Methodology of selection of spots for urban environmental acupuncture (UEA)

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Summary

INTRODUCTION

This report contains methodology of selection of Urban Environmental Acupuncture (UEA) spots. This is one of the key element of methodological and strategic framework for planning & implementation of UEA at Functional Urban Area (FUA) scale, which is the subject of the SALUTE4CE project.

According to the UEA idea, the numerous interventions in many small spots (which should not exceed 0.2 ha) in a FUA can provide an effect for the FUA as a whole. However, in order to achieve significant and lasting social and environmental benefits, with the involvement of relatively small financial resources, an optimal choice (number and distribution) of UEA places is necessary.

The methodology presented in this report is used to implement Action plans for UEA in four FUAs. That is why the report used the latest lessons learned by project partners preliminary selection of pilot sites in Chorzów, Liptovsky Mikulas, Alessandria and the Weimar-Erfurt-Jena FUA. Generally, however, the proposed method results from state-of-the-art recognition regarding methods of selection of public sites deserving of improvement, especially by introducing elements of the urban green infrastructure. This is based on two large groups of qualitative and quantitative assessment criteria: necessity (expected benefits of greening particular site) and suitability for greening (favourable /unfavourable conditions).

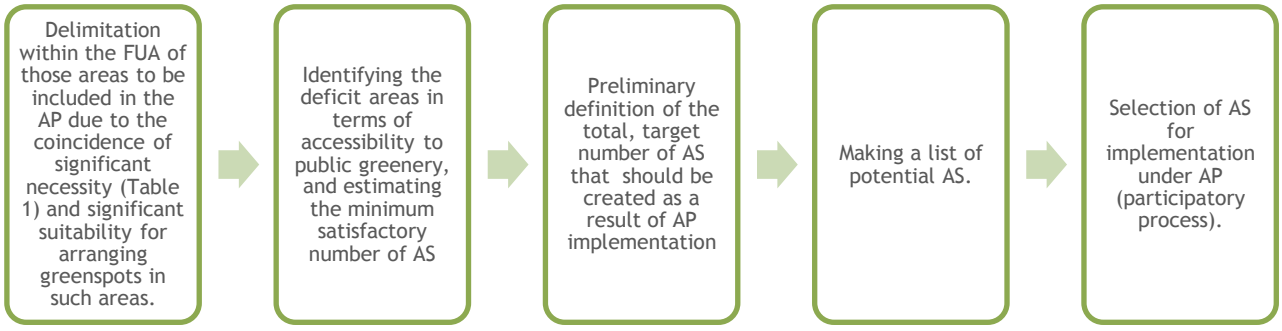
A good choice of spots opens the way for a good choice among possible intervention solutions, but the next report will be dedicated to this last issue.

A. BASIC PRINCIPLES OF PRELIMINARY SELECTION

1. The starting point for analysis must be a broad query of data and information sources, which should relate to all aspects of necessity and suitability for UEA. In both recent and prospective analysis, the data available on digital platforms should be used as far as possible. It may also be appropriate to digitize and introduce data previously obtained in analog form to the digital platform. Therefore, data collection in "traditional" forms, including those obtained through field visits, should not be neglected. Each data / information should be analyzed in terms of completeness, reliability and usefulness for determining the location of potential AS.

2. Preliminary selection of AS (Acupuncture Spots) is an essential element in the preparation of any action plans (AP) for urban environmental acupuncture (UEA) in FUAs.

3. The proposed procedure of selection consists of five main stages:



4. The use of GIS tools can be very helpful at any stage. Therefore, it is strongly recommended to check available digital platforms in the context of the possibility of their use not only as a data source, but also as analytical tools. In the case of prospective analysis, the use of GIS should also be considered as prognostic tools.

5. The necessity and suitability assessment is carried out at individual stages; it is recommended to keep this order (the exception is the stage no: 2, which fully relates to the necessity)

6. Both the necessity and suitability assessments are made in the context of current (recent) conditions and in the context of anticipated (prospective) conditions

7. For the correct interpretation of data on FUA conditions and the conditions of potential AS, one should use the support of specialists (scientists, decision makers, architect, landscape architect, lawyer, environmental engineer) in fields related to all aspects of necessity and suitability-

8. For proper assessment of necessity, consultation with local stakeholders is necessary, and the result of the consultation is included in the scoring according to individual criteria.

B. Stages of preliminary selection

Stage No. 1. Delimitation within the FUA of those areas to be included in the AP.

The logic of delimitation is based on the recognition of those areas that clearly qualify for exclusion, due to the lack / insignificance of necessity or the lack / insignificance of suitability. Consequently, the remaining part of FUA will be indicated for subscription as areas of likely co-existence of significant necessity and suitability. Such analysis must be preceded by the adoption of detailed criteria of necessity and suitability, adequate for the given FUA.

Lack of / insignificance of necessity occurs when, in the light of specific criteria:

- Sufficient green infrastructure exists

  There is already sufficient quality and sufficiently accessible, extensive green area or sufficiently dense network of greenspots in the analyzed, residential area. Sufficient accessibility to greenery can be said in relation to the space in which the functional and spatial proximity of greenery is measured (measured by distance meters and walking time), and at the same time there are no permanent (irremovable or difficult to remove) architectural / legal / site barriers for free access, or

- Potential contribution toward greenspace is low

  The analyzed area is not significant in the light of prospective analysis, i.e. it is poorly accessible as a public space and at the same time far away from the places of residence, and at the same time it is not very important for the functional coherence of the (blue) green infrastructure (B) GI system on the FUA scale, or

- Plans already exist to fill a deficit of greenspace

  There is a deficit of greenery in a given area, however, in the light of prospective analysis, it seems clear that this deficit will soon be eliminated by projects other than our AP. For example, it may turn out that the plans of a local government or developer or other investor

include the introduction of greenspots. In this case, any decision to exclude from AP should be particularly carefully considered and consulted with key stakeholders.

Lack of / insignificance of suitability occurs when, in the light of specific criteria:

- It is illegal

  Pursuant to local law (e.g. according to local development plans), it is not possible to introduce AS in the analyzed area, or

- Plans exist to remove greenspace

  Prospective analysis shows that the area is intended for projects forcing the removal (permanent or temporary) of greenery; such a case may occur despite the lack of a legal barrier to the introduction of AS), or

- Land is unavailable for public use

  The analyzed area cannot be obtained for AP due to the conditions of land ownership.

The area designated for AP implementation should be clearly delimited on a digital map available for analyzes using GIS tools.

STAGE NO. 2. IDENTIFYING THE DEFICIT AREAS, AND ESTIMATING THE MINIMUM SATISFACTORY NUMBER OF AS.

This stage of analysis is aimed at the first, approximate determination of the number of AS to be formed as a result of the implementation of the prepared AP. In-depth map analysis concerns the part of FUA that has already been pre-designated for inclusion in the AP. It is assumed that in this part of FUA there are areas that stand out in terms of the necessity to create greenspots. In fact, these are areas where none of the adopted / recommended for a given FUA urban standards specifying public green/blue infrastructure is met. Such area is hereinafter referred to as "deficit area". It should be emphasized, however, that the location of a site outside the deficit areas does not result in excluding this site from the AP.

It is such a number of AS that, with their optimal location, would be enough to eliminate the deficit completely, i.e. that the urban standard determining accessibility to public greenery would be, even to a minimal extent, met for each resident. It is suggested that the reference point is the maximum distance (expressed as meters or walking time) to the nearest green area having at least the form of a properly arranged greenspot. We can assume that a sufficient number of AS has been designated when each of the deficit areas (each square or hexagon) has at least one site of activity (minimum satisfactory numbers of AS) (Fig. 1).

The correct designation and delimitation of deficit areas is of key importance. Ideally, they would be delimited and visualized using GIS tools. A variety of traditional or digital tools can be used to estimate the minimum satisfactory number of AS for a delimited deficit area.

It should be remembered that it is only about determining the approximate number of greenspots, and also that no theoretical model and no GIS algorithm can replace knowledge of the realities of a given FUA or common sense. Nevertheless, it is worth applying, as an auxiliary, geometric approach, covering the map of the deficit area with grids of regular figures or regularly spaced points. To obtain a fairly good approximation of the number of greenspots, the following solutions can be recommended:

- hexagonal close packed layer of circles - the radius of the circle corresponds to the maximum distance accepted by the urban standard for the nearest greenspot; then the minimum number of AS is equal to the number of wheels within the deficit area
- regular hexagonal grid - the distance specified by the urban standard corresponds to the length of the side of the hexagon; then the minimum number of AS is equal to the number of hexagons located in the deficit area
- hexagonal lattice - the distance of adjacent points corresponds to the distance specified by the urban standard, then the minimum number of AS is equal to 1/7 of the number of points within the deficit area

When estimating the minimum satisfactory number of AS, it should be remembered that in each practical case the border of the deficit area, as well as the border of the whole AP area, does not have to coincide with the limit of the range of anticipated effects. The latter may go beyond the area covered by the action, and run through the adjacent part of the areas excluded due to the lack / insignificance of suitability. For this reason, it is recommended that, using a geometric approach, take into account, as a rule, all those peripheral circles / hexagons that are at least partly in the deficit area.

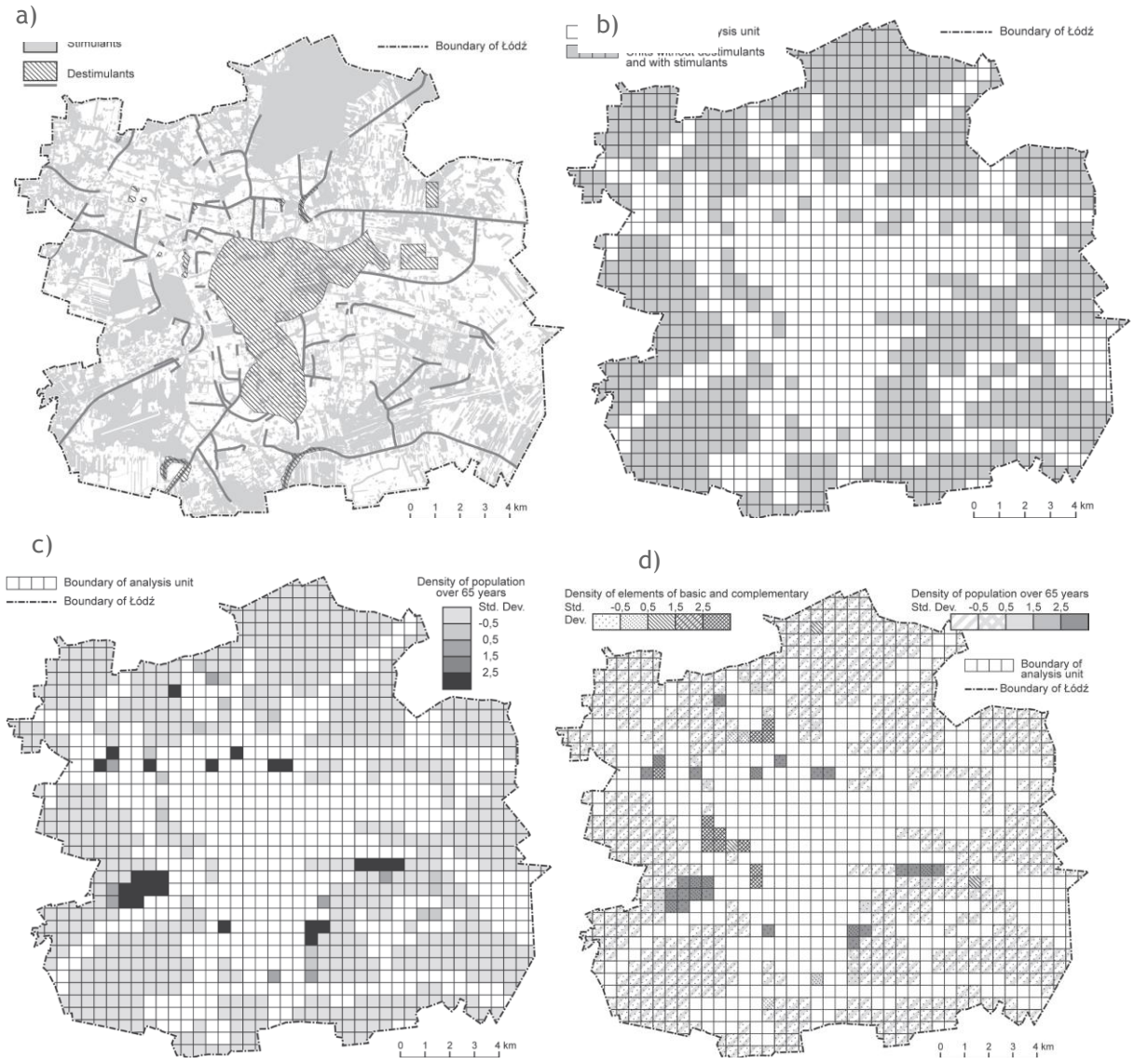


Fig. 1. Space of the City of Lodz, Poland. (Firnoczek-Wojciechowska M. et al., 2007).

a) Distribution of destimulants and stimulants in the space of the city
b) Areas marked for further analysis after taking into account stimulants and destimulants
c) Spatial differentiation of elderly population density in 2015 in Łódź
d) Spatial differentiation of basic fields of analysis in respect of possibility of and need for introducing Inclusive Urban Green Infrastructure

STAGE NO. 3. PRELIMINARY DEFINITION OF THE TOTAL, TARGET NUMBER OF AS THAT SHOULD BE CREATED AS A RESULT OF AP IMPLEMENTATION.

This number will be the sum of the minimum satisfactory number of AS in deficit areas, and the number of AS to be implemented outside these areas. There is no universal formula that would associate the total number of AS with the overall size of the area where AP will be implemented, because there are too many factors to consider when determining the number of AS. It is known, however, that as a result of the full implementation of AP, the entire FUA should change its face in the long term. Therefore, assuming that the action will be a long-term undertaking, one should not unduly limit the number of AS due to current difficulties, e.g. financial or logistic. If AP is to be implemented for many years, it is worth assuming that the implementation of AS in some locations may occur not immediately, but after the current restrictions have been removed.

STAGE NO. 4. MAKING A LONG LIST OF POTENTIAL AS.

The goal of this stage is to form a list of all potential AS, i.e. located in an area delimited in Stage No. 1. Each potential place must combine high necessity and suitability. It is recommended to use the full list of criteria (see Table 1, Table 2) each time for the assessment of a spot.

Pre-selection of a very large number of potential AS should not be avoided. Nothing is wrong if, for example, the number of AS potentials is two to three times higher than the target number of places to be realized, as specified in Stage No. 3.

All available data and information sources should be used for the initial indication of potential AS. These can be planning documents in force in the FUA, local revitalization programs, existing expert studies in various fields (social, natural, economic), street surveys, needs reported through social media, data available on city or larger portals, as well as specialized studies made especially for the needs of the AP elaboration.

All pre-selected places should first be assessed according to necessity criteria. As far as the availability of prognostic data, the assessment should take into account not only the needs arising from the current use of land, but also the projected prospective analysis over the time horizon. The simplest and recommended approach involves directly using the criteria set out in Table 1.

Table 1. The necessity criteria for AS assessment: expected benefits from implementing UEA in a given site. The table was developed on the basis of literature data and as a result of consultations with the project SALUTE4CE partners.

Aspect	Benefits of …	Scoring [0-2 points]
Integration of the local community	Creating "neighbourhood spaces" for spending free time and socialization	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit

	Increasing sense of security	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Creating a positive identity of the place and its vicinities	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Increasing (or creating) the visual appeal of the place	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
Environmental component of life quality	Improving accessibility/ quality of public greenery (in terms of urban standards or ecosystem services)	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Improving the micro-climate (incl. reducing the exposure of people to the heat island effect)	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Improvement of the usability of the green by increase the quality of stay	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Improving accessibility of green space for elderly, mothers with children and/or disabled persons	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
Coherence /connectivity /continuity of urban (Blue)Green Infrastructure network	Spatial/functional linking with already existing or planned blue or green areas / green spots	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Increasing of urban biodiversity (e.g. introduction of native plant species, elimination of invasive plant species).	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Providing the nutrition functions for wildlife (small animals incl. butterflies and other pollinators, or small birds)	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
Components of circular economy in terms of land management	Enabling reuse of urban wasteland by the local community	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Improving rainwater management (by local use of excess rainwater, or infiltration to the ground, or local retention)	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
Functional diversity of public space	Local enrichment of public space with new functions (on a scale of the place)	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit
	Increasing functional coherence of a network consisting of various types of public spaces	2 – big benefit; 1 - moderate benefit; 0 – insignificant benefit or no benefit

It is recommended that the full variety of benefits be taken into account at this stage of the analysis. There is no need to introduce weights for individual aspects or types of benefits.

The initial selection of potential AS can be started only when the indication of sites is already completed or almost completed. Only then should the scoring method and threshold values can be selected.

In order to take full account of the multi-faceted nature of benefits, it is recommended that the score for a given criterion should be able to take only 0/1 at this stage. The threshold values below which preliminary indicated sites will be eliminated from the list should be selected in such a way that the list is at least 3 times longer than the number of AS resulting from the analysis carried out in Stage No. 2. If the number of indicated sites is too small for such a reduction, one should stop at assigning a score to each site.

The list of potential AS selected as a result of the first selection carried out using the necessity criteria should be analyzed according to the suitability criteria. To this end, each potential AS should first be confronted with a list of mandatory criteria, which MUST be complete in order for a given place to be evaluated further. To qualify a site for further analysis, it is necessary that it meets all of the following admission criteria (failure to meet at least one of them is equivalent to elimination):

1. No need for requalification of the site
2. Clear legal status of the place and clear path of arrangements / permits
3. No irreversible conflicts with existing / planned infrastructure
4. No contradiction with applicable plans / programs / projects to which the place is covered (contradiction occurs e.g. when in the light of strategic / planning documents or for technical / architectural reasons, public greenery is not allowed in this place)
5. No explicit conflicts with local stakeholders -

Further detailed assessment of suitability, depending on the availability of prognostic data, should take into account not only the conditions resulting from the current use of the land, but also the ones predicted in the time horizon of the prospective analysis. The simplest and recommended approach involves directly using the criteria set out in Table 2.

Table 2. The suitability criteria for AS assessment: favourable and unfavourable conditions for implementing UEA in a given site. The table was developed on the basis of literature data and as a result of consultations with the project SALUTE4CE partners.

Conditions	Favorable/ unfavorable	Scoring [0-2 points]
Expected restrictions on the use of AS resulting from ownership conditions (public, private)	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
Expected nuisance / time consumption for necessary construction, environmental and conservation approvals / permits, for the implementation of UEA here	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big t
Cost-consuming or time-consuming preparatory work necessary, compared to final implementation and maintenance of greenery	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
Expected restrictions on the use of AS resulting from proximity to “incompatible” objects (e.g. shopping centres, industrial centres, administrative	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big

centres, logistics centres, urban infrastructures, wastelands)		
Difficulties resulting from the specificity of the location, increasing the workload and costs of maintenance, cleaning services and quick repair	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
Potential impediments to implementation or limitations in the use of AS, resulting from current / planned expansion or reconstruction of urban infrastructure at the site	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
The threat of vandalism or anti-social behaviour, the attractiveness of the place for criminals (compared to neighbouring areas)	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
Restrictions on implementation or use arising from the requirements of protection for cultural or natural values already existing in a given place	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
Existing or anticipated restrictions on accessibility for elderly, mothers with children and / or disabled persons (in AS or in the immediate vicinity)	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
Environmental conditions limiting possibilities / comfort for people to stay (air quality, exposure to noise, risk of flooding etc.)	unfavorable	2 – not occurring or insignificant, 1 – moderate, 0 – big
The implementation of UEA will create the possibility of long-term (many years) use of the planned AS as a green spot in public space.	favorable	2 –UEA is coinciding or synergic to previous, not implemented plans for this place; 1 - the introduction of greenery is generally consistent with the programs implemented at FUA level, 0 - no direct premises
Acceptance of local community (in the context of possible conflicts with owners / users of adjacent properties)	favorable	2 - confirmed acceptance from owners / users of adjacent properties, in the absence of premises for potential conflicts, 1 - no premises for potential conflicts, but no confirmation of acceptance, 0 - significant premises for the occurrence of conflicts (not yet disclosed)
Despite the lack of greenery, a place preferred by owners / users of adjacent properties) for spending free time	favorable	2 - often (established custom), 1 - occasionally, 0 - no
Expected functional/spatial links with nearby compatible facilities (e.g. residential centers, sports centers, cultural centers, educational	favorable	2- significant links, 1 - moderate link, 0 - no links

centers)		
The possibility of introducing and maintaining solutions integrating greenery with the management of excess rainwater or their infiltration into the ground	favorable	2 - easy, 1 - moderately difficult, 0- difficult

Warning! It should be borne in mind that the scoring method for criteria related to favorable and unfavorable conditions is different

It is recommended that the score for a given suitability criterion should only take values 0/1 at this stage. There is no need to introduce weights for individual aspects or types of conditions.

For a combined assessment of necessity and suitability, it is recommended to use Mc Kinsey Matrix (GE version) (Fig. 2).

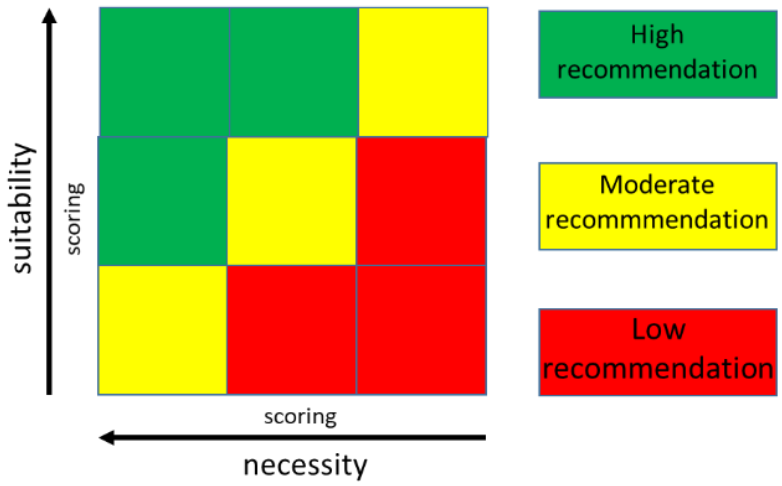


Fig. 2. Mc Kinsey Matrix (GE) in application to the initial assessment of necessity and suitability of potential UEA sites.

Each analysed potential UEA site is reflected by scoring - as a point in the matrix area - in the green, yellow or red field. In the simplest case, maximum both necessity and suitability scorings as 15 pts can be assumed (15 is the number of detailed evaluation criteria). The location of threshold values can be arbitrary and result from the adopted needs / assumptions of the analysis (e.g. 3 points for moderate necessity, 9 for high necessity, and in the same time 4 points for moderate suitability and 11 for high suitability). Assigning a given site to the red field means definitive rejection and exclusion from further analysis. Assignment to a green or yellow field means placing on the list of sites candidates for inclusion in the AP.

STAGE NO.5. SELECTION OF AS FOR IMPLEMENTATION UNDER AP

The goal of this stage is to ultimately indicate sites for AS to be implemented under AP- by selecting from a long list of potential AS prepared in the previous stage. Only this short list will be the subject of further agreements among decision-makers and stakeholders. It is therefore important that it is the result of a thorough comparative analysis of all potential AS.

As in the previous stage, each potential site is evaluated by the criteria of necessity and suitability, and then positioned on the Mc Kinsey matrix. However:

- scores for each criteria should be gradable (0/1/2),
- different weights can be assigned to different criteria depending on the specifics of a given FUA

To assign such and no other weights to particular criteria one should analyse the current and predicted conditions of a given FUA. For example, in the case of the criterion Improving accessibility / quality of public greenery (in terms of urban standards or ecosystem services), it should first be assessed how significant is the deficit of greenery in analysed area.

For the above reasons, the scoring of a given site is more detailed compared to the initial analysis carried out at Stage 4. In addition, the basis for ordering is the product of score and weight across all criteria (Fig2).

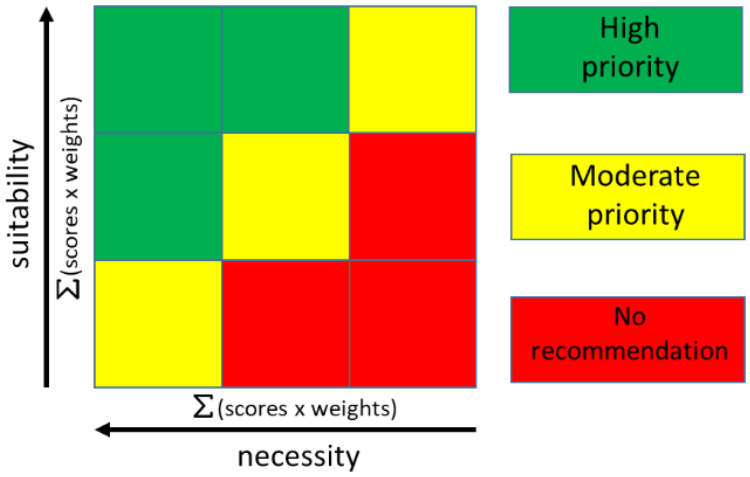


Fig. 2. Mc Kinsey Matrix (GE) in application to prepare the list of AS proposed for implementation under AP

Symbolism of field colours in MC Kinsey Matrix (GE) is associated both with a recommendation (or lack of recommendation – when red) for the implementation of potential AS, and - in relation to recommended AS - for their prioritization. Assigning a given AS to a green field means both a high recommendation and a suggested implementation at an early stage of AP implementation. Assigning a given AS to the yellow field means both a weaker recommendation and a suggested implementation at a later stage. Particularly noteworthy are the AS assigned to the yellow field in the lower left corner of the diagram. These are AS important in the context of FUA due to high necessity, and therefore deserve the fastest possible implementation. However, this will require immediate removal of existing or anticipated barriers or restrictions determining low suitability.

C. INDICATORS

Indicators were divided into two groups - regarding necessity and suitability. Within each of the two tables below, the indicators have been additionally divided into those that relate to an individual spot and those that relate to specific area screening (under preparation).

Table 3. The necessity indicators for AS assessment. They were developed on the basis of literature data and as a result of consultations with the project SALUTE4CE partners.

Possible benefits	Necessity indicators
Integration of the local community	neighbourhood spaces – availability and quality; sense of security; identity of the place and its vicinities visual appeal of the place
Environmental component of life quality	quality of public greenery accessibility of public greenery for disabled, elderly, and mothers with children exposure of people to Urban Heat Island effect usability of greenery (quality of stay)
Coherence /connectivity/continuity of urban (Blue)Green Infrastructure network	linking with other green or blue-green areas / spots quality of plant cover in terms of biodiversity invasive plant species provision of habitat for wildlife nutrition functions for pollinators, and small mammals, and birds, perhaps also other animals typical for respective landscape/biotope/habitat type (e.g. amphibia in wet landscapes/…, reptilian in dry landscapes/… .
Components of circular economy in terms of land management	reuse of urban wasteland local use of excess rainwater local retention of rainwater local infiltration of rainwater
Functional diversity of public space	multifunctionality of public space coherence of a network consisting of various types of public spaces

Table 4. Suitability indicators for AS assessment.

Conditions	Suitability indicators
General conditions of use	ownership conditions time-consuming of necessary approvals / permits, expected workload and cost-consuming of maintenance cost-consuming / time-consuming of preparatory work vs implementation / maintenance cost
Land use or infrastructure conditions	proximity to “incompatible” objects requirements of protection for cultural or natural values links with nearby compatible facilities possibility of long-term public use as a green spot possible infrastructure conflicts at the site

Social, or social security conditions	acceptance (or possible conflicts) of local community recognized preferences for spending free time at the site vandalism or anti-social behaviour attractiveness of the site for criminals restrictions on accessibility for disabled persons, elderly or mothers with children
Environmental conditions	air quality, exposure to noise risk of urban flooding possibility for integrating greenery with rainwater management

CONCLUSION

The presented methodology can be used in various FUAs in the CE area, wherever there are no large areas for planting greenery. It includes various types of expected benefits, such as integration of local community, functionality of public space, life quality, but also benefits for biodiversity, infrastructure, and land management. Therefore, in addition to action plans similar to the SALUTE4CE project, it can be useful, for example, in activities regarding urban revitalisation, climate change adaptation, urban renaissance, urban green infrastructure etc.

The selection procedure always requires:

- recognition of current and future conditions of the FUA area based on all available information, using, as far as possible, decision support tools available in the digital space.
- social participation
- integration of expert knowledge in various fields (social, environmental, urban, legal, etc.)

For the above reasons, its use can contribute not only to improvement of the quality of public spaces, but also to the dissemination of participative approach to public space management

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