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Aviatorilor Boulevard - Qualitative Tree Assessment

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Abstract

The study is presenting the results of the tree assessment survey carried out over a segment of Aviatorilor Boulevard - an important part of the Romanian green heritage which is also an existing green corridor that links two of the most important landscaped spaces of Bucharest: Kiseleff Park (one of Bucharest's first public gardens) and Herastrau Park (the largest urban park of the city). Beside more deeply inquiring the vegetation status - by adding several new analysis criteria - the study is presenting the outcomes in comparison with the results obtained in 2009 through another study conducted on the same area. The outputs revealed that meantime the overall state of the vegetation worsened although several new additions were made. The gathered data have enabled also the generation of a more accurate image regarding the vegetation's condition embedded within this site. The survey's structure allowed the formulation of some consideration toward the interventions needed in order to stop the vegetation decay and for the future rehabilitation of the ensemble.

Introduction

Romanian cities are facing an accelerated loss of their green assets (especially trees) due to the lack of proper management plans. This problem is mainly generated by the absence of suitable assessment tools, capable to provide information regarding the vegetation state and its needs toward maintenances works. This gap is now reflecting in chaotic trimmings (made regardless of actual needs, importance or overall image of a landscaped area, recommended time for intervention, etc.) concealed under a "beautification" and "sanitation" slogan stated by the local administration representatives. Often, public local administrations are inflicting irreversible damages to urban trees in hasty actions, unsubstantiated on proper studies, only to be fined later by the National Environment Guard in a rather symbolical lanner because nothing else can be done in order to improve the situation (Fig. 1). Besides erratically spending the resources (financial, human, time, equipment), this "management" approach is also producing a rapid decay of urban green space.

Although the vegetation assessment is enforced in Romania by Law no. 24/2007, which states that municipalities should gather "technical data" for all their green spaces according to "quality and quantity parameters" (Parlamentul României Camera Deputaților Senatului, 2007) little was done in this respect. Such

Fig. 1 Images depicting the before (left) and after (right) situation generated by the "beautification" and "sanitation" interventions made by the local public administration in January 2014 upon the vegetation (Quercus rubra specimens) placed along one of the main entrances of Herastrau Park - Bucharest's largest historic park; the cuttings were applied regardless of tree's health, species, needs, etc.; at a later date, under community's pressure, the National Environment Guard analysed the situation and decided that the intervention was made without suitable studies and administrative approvals, but the only measure that has been taken was to fine the administration with approx. 1000 EUR for destroying a main historic feature of the capital city of Romania *(source: left photo - Alexandra Mihailciuc - before February 2014; right photo - Diana Culescu - February 2014)*

an example is Bucharest's Green Cadastre where trees are assessed only by two criteria: height and trunk girth (Fig. 2), thus issues like health, viability, importance within the set-up, future maintenance needs, etc. cannot be addressed.

In the local context there are few incipient demarches, belonging to professionals coming from different work fields, which aim to provide solutions for these problems, but they are either too site / set-up specific or too demanding in terms of human resources needed to carry out the analysis. As an example for the first approach it can be mentioned the method for assessing historic set-ups originating from the romantic period, where the maximum aesthetic value is awarded for "fallen old trees, whose huge decaying trunks have imprinted a dramatic and spectacular touch to the landscape" (El-Shamali, 2010). Also a rather narrow targeted approached is described in the national literature by Dobrescu (2007). Another method developed in the Romanian context is proposing vegetation's assessment according to 28 very complex criteria which represents an extremely laborious work even from the authors' point of view (Ciupa et

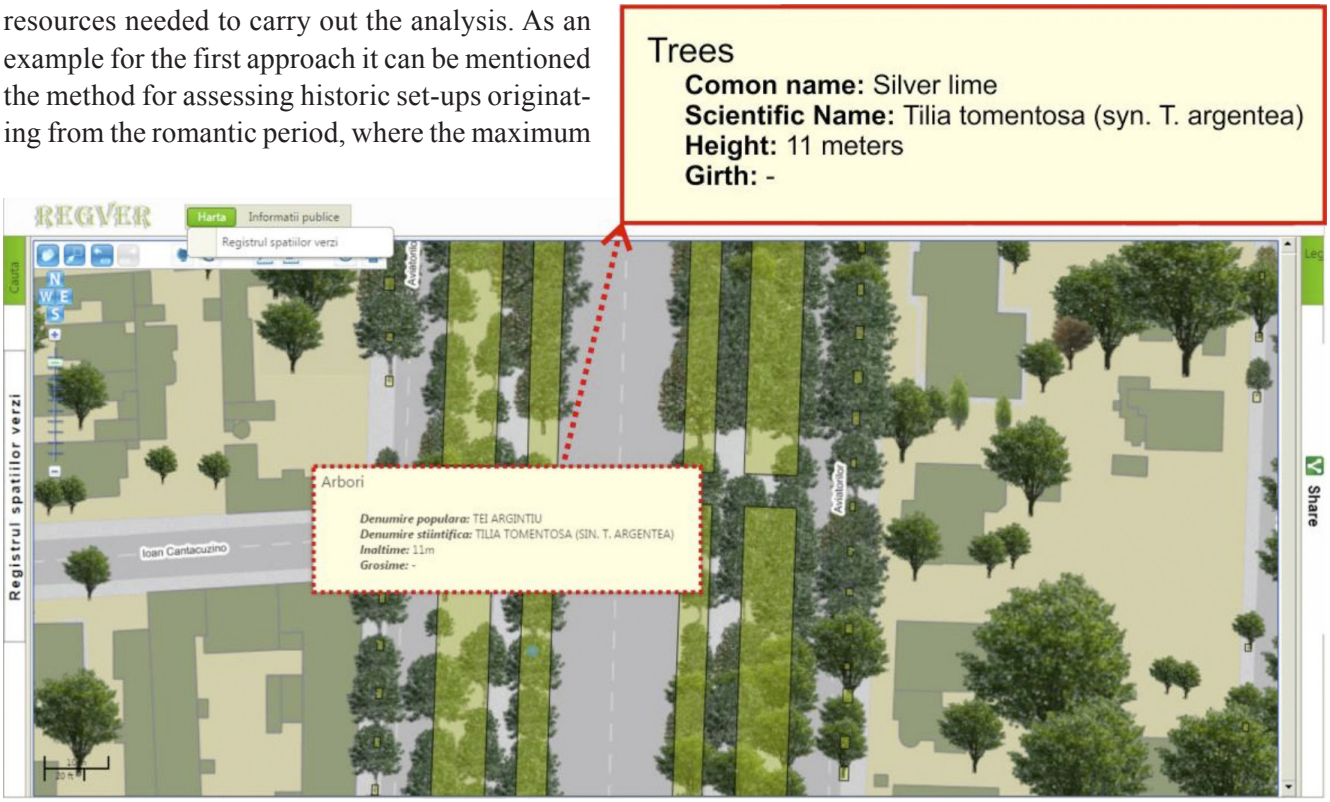

Fig. 2 Sample data embedded by the Green Cadastre of Bucharest for the vegetation placed along Aviatorilor Boulevard *(source: http://regver.pmb.ro/, 2014)*

al., 2005). For example, one of these criteria requires the classification of trees' ages in "classes of ages from 20 to 20 years, similar to the forest management plan" which implies a good knowledge of forestry principles.

This is highlighting another important aspect regarding the public administration's tree survey activity in Romania: the lack of suitable human resources and equipment. Almost always the data are collected from field by inexperienced and unspecialized persons (e.g. students from non-related fields of study). Also, the equipment endowing in rather minimal and oftentimes measurements are not carried out, the physical characteristics being approximated at will by the assessor. This status quo prevents the implementation "as it is" of already established methods used already in other countries.

In this context, the research team's broad intention is to develop a tree analysis method that can be implemented with scarce resources (human, financial, equipment, etc.). In this endeavour, several types of sites are analysed (parks, squares, tree lines, etc.) and different sets of criteria are used in order to determine which are the most easy to be implement and, at the same time, what are the information that they can offer about the quality of the assessed vegetation (by themselves or n correlation with other criteria).

In establishing the analysis criteria also the international literature and practice was revised. In developing the analysis method, there were retained only criteria that implied usage of little or no equipment at all. For example, in establishing the age group classification it was preferred the method specified Littlewood (1988) to the one described by Bourgery and Castaner (1988) which was also considered invasive. An important role was assigned to the visual assessment of trees starting from the work of Mattheck and Breloer (1997) and Shigo and Marx, H (1977), but taking into consideration more recent visions like the one presented by Dujesiefken et al. (2005).

Seeing the particular approach (developing a tree survey method that is relaying very little on specific equipment and specialized assessors) and the fact that tree assessment is a well-established field in countries with tradition regarding this topic (e.g. Germany, France, U.S.A) is not surprising that further similar approaches could not be found in the reviewed literature.

This paper is presenting the outputs generated by the assessment method (in development) regarding a segment of Aviatorilor Boulevard from Bucharest in the summer of 2014. The site is an important part of the modernization period from the beginning of 20th Century and, unlike the other sites studied by the research team in this endeavour, it was previously assessed in 2009. The survey conducted then (Culescu, 2009) used a more limited set of criteria and predicted that the vegetation status will decline further.

Beside describing the outcomes brought by the implementation of the proposed analysis method, the current paper aims to establish if this prediction was met and which are the differences and similarities between the two phases.

Material and Methods

The basis of this survey was Bucharest's Cadastral Plan issued in 1990 and updated in 1991 by Proiect Bucuresti Institute) and the Green Cadastre of Bucharest developed by the local City Hall between 2009 and 2011.

În situ observations were made and data were gathered based on a sheet containing the assessment criteria sections as described below (Tab. 1). The analysis indicators were chosen according to their potential contribution for the development of suitable management plans. Thus, for example, the *age* criterion was quantified in relation with specific maintenance stages and works such as: irrigation or sustaining system monitoring for newly planted trees (N), crown forming cuts for young trees (T), monitoring for mature trees (M), developing in advance new specimens capable to accomplish the same role within a set-up for old trees (B).

The Physical characteristics section is describing the dimensions estimated for each tree using a 1.00 m metal rod module placed at the base of the tree (using a method specific for freehand drawing measurements. For an easy reading of the data and a confirmation of the estimated age, the database is including also the maxim total height characteristic for the specie. The tree size criterion was added to highlight the difference between this two dimensions and it was quantified as: (1) for small trees that have not yet reached half their species' maximum height, (2) for medium trees that passed half of their species' maximum height, (3) for large trees that reached the maximum height specified for their species and (3) for extra-large trees that exceeded their species' maximum height. The trunk height was established also using the approximation based on the reference module. The height of the crown was determined automatically subtracting the trunk height from the total height of the tree. This feature, together with the estimated crown diameter was considered in order to establish the potential tree

Tab. 1 Analysis criteria and their expression within the survey

Analysis criteria	Notation*
ESTIMATED AGE	N (newly planted tree), T (young tree), M (mature tree), B (old tree)
PHYSICHAL CHARACTERISTICS	
Total height	estimated measurement (m)
Trunk height	estimated measurement (m)
Crown height	estimated measurement (m)
Crown diameter	estimated measurement (m)
Trunk girth	measurement (cm)
Axis deviation	(0) for no deviation, (-1) for a $0^0 < X^0 \leq 20^0$ range, (-2) for a $20^0 < X^0 \leq 45^0$ range, (-3) for an angle higher than 45^0
Deviation orientation	N, NE, E, SE, S, SV, V, NV (main cardinal points)
STATE	
Stability	da (=yes); nu (=no)
Anchorage system	da (=yes); nu (=no)
Staking support system	da (=yes); nu (=no)
General condition	(1) for poor condition, (2) for reasonable condition, (3) for good condition, (4) for excellent condition
Useful life expectancy	(1) for 5-20 years - specimens viable on short and mid-term, (2) 20-40 years - specimens viable on a mid and long-term, (3) 40-100 years - specimens viable on long-term, (4) 100+ years - specimens viable on a very long-term
VALUE	
Importance within the set-up	(1) small contribution, (2) medium contribution, (3) considerable contribution, (4) very important contribution
Relation with the surroundings	(1) moderately suitable, (2) relatively suitable, (3) suitable, (4) especially suitable
Aesthetic value	(1) small value, (2) medium value, (3) considerable value, (4) high value (according to the species that the specimen belongs to)
Historic value	(1) small value, (2) average value, (3) considerable value, (4) high value (according to the set-up that the specimens belong to)
Horticultural value	(1) small value, (2) average value, (3) considerable value, (4) high value(according to the species that the specimen belongs to)
Ecological value	(1) small value, (2) average value, (3) considerable value, (4) high value (according each specimen contribution for the environment, biodiversity, ecosystems, etc.)
OBSERVATIONS	descriptive section
REQUIRED INTERVENTIONS / RECOMANDATIONS	descriptive section

*all abbreviation are generated by Romanian terms (e.g. B for Bătrân = old)

foliage volume. The crown diameter is also the main parameter for approximating the size of the shaded surface within the site. The trunk girth in centimetres was measured with a graded ribbon at 1.30 m from the base of the tree. In order to ease the reading of the data for non-professional also the trunk diameter calculated based on the measured circumference was added to the final documented information). The axis deviation considered within this study as the swerve of the tree's trunk from the perpendicular to the ground was also recorded and it was coded as (0) when the trunk deviation is non-existent, (-1) when the trunk forms an angle with a value within the range $0^0 < X^0 \leq 20^0$, (-2) when the average deviation angle is placed within the range $20^0 < X^0 \leq 45^0$ and (-3) for an angle with a value higher than 45^0. The deviation orientation was considered according to the cardinal points using the following notation N for north, NE for north-east, E

for east, SE for south-east, S for south, SV for south-west, V for west, and NV for north-west. These last two parameters were taken into consideration because they can provide information on a number of issues such as the inter-species compatibility / competition, the stability, the viability, etc.

The state section is sketching the general condition of each specimen and embeds the following issues: the stability witch is depicting the capacity of the tree to support its own weight without support / anchorage elements; the anchorage system parameter which records the presence / absence of a supporting system of this type; the staking support system parameter which records the presence / absence of a supporting system of this type. For the general condition and useful life expectancy parameters a four step notation was used ranging from the lowest to the highest, with two intermediary stages.

In terms of value, the analysis envisages: the importance within the set-up which refers to the aesthetic contribution of each specimen as part of the entire landscaped area; the relation with the surroundings is describing the relationship of each plant with the other elements of the set-up (relief, built elements, focus points, etc.); the aesthetic value of the ornamental features; the historic value refers to the importance of the specimens as part of the historical heritage; the horticultural value reflects species particularities within the local context; the ecological value refers to specimen contribution brought to the environment, biodiversity, ecosystems, etc.

The survey is embedding the description of each specimen status and the associated recommendations for further maintenance works. In addition to the gathered information, the state of every specimen was photo-documented in order to unequivocally record this site's "radiography". All data were digitally processed and several maps presenting the current circumstances were generated.

Results and Discussion

In terms of species, the overall vegetation profile did not change significantly in the last 5 years. *Tilia sp*. remains dominant (with roughly 90%) followed by *Fraxinus excelsior* and *Ulmus carpinifolia* (Tab. 2). All specimens of *Acer platanoides* and *Ailanthus altissima* were removed and two new *Abies concolor* were added as a private demarche (the specimens are placed next to an entrance to a private plot, filling a gap recorded in the 2009 survey). Except this case, all new additions are *Tilia sp.* specimens. 6 dead trees were recorded on site in 2014, and the ones logged in 2009 were removed meanwhile.

Tab. 2 Vegetation profile - comparison between 2009 and 2014

Species	No. of specimens - 2009	No. of specimens - 2014
Abies concolor	-	2
Acer platanoides	2	-
Ailanthus altissima	1	-
Celtis australis	1	1
Fraxinus excelsior	36	27
Tilia sp.	518	522
Ulmus carpinifolia	13	13
Dead tree	4	6
Total no. of specimens	*575*	*571*

The specimens are in majority young trees (T), which did not yet reach even half of the dimensions characteristic for their species. Over 6% of the vegetation was framed within the newly planted trees (N) typology. The measurements taken for every specimen emphasizes this observation and the crown coverage (projected diameter) is illustrative for the overall destructured appearance of the set-up (Fig. 3).

Around 24% of the trees - almost a quarter of the vegetation - show a small or medium deviation over the North-South or East-West direction. This issue is mainly caused by the infrastructure works carried out over time in this area without any regard for the trees' root systems. However, at this point all the trees are stable, including the dead ones. *Staking support systems were recorded for all the newly added trees.*

In terms of general condition, a decreasing of the vegetation's quality could be observed (Tab. 3; Fig. 4). Thus, the medium condition percentage shifted from 59% to 47%, and the number of specimens with a poor condition increased with 11% (from 31% to 42%). The very poor condition percentage increased with only 1% from the previous survey. There should be noted that no tree in excellent condition could be found within the

Tab. 3 Vegetation state - comparison between 2009 and 2014

State*	No. of specimens - 2009	No. of specimens - 2014
Medium condition	342	267
Poor condition	176	243
Very poor condition	53	55
Dead trees	4	6
Total no. of specimens	*575*	*571*

*NOTE: no tree in excellent condition could be found within the ensemble

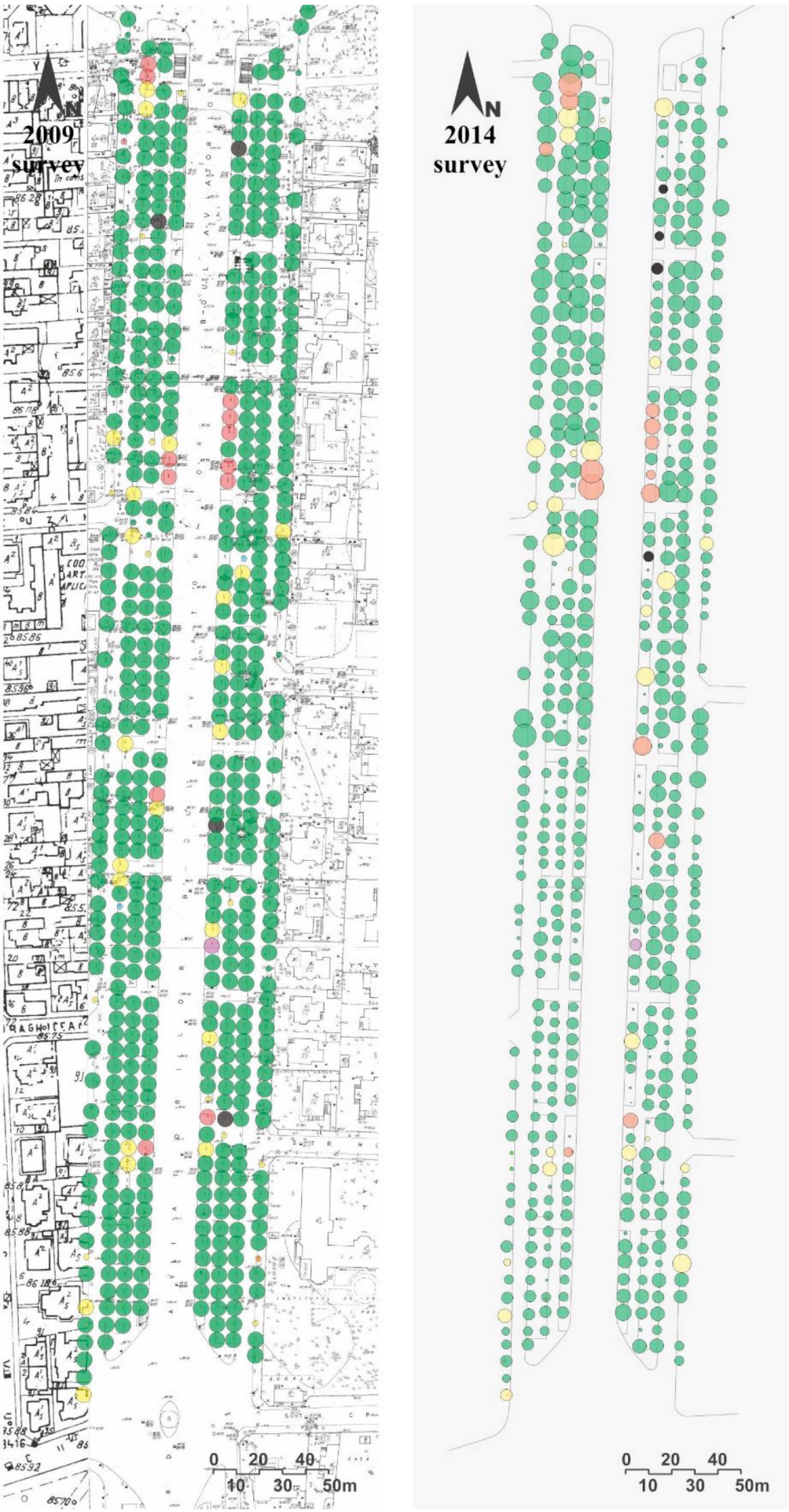

Fig. 3 Species distribution - comparison between 2009 and 2014; in contrast with the 2009 survey, the information acquired in 2014 allowed the production of a clearer image of the overall vegetation status depicting a de-structured set-up.

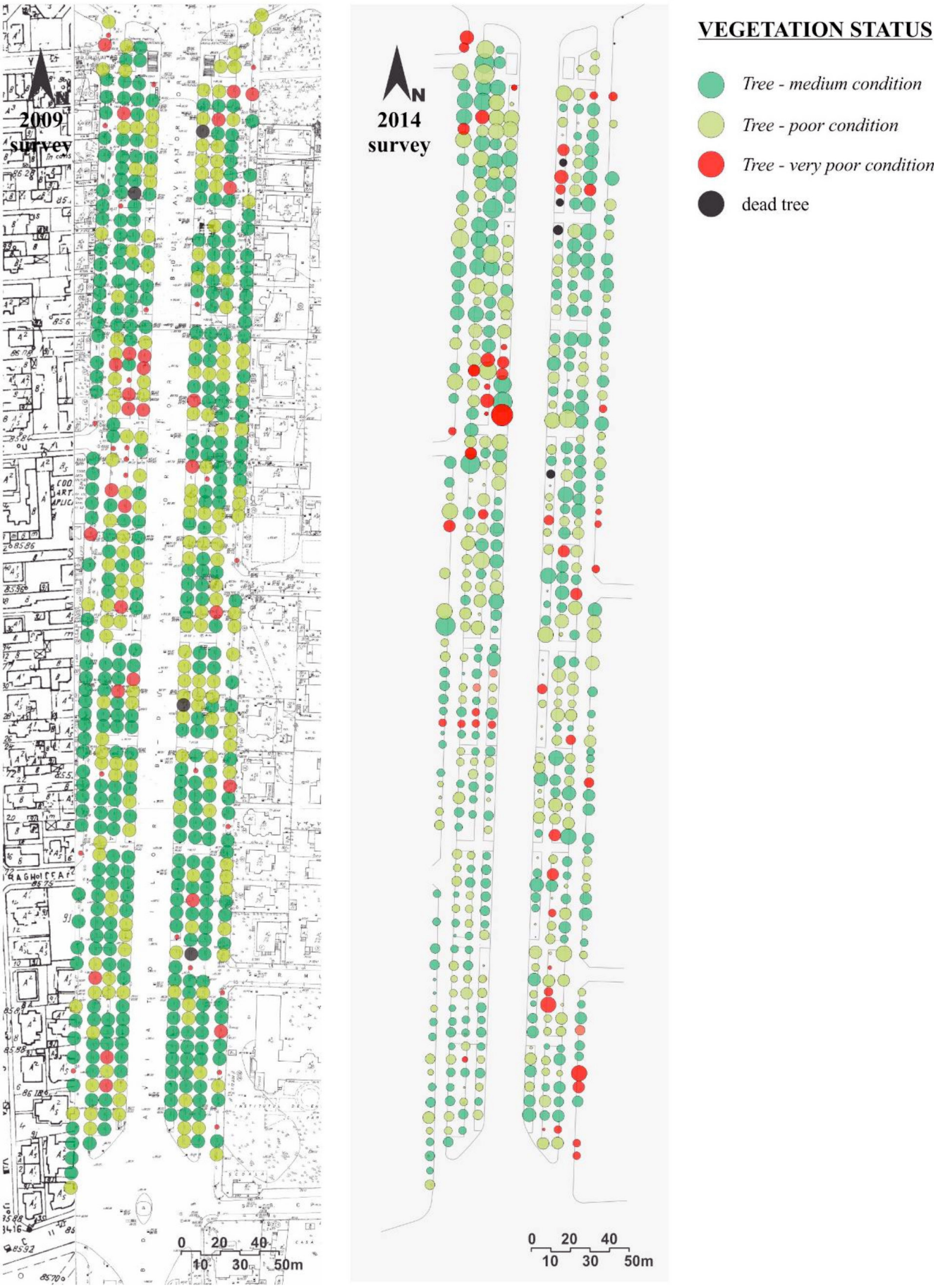

Fig. 4 Vegetation status - comparison between 2009 and 2014; the trees' depreciation can be better observed in relation with the crown dimension in the 2014 survey.

ensemble. These aspects are also reflected by the useful life expectancy of the specimens, more than a half being encased in the first stage (*5-20 years - specimens viable on short and mid-term).*

Seeing the kindred role played by each specimen (part of the tree lines accompanying the boulevard), the species embedded by the site, the overall historic value of the ensemble and the similar relationships established with the surroundings, the survey revealed the fact that there is not a significant difference in terms of trees' value.

For the specimens with a poor or very poor state the main problems noted were: cutting of the growth tip, several dead branches embedded by the crown, unhealed wounds due to inadequate cuttings, asymmetric crown, broken branches, branch stumps, hollows and growth abnormalities. Trees with a medium condition presented some of the following issues: cutting scars, superficial wounds, small hollows, greedy shoots at the trunk level, broken branches, branch stumps, etc.

Regarding the required interventions / recommendations section, maintenance guidelines were drawn for each specimen. They included directives intended to improve (where possible) or to preserve the current state of the vegetation, such as: greedy shoots cutting, branch stumps cuttings, injuries and hollow care interventions, mild (forming) crown cuts, removal of dead wood, etc.

Conclusıons

The general conclusion regarding the assessed site is that the state of the vegetation is continuously deteriorating and, in the absence of appropriate maintenance interventions, the decay will install even more rapidly.

The newly added analyses criteria described a clearer picture of the ensemble, thus showing a rather de-structured set-up. Future management plans should take into consideration the refurbishment of the entire vegetation considering that now more than half of the specimens have a poor or very poor condition and, therefore, cannot properly fulfil their role as a part of one of Bucharest most important green heritage sites.

The implementation of this new analysis method also brought an important angle for its further improvement. The recurring problems described in the *Observations* section and the and the similar suggestion made by *Required interventions / Recommendations* heading have generated several abbreviation used during the field data collection. Thus, in order to ease the data gathering, these sections can be transformed from descriptive into issue selection based.

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