of more than 15 million and 28,360 people per hectare, Istanbul is Turkey's most densely populated and urbanized province. This corresponds to approximately 19% of the country's population and 60% of the Marmara Region (TUIK, 2018). The research was conducted on a sample of totally 11 urban forests in Istanbul (Fig. 1) covering 1,778.69 ha (Table 1).

2.2. Sampling and data collection

Three interest groups as experts were selected to conduct the questionnaires: (1) Technical staff and managers working in the Istanbul Regional Directorate of Forestry (IOBM) and the 1st Regional Directorate of the Ministry of Agriculture and Forestry, (2) academicians from the Forest Engineering and Landscape Architecture departments of the Istanbul University-Cerrahpaşa Faculty of Forestry and (3) representatives of non-governmental organizations (NGOs) and related institutions.

The first two groups constituted the main sample size of the survey (N=270). Regarding sample size in limited groups, the number of organizational employees in the first two groups surveyed was calculated using (Eq. 1) (Dasdemir, 2016; Orhunbilge, 2000):

$$n \geq \frac{Z^2 xNxpxq}{NxD^2 + Z^2 pxq} \quad (1)$$

were: n is the sample size, Z the confidence coefficient (Z = 1.96 at the 95% confidence level), N the main sample size (N = 270), p the probability of the feature to be measured in the main sample size, q the probability that the feature to be measured does not exist in the main sample size (taken as p = 0.5; q = 0.5), and D shows the accepted sampling error (taken as 0.05).

According to the formula, n was determined as 158 and divided by N (n / N) in order to obtain the coefficient to discover the minimum number of those to be interviewed in each group. Thus, questionnaires were to be applied to 106 experts from the first group and 52 from the second group, but this number was exceeded to a total of 171 during the field survey. A total of 201 questionnaires were applied, including 30 experts from the third group, which were determined by using the layered-simple random sampling method. Before administering the survey, a preliminary trial was carried out concerning the survey application, the appropriateness of the questionnaire form design, the comprehensibility of the questions and the presence of missing parts, and the necessary corrections were made accordingly.

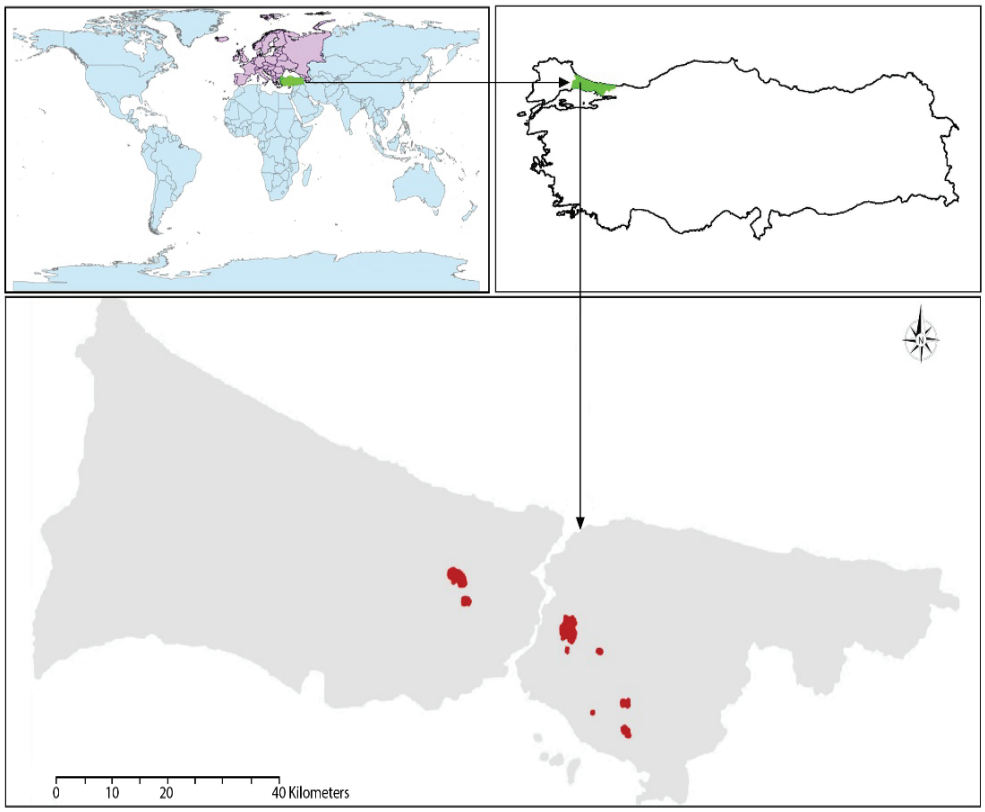


Fig. 1. The geographical location of urban forests in Istanbul (Köse, 2020)

Table 1. The location (district), name and area of urban forests in Istanbul according to IOBM (2019)

District	*Name*	*Area (ha)*
Çekmeköy	Rahmi Demir Urban Forest	33.40
Çekmeköy	Muhsin Yazıcıoglu Urban Forest	5.50
Beykoz	Kanuni Sultan Süleyman Urban Forest	847.50
Ümraniye	Hekimbası Urban Forest	34.19
Ümraniye	Ümraniye Urban Forest	27.40
Kartal	Aydos (Ayazma) Urban Forest	106.87
Maltepe	Maltepe Urban Forest	13.16
Tuzla	Tuzla Urban Forest	3.10
Sancaktepe	Sancaktepe Urban Forest	105.61
Sultangazi	Mimar Sinan Urban Forest	82.16
Eyüp	Kemerburgaz International Urban Forest	519.80

The main variables in the applied questionnaires were; (1) status, concept, location and size of urban forests in terms of quality and character, (2) their legislation and management, (3) main functions of urban forests, (4) activities that can be carried out in urban forests, (5) necessary spatial functions within urban forests, and (6) internal and external problems.

The data obtained in the survey were assessed using descriptive statistics to determine whether the experts' opinions on urban forest management planning in Turkey were related to various socio-economic variables (gender, profession and experience).

2.3. Data analysis and statistical methods

In this study, whether there was any statistically significant difference between the median groups was determined by Kruskal-Wallis H-Test. SPSS (23.0 version) program was used to evaluate the data. If a difference had been detected, the detection of the different group(s) was investigated by Duncan's Multiple Range Test (MRT). The Kruskal-Wallis H-Test is used to test whether the mean of two or more samples show a statistically significant difference from each other. MRT is widely used to compare many means. To use this test method, the general F test (analysis of variance) is not required to be important, and a protection level varying according to the average number (p) tested is used.

3. Results and discussion

Results revealed that 36.5% of 201 subjects were female and 63.5% male. Three main professional groups were identified as academicians (29%), forest engineers (60%) and others (11% - landscape architects, survey engineers, environmental engineers, and civil engineers). Respondents' level of experience varies from less experienced to very experienced; 38.2% have been working for 0-10 years, 26.1% for 11-20 years and 35.7% for 20 years or more. Additionally, 12% of the subjects had served in an urban forest establishment and /or management.

Regarding "*the status and character"* of urban forests, subjects mainly preferred their status as "*resting areas in the forest*" (38%), followed by

"*urban open green spaces*" (21%) and "*nature conservation areas*" (20%). Statistically, there was no significant difference between subjects in terms of gender, professional group or experience. 39% of the subjects associated "*the concept of urban forests"* with "*forests and forest ecosystems*", which is followed by "*city parks, lawns and green spaces*" (20%) and "*wooded areas*" (19%). Although there was no statistically significant difference between groups in terms of gender or experience, forest engineers and other professional groups generally adopted the definition "*forests and forest ecosystems*", while academicians tended to choose "*city parks, grassy areas and green spaces*" (Table 2).

No matter which gender, professional group or experience, the majority of the experts (55%) recommended the size of the urban forests to be 50 ha, while 30% suggested other spatial sizes mainly above 50 ha. Similarly, we detected two main tendencies for "*the location of areas designated as urban forests*" as within suburban areas (36%) and outside (24%).

The concept of urban forests is not included in any article of the law in Turkey and this was emphasized as a gap in the legislation by the experts. Thus, subjects were mainly of the opinion that urban forests should be addressed either under the Forest Law (34%), National Parks Law (17%) or a new Urban Forest Law (22%). We found no statistically significant differences between professional groups, but experience and gender. Accordingly, a higher percentage of the less experienced (0-10 years) and women felt urban forests should be managed by the "*Forest Law*", whereas the moderately and very experienced (≥11 years) and men preferred the *"New* (*Urban Forest) Law*" (Table 2).

Table 2. Subjects' opinions and their statistical analysis concerning status, concept, size, location and legislation of urban forests (In bold the highest frequency for each variable)

Variable	***Option***	***Preference (%)***	***Kruskal-Wallis H-Test***		***Duncan's Multiple Range Test Results***			
			Criterion	***Asymp. Sig.***	***No.***	***Different Group Elements***	***Av.***	***N***
1. Status and character	Resting areas in the forest	**38**	No significant difference in terms of gender, professional group or experience					
	Urban open and green spaces	21						
	Nature conservation areas	20						
	Conservation forests	8						
	Nature preserves	5						
	Special environmental protection areas	3						
	Living plant museums	1						
	Other	4						
2. Concept	Forests, forest ecosystems	**39**	No significant difference in terms of gender or experience					
	City park, lawns and green spaces	20	Professional groups	0.031*	1	Academicians	20.87	56
	Wooded areas	19						
	All related vegetation / organisms	16			2	Forest Engineers and Other	25.85	140
	Single trees, tree groups, woody plants	6						
3. Size	50 ha	**55**	No significant difference in professional group, experience or gender					
	0.5 ha	15						
	0.1 ha	1						
	Other	30						
4. Location	Within the boundaries of suburban areas	**36**	No significant difference in a professional group, experience or gender					
	Outside suburban areas	24						
	Within the boundaries of residential areas	17						
	Within the boundaries of established state forests	15						
	Other	8						
5. Legislation related to the management	Forest Law	**34**	No significant difference in terms of a professional group					
	National Parks Law	17	Experience	0.010*	1	Less experienced (0-10 years)	24.28	75
	Environmental Law	2						
	Special Provincial Administration Law	1			2	Moderate and very experienced (≥11 years)	19.46	121
	Law on the Protection of Natural and Cultural Properties	6						
	Urban Open and Green Areas Law	12	Gender	0.004**	1	Male	90.37	124
	New (Urban Forest) Law	22						
	Municipality Law	3			2	Female	113.66	73
	Other	3						

*If Asymp. Sig. is >0.05, there is no difference at 95% confidence level; if Asymp. Sig.is 0.01< – <0.05 *; if Asymp. Sig is <0.01 ***

The experts ranked the unit that urban forests should be affiliated with in order of priority. Regional Directorate of Forestry/1st Regional Directorate of Ministry of Agriculture and Forestry and Metropolitan Municipality got the highest ranks (Table 3).

The majority of the subjects emphasized the main purpose of urban forests as "*meeting the recreational and social needs of city dwellers*" and "*making positive contributions to the urban climate*". The most favoured feasible activities were "*nature hikes and excursions", "photography"* and *"extreme sports meets (orienteering, trail running, mountain biking, etc.)*", whereas "*motor vehicle use (motorcycles, ATVs, etc.)*" was the least preferred option. The majority of the subjects suggested the main functions to be included in urban forests as "*hiking and jogging trails*" and "*botanical gardens*", while "*bungalow houses and / or accommodation facilities*" got the lowest score (Table 4).

Statistical analyses showed that experts from different experience or professional groups agreed on the idea of urban forests "*meeting the recreational and social needs of city dwellers",* but male subjects were more likely to adopt this idea than females. Meanwhile, no significant difference was found among different groups for the most favoured "*feasible activities*" and "*spatial functions to be included in urban forests"* (Table 5). The experts mainly pointed out that "*coordination among institutions is inadequate*", "*urban forests are poorly managed"* and *"the functions and objectives of urban forests have not been promoted*" as the major internal problems arising from the structure and characteristic of urban forestry. The most crucial external issues affecting urban forestry were specified as "*relevant laws or regulations are insufficient*" and "*the concept of urban forests has not been adequately defined in Turkey"* (Table 6).

Statistical analyses showed that no significant difference was found among groups for the arguments "*urban forests are poorly managed*" and "*inter-institutional coordination is inadequate"*. However, a larger percentage of academicians and other professional groups agreed that "*the functions and goals of urban forests have not been promoted"* compared to those working as forest engineers. Meanwhile, in terms of professional groups, more academicians and others adopted the idea of "*relevant laws or regulations are insufficient"* than did forest engineers.

In terms of gender, more women than men agreed with this. Regarding professional groups, more academicians and others accepted the argument that "*the concept of urban forests has not been sufficiently defined in our country*", than did those working as forest engineers (Table 7). Ensuring sustainable and participatory resource management requires long-term planning.

Table 3. Distribution of units to be affiliated with urban forests ranked according to priority

Unit to be affiliated with urban forests	***1st Priority***	***2nd Priority***	***3rd Priority***	***Total Score***
Regional Directorate of Forestry / 1st Regional Directorate of Ministry of Agriculture and Forestry	68	2	2	72
Metropolitan Municipality / Municipality	18	24	2	44
Governor's Office	2	6	6	14
Provincial Directorate of Environment and Urbanization	6	7	11	24
Special Provincial Administration	1	1	3	5
NGOs	-	2	3	5
Federations	-	-	-	-
Private Sector	1	1	2	4
City Councils	6	2	10	18

Table 4. Frequency distribution for "*the main purpose of urban forests*", *"feasible urban forest activities"* and *"spatial functions to be included in urban forests*" according to importance (in bold the first two highest frequencies in the score 5)

The main purpose of urban forests in terms of their functions											
	1	***2***	***3***	***4***	***5***		***1***	***2***	***3***	***4***	***5***
Providing an environment for scientific research and nature education	15	15	23	20	27	Providing an organic connection between urban green areas and rural areas	8	15	24	20	32
Meeting the recreational and social needs of city dwellers	12	7	9	19	**53**	Reducing and improving noise and air pollution	9	10	15	28	38
Providing an environment for tourism activities	16	18	24	28	14	Making positive contributions to urban climate	11	9	17	19	**43**
Providing an environment for outdoor sports activities	9	11	23	24	33	Preserving plant and animal species diversity	14	8	23	20	36
Protecting water and watersheds	14	16	18	23	29	Preventing landslides and erosion	16	15	20	17	31
Feasible urban forest activities											
Nature hikes and excursions	17	5	11	16	**51**	Recreational and picnic activities	16	18	18	20	29
Planting saplings / Afforestation	13	16	22	16	32	Festivals	21	21	14	24	20
Scouting activities for students	12	11	17	24	35	Photography	13	6	14	25	**42**

Bazaars and local markets	16	21	27	20	16	Horseback Riding	13	23	21	24	19
Summer school and youth camps	10	14	27	21	29	Cycling	13	8	24	18	36
Scientific research education and education research	18	14	22	19	28	Motor vehicle use (motorcycles, ATVs, etc.)	52	14	15	4	15
Wildlife and bird-watching	12	12	17	25	35	Water sports	16	17	23	24	20
Extreme sports meets	7	12	20	24	37						
Spatial functions to be included in urban forests											
Botanical gardens	18	6	16	23	**37**	Multi-purpose sports fields	24	18	16	25	17
Zoological gardens	30	14	20	17	19	Areas for air sports	24	21	21	20	14
Hobby gardens	20	15	29	15	21	Golf courses	54	20	5	6	15
Stone / rock and therapy gardens	11	15	24	32	18	Cafes-restaurants	24	19	26	16	15
Children's playgrounds and equipment	12	13	23	27	25	Bungalow houses and / or accommodation facilities	23	12	22	24	19
Hiking and jogging trails	12	8	6	19	**55**	Camping and / or caravan areas	23	12	22	24	19
Orienteering trails	8	9	21	27	35	Natural or artificial ponds	10	11	23	29	27
Mountain / rock climbing trails	12	13	26	27	22	Bridle (horseback riding) trails	16	20	25	21	18
Non-motorized vehicle track	11	10	19	24	36	Show and exhibition grounds	12	15	28	22	23
Motor vehicle track	54	15	10	6	15	Natural history museums	13	11	16	28	32

1 = completely unimportant; 2 = not important; 3 = somewhat important; 4 = important; 5 = very important

Table 5. Analysis of the differences in expert opinions about the "*main purpose of urban forests", "feasible activities"* and *"spatial functions to be included in urban forests*" in terms of their differences in gender, professional group and experience

Variable	***Kruskal-Wallis H-Test***		***Duncan's Multiple Range Test Results***			
	Criterion	***Asymp. Sig.***	***No.***	***Different Group Elements***	***Av.***	***N***
Meeting the recreation and social needs of city dwellers	No significant difference in terms of professional group or experience					
	Gender	0.039*	1	Male	104.43	123
			2	Female	88.50	73
Nature hikes and excursions	No significant difference in terms of gender, professional group or experience					
Hiking and jogging trails	No significant difference in terms of gender, professional groups or experience					

*If Asymp. Sig. is >0.05, there is no difference at 95% confidence level; if Asymp.Sig.. is 0.01< – <0.05 *; if Asymp. Sig is <0.01 ***

Table 6. Frequency distribution of arguments on "*internal problems arising from the structure and characteristic of urban forestry in Turkey*" and *"external issues affecting urban forestry activities in Turkey"* (In bold the first two highest frequencies for each argument)

Arguments on the internal problems arising from the structure and characteristic of urban forestry	***1***	***2***	***3***	***4***	***5***
Urban forests are not well managed	7	8	24	23	**38**
Research and development findings could not be implemented sufficiently	4	8	22	38	28
There is a lack of education, knowledge and experience	9	9	18	38	26
Resources are not used rationally	4	10	20	37	29
Public relations are not adequately developed	6	8	19	39	29
The functions and goals of urban forests have not been promoted	5	6	16	36	**38**
Coordination between relevant institutions is insufficient for the establishment and operation of urban forests (Ministry, Municipality, Governor's Office, etc.)	4	8	21	26	**40**
There are no accurate and complete inventory studies on urban forests	5	8	34	33	20
There are no specialized management or maintenance teams in urban forests	2	12	32	31	23
No maintenance, conservation, development or monitoring programs have been established for urban forests	2	8	29	35	26
Urban forests do not provide employment for city dwellers	8	21	36	25	10
Urban forests do not contribute to the urban economy	9	19	34	26	13
Arguments on external issues affecting urban forestry activities					
The concept of urban forests has not been sufficiently defined in Turkey	2	5	7	49	**37**
Laws or regulations related to urban forests are inadequate	6	9	16	29	**40**
The political and social demand for urban forestry is weak and insensitive	8	9	16	34	33
The labor force in urban forests is not qualified or sufficient	8	10	30	34	18
Expert planning teams cannot be utilized in the planning of urban forests	4	10	29	32	25
There are financial deficiencies	8	16	36	27	13
Site selection for urban forests is not made by scientific means or by experts	8	7	33	22	30
EU harmonization laws do not provide sufficient contributions to the establishment and development of urban forests	8	8	47	22	15
The budget allocated for management is not enough	6	8	46	23	17
Not enough staff is allocated for management	5	9	43	25	18

1 = Strongly disagree; 2 = Disagree; 3 = No opinion; 4 = Agree; 5 = Strongly agree

Accordingly, Kenney et al. (2011) pointed out the importance of clearly defined goals or criteria for the successful evaluation of urban forest management, while success must be assessed due to selected performance indicators. The success of the plan is based on defining the vision, goals and strategic objectives clearly and the lack of gaps regarding management and organization.

An urban forest must be handled with a holistic approach within the urban development plan and urban policy (Farr, 2004; Miller Report, 2005). The more rational, applicable, participatory and solution-oriented are the objectives and tools determined to achieve the defined goals, the more successful the result will be (Benedek, 2018; Ulman and Dobay, 2020). The results of this study indicate that it is necessary to establish an interdisciplinary team of experts for management plan preparation, site-selection, data collection and evaluation for developing a sustainable utilization system. Setting priorities by encouraging the participation of relevant stakeholders in decision-making and management practices and selecting appropriate planning and design approaches in accordance is crucial. Urban forest management policies should be established in line with the targets set for smart, rational and sustainable management of resource values. A proposed *urban forest management plan* should include plant selection and planting principles, monitoring vulnerability by tree-by-tree-Visual Tree Assessment (VTA), removal and transport operations, budgeting, monitoring and work evaluation, consultation and data collection, all to be carried out in a timely manner. In this study, a 3-stage management planning model is presented within the framework of sustainable conservation and usage approach that includes managers, practitioners and users to the process. The first two steps are (1) data collection and determination of the work to be done and (2) grouping of tasks as in Table 8.

The first two steps are followed by the final step, evaluation and action programming, according to the proposed framework containing objectives and actions to be taken through each process. This step contains complex but essential eight different processes, while first four (resource management, conservation, construction completion and environmental management) are more related with the evaluation of the resource and building an active implementation framework (Table 9). The further processes of evaluation and action programming focus predominantly on policy making and integration with the stakeholders as summarized in Table 10.

Finally, developing a detailed monitoring and evaluation scheme is suggested under Step 3 for the continuity of the established system and sustainable management of the forest, as well as maximizing benefits for the society (Table 11).

Table 7. Analysis of the differences of the expert judgements on *"internal and external problems*" with urban forests in terms of gender, professional group and experience

Variable	*Kruskal-Wallis H-Test*		*Duncan's Multiple Range Test Results*			
	Criterion	*Asymp. Sig.*	*No.*	*Different Group Elements*	*Av.*	*N*
Urban forests are not well managed	No significant difference in terms of gender, professional group or experience					
The functions and goals of urban forests have not been promoted	No significant difference in experience or gender					
	Professional Groups	0.002**	1	Forest engineers	3.74	120
			2	Academicians or others	4.28	80
Inter-institutional coordination is insufficient	No significant difference in terms of gender, professional group or experience					
Laws or regulations related to urban forests are insufficient	No significant difference in terms of experience				--	--
	Professional Groups	0.009**	1	Forest engineers	3.68	120
			2	Academicians or others	4.12	80
	Gender	0.037*	1	Female	111.20	73
			2	Male	94.35	127
The concept of urban forest has not been adequately defined in Turkey	No significant difference in experience or gender					
	Professional Groups	0.007**	1	Forest engineers	4.03	120
			2	Academicians or others	4.29	80

*If Asymp. Sig. is >0.05, no difference at 95% confidence level; if Asymp. Sig. is 0.01< – <0.05 * ; if Asymp. Sig. is <0.01***

Table 8. Step 1 and 2 of urban forest management planning framework

***STEP 1* Data Collection and Determination of the Work to be Done**
All data related to urban forests and urban forestry, as well as general, tactical and practical aspects, are collected for each management division (zone). General and specific targets are set for the management and developing policies that are based on the sustainability principle and will ensure balanced utilization of the resource values of the area. For this purpose, the following data on the area and urban forestry should be obtained:
(1) Data related to surveys conducted with city dwellers and experts, and their statistical analyses, (2) expert opinions, (3) SWOT (strengths, weaknesses, opportunities, threats) analysis, (4) field data and their spatial analysis, (5) visual and ecological analyses with recreational potential synthesis, (6) laws and regulations related to urban forests, (7) regional and other plans on the subject, (8) technical infrastructure and human resources, (9) stakeholder opinions and (10) national, regional and local action plans.
***STEP 2* Grouping of Tasks**

The tasks to be specified in the management departments (zones), created within the framework of the protection-use approach, are grouped. This grouping essentially constitutes the basis for the establishment of the management departments. For this, first of all, tasks that are similar, successive, or physically / geographically close to each other should be considered in the same group. Main tasks may be grouped as follows:
(1) Determination of areas of the greatest to lowest natural importance, areas with low to high recreational potential, non-recreational areas with low recreational potential, panoramic view and observation points, areas with educational potential and landscape elements with high visual value, (2) Defining ecosystem services to be reflected in decision-making, (3) Adopting a sustainable and participatory resource management approach, (4) Protection of main resource values of the area, (5) Developing an action program on the facilities, recreation areas and infrastructure, (6) Promoting economic activities, (7) Developing an action program aimed at preventing environmental pollution in urban forests and minimizing anthropogenic pressures, (8) Developing an action program for the protection and promotion of natural resources, (9) Ensuring that all relevant stakeholders participate in planning and management, (10) Monitoring, controlling and evaluation.

Table 9. Step 3 of urban forest management planning framework Actions according to priority status: high priority (H) - actions should be done within the first 5 years; medium priority (M) - actions should be done within 10 years; low priority (L) - actions should be done within 10-15 years

STEP 3 Evaluation and Action Programming		
For sustainable natural resource management and reflecting ecosystem services provided by urban forests in line with the determined targets, it is necessary to determine which units or workgroups will perform these tasks once the general framework is identified and tasks are grouped. To this purpose, strategic goals, objectives and actions must be provided such as given below:		
A	**Resource Management**	**Strategic Goal: To ensure effective, efficient, sustainable and participatory resource management of the area.**
Objective 1: Establishment of urban forest administrative organization structure		**Actions**: (1) Urban forest manager, assistant manager, support services personnel (forest engineer, landscape architect, etc.) and personnel responsible for site protection and entrances (H). (2) Establishment of working groups related to the field and presenting a work plan (H).
Objective 2: Making necessary arrangements related to the organizational and administrative structure		**Actions:** (1) Job descriptions of managers, technical and all other personnel (H). (2) Making the necessary legal arrangements regarding organizational and managerial structure (H).
Objective 3: Increasing work efficiency and job satisfaction of staff		**Actions:** (1) Seminars and meetings on job productivity and job satisfaction of staff, planning and implementation (M). (2) Making and implementing arrangements for improving the working conditions and personal rights of the personnel (M).
Objective 4: Budgeting of all types of activities		**Actions:** (1) Determining all types of income-generating activities in the area, planning and implementing them (H). (2) Identification and planning of donation opportunities for the protection and utilization of natural resources (M). (3) Defining costs of personnel expenses, equipment and so on, reinforcement of equipment and its maintenance and repair costs, site protection, project applications and so on, and budgeting of all activities related to the field (H).
B	**Conservation**	**Strategic Goal: To ensure that the main resource values of the area are preserved.**
Objective 1: Determination of flora and fauna		**Action:** (1) Preparation of inventory of flora and fauna and endemic species of urban forests (H).
Objective 2: Conservation and development of flora and fauna		**Action:** (1) Providing information on the resource values (forest ecosystem, flora and fauna elements, and esp. rare and endemic species) (H). (2) Putting warning and information signs (H). (3) Taking measures to prevent forest fires (H). (4) Preparation and implementation of management, silviculture and afforestation plans with an interdisciplinary study (H). (5) Erosion risk analysis (steep slopes, moss vegetation cover, etc.) (M). (6) Preparation and implementation of training programs to inform the public about the main resource values of the area (M). (7) Provisioning of necessary equipment and reinforcement for the activities (H).
C	**Construction Completion**	**Strategic Goal: To establish recreational areas and administrative centers in the urban forest that address visitors from different parts of society and to solve all types of infrastructure problems in the area.**
Objective 1: Development of recreational areas and facilities		**Actions**: (1) Determination of entry points (H). (2) Design and construction of all types of facilities for administrative centers (H). (3) Identification, design and implementation of all types of facilities and recreation areas for visitors (H). (4) Establishment and implementation of maintenance and repair programs for the facilities and areas (H).
Objective 2: Development of vehicle and pedestrian access infrastructure		**Actions**: (1) Identification of existing and needed vehicles and pedestrian access infrastructure and superstructure (H). (2) Design and implementation of infrastructure and superstructure and additional space needed for vehicles and pedestrian transportation (M). (3) Identifying areas for plantation and preparation of planting program (L).
D	**Environmental Maintenance**	**Strategic Goal: To prevent environmental pollution in urban forests and minimize anthropogenic pressures.**
Objective: Preventing environmental pollution and minimizing anthropogenic pressures		**Actions**: (1) Cooperation with the relevant municipality on environmental cleanliness and the transportation of solid wastes (H). (2) Placing appropriate trash bins of sufficient number and size in the area (H). (3) Collection, storage and removal of organic and solid wastes (H). (4) Creation of security systems, cameras, etc. (H) (5) Raising awareness on pollution prevention (M).

Table 10. Further processes of Step 3 of urban forest management planning framework Actions according to priority status: high priority (H) - actions should be done within the first 5 years; medium priority (M) - actions should be done within 10 years; low priority (L) - actions should be done within 10-15 years

STEP 3 Evaluation and Action Programming (continued)		
E	**Development of Business Policies**	**Strategic Goal: To determine and implement all types of economic activities in order to generate income, considering the protection and sustainability of resource values.**
Objective 1: Development of areas, facilities and activities		**Actions**: (1) Determination of existing recreation areas/activities, facilities and their development (H). (2) Making each of the facilities, areas and activities suitable for operation considering the current economic conditions (H). (3) Regulation of entrance fees (H).
Objective 2: Establishing programs for the organization of different activities		**Actions**: (1) Determination of all activities related to nature (H). (2) Coordinating these activities with stakeholders to whom they may be relevant (H). (3) Identifying the locations and routes of each of these activities and implementing project planning and organization of programs (H). (4) Promotional activities aimed at making these events publicly known (H). (5) Establishing their remuneration by the economic conditions of the day (H).
Objective 3: Producing and selling natural and handmade products		**Actions:** (1) Identifying and producing products specific to the the regional and urban identity (H). (2) Determination of suitable places in the urban forest for the marketing of these products and establishment of sales points (M). (3) Placement of signs that indicate sales locations (M).
F	**Promotion and Awareness Policies**	**Strategic Goal: To raise awareness of local people and visitors about the values of the natural resources of urban forests and the importance of their protection.**
Objective 1: Ensuring public awareness		**Actions**: (1) Producing books, brochures, jigsaw puzzles, etc. for educational and informational purposes for different target audiences as well as the production of informative materials and preparation and implementation of educational programs (M). (2) Realization of nature education in cooperation with relevant institutions and NGOs (M). (3) Carrying out other educational and promotional activities (festivals, competitions, etc.) (H).
Objective 2: National and international promotion		**Actions**: (1) Preparation of a WEB page covering the urban identity and the local characteristics of the urban forest (H). (2) Providing publicity-related fairs, organizations and so on, with the aim of participation at a national and international level (L). (3) Production and marketing of products and materials (books, banners, local products, etc.) that can reflect socio-economic and socio-cultural values (M).
G	**Cooperation with Stakeholders**	**Strategic Goal: To ensure cooperation between responsible and effective institutions and organizations, individuals and other stakeholders in the management of urban forests.**
Objective 1: Harmonious and scheduled cooperation among relevant stakeholders		**Actions**: (1) To plan and implement compatible and programmed cooperation among the relevant stakeholders (H). (2) Carrying out studies for raising awareness of local people in economic terms (M). (3) Conducting studies for the socio-cultural development of visitors (H). (4) Making efforts to meet the recreational needs and expectations of visitors (H). (5) Organizing events to cover the personnel, protection and maintenance costs (H).

Table 11. Monitoring and evaluation in Step 3 of urban forest management planning framework. Actions according to priority status: high priority (H) - actions should be done within the first 5 years; medium priority (M) - actions should be done within 10 years; low priority (L) - actions should be done within 10-15 years

STEP 3 Evaluation and Action Programming (continued)		
H	**Monitoring and Evaluation**	**Strategic Goal: To monitor, control and evaluate the area in terms of ecological, socio-economic and socio-cultural, recreational and tourism activities.**
Objective 1: Detecting changes in flora, fauna and soil structure		**Actions**: (1) Detecting and monitoring tree health status and changes in the soil structure, and density and diversity of flora and fauna every 5 years esp. in the areas where recreation activities are intense (H). (2) Monitoring tree health status by VTA (H). (3) Taking necessary measures when any negative change is detected (H).
Objective 2: Ensuring environmental cleanliness		(1) Monitoring and controlling the locations and densities of trash bins and warning signs in the area (H). (2) Monitoring and controlling environmental cleanliness in general areas (facilities, recreation areas, roads, etc.) (H). (3) Taking the necessary measures when any negative change is detected (H).
Objective 3: Number of visitors		**Action**: Monitoring, controlling and evaluating the number of vehicles and visitors entering the area and number of participants to the events (H).
Objective 4: Determining R & D subjects and conducting R & D studies		**Actions**: (1) Identifying and prioritizing the issues to be investigated (H). (2) Identification of institutions or persons who may be stakeholders in R & D activities (research institutions, universities, municipalities, etc) (H). (3) Creation of working groups, starting and finalizing the work (M).
Objective 5: Sustainable and participatory resource management		**Action**: (1) Monitoring, controlling and evaluating the management plan, organizational/managerial regulations, work efficiency and satisfaction, and the budget for all activities related to income and expenses (H).
Objective 6: Studies on the conservation of resource values		**Actions:** (1) Monitoring and controlling of educational materials and training programs, books, brochures, jigsaw puzzles, local products, etc. (H). (2) Monitoring and controlling of nature-related festivals, competitions, tree planting campaigns, etc. (H). (3) Monitoring, controlling and evaluating other studies that are specific to the urban identity of Istanbul and the region (H).
Objective 7: All types of economic activities for raising income		**Actions:** (1) Controlling and evaluating different recreational activities suitable to the potential of the area, as well as the activities and organization of programs and local products and the sales points where these are marketed (H). (2) Monitoring, controlling and evaluating information boards (H).

5. Conclusions

In Turkey, the General Directorate of Forestry (OGM) under the Ministry of Agriculture and Forestry (Regional Directorate of Forestry / Regional Directorate of Agriculture and Forestry) is the major authority in forests, thus resulting with the planning and management of urban forests. However, our proposed model encourages the participation of all stakeholders (i.e. municipalities, NGOs, universities, city councils and dwellers, private sector, etc.) to the pre- and post-planning process, which is found crucial for the ecologic and socio-economic sustainability of the area. After updating and revising the *concept of urban forests* according to the ecosystem services they provide in related regulations and urban green system, standards for site-selection should be developed in order to ensure the maximum contribution of Istanbul's urban forests for increasing the life quality of city dwellers as well as enriching habitat diversity in the urban environment. An urban forest offering various activities, spatial functions and multi-purpose services is found as a key to meet the recreational, social and ecological needs of the urban population.

Therefore, activities like hiking, climbing, cycling, orienteering and nature photography as well as more traditional areas like children's playgrounds, observation and viewpoints and botanical gardens should be planned and designed for meeting public demands. Academics, policy-makers, practitioners and other relevant stakeholders need to work much more closely to overcome the difficulties in the establishment and operation of urban forests and to improve urban forestry management.

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