Green Areas as a Framework for Ensuring the Resilient of Cities

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Abstract. The article is devoted to the assessment of one of the settlements resilient elements - green areas. It is the settlements greenery that fulfill a huge complex of ecosystem environmental services and functions. Several definitions of the settlement's resilient are given. Further development of this scientific area is includes city resilient profiling and is carried out to compilation the object passport. The method of systematic analysis was applied to field data of structural features and functional zoning of cities in Russia and abroad. It allows us to identify the possibilities of green areas for determination of settlement resilient. The article gives a general view of relevant and up-to-date classification of green areas, which consists of 4 categories and 30 types. Each greening object is evaluated according to the author’s methodology, which includes an assessment of 31 indicators (e.g. debris on the land, area of disturbed land, the presence of unique species, the intensity of the load at survey time, etc.) Each greening object is evaluated according to the author’s methodology, which includes an assessment of 31 indicators (e.g. debris, area of disturbed land, the presence of unique species, the intensity of the load at survey time, etc.) and estimation of six classes of hemorobicity from normal to catastrophic. The total score of these indicators is the coefficient of the environmental situation. With this coefficient, it is possible: to assess the state; compare dynamics and objects, carry out remedial actions to reduce the class of hemorrhage and analyze the effectiveness of these actions. This indicator is a convenient tool for city logistics decision-makers and public environmental organizations.

1. Introduction
Urban areas can be considered as living organisms, subjected to constant change. It affects all elements of the city - environmental and human, material and intangible. The changes are a consequence of a significant number of factors - from disasters, accidents and the implementation of a general plan for the building, the elimination of obsolete industrial facilities, and the widening of highways, up to revolutions and epidemics.

Programs listed below considered important in regulating the development of settlements, especially large ones. It has different levels of government - from the World Community to documents of municipalities:

1. UN-Habitat.
2. Sustainable Development Goals.
3. WHO - Healthy cities.
4. Federal target programs of Russia.
5. General planning of development of cities and settlements.
6. Municipal development and improvement programs.

Nowadays a huge part of the world's urban population is significantly exposed to environmental risks, such as high pollution of all parts of the environment, increasing population and density, extreme weather events resulted in more frequent and severe droughts and floods, sea levels rising, extreme heatwaves, earthquakes, tsunamis, landslides, flash floods. These events cause enormous economic and social losses, and they even frequently result in human casualties. The international community under United Nations auspices is elaborating a vector of innovative development - such as profiling the resilient of cities.

The main purpose of this work is to categorize the green areas as ensuring framework for the resilient of cities.

During the work, the following tasks were highlighted and completed: collecting data on the state of green areas, classifying landscaping objects, determining the type of green area and its features, calculating the coefficient of the environmental situation to assess the state of the object greened.

2. Theoretical part
Resilient of settlement:
- as stability and the ability to maintain its functions, especially in case of natural and man-made disasters;
- as the capacity to absorb and implement a new sphere/area and/or sector of industry towards the existing in accordance with the division of Labour Recruitment of Industries
- as an innovative structure that ensures the self-sustaining functioning of all system parts at any time at any changes;
- as the ability of individuals, local population and organizations to survive, adapt and develop under the pressure of serious stresses. It consists of the proper organization of the city space, the readiness of services and the correct behavior of the population, there are environmental, economic and social directions for sustainable development [1, 2].

Profiling, as a collection and a set of characteristics, may be considered a portrait of an object. Resilient could be defined as a creation, fulfillment and maintenance of such characteristics of the city that will:
- enable the city to endure natural disasters and other distresses with the negligible or minimal losses for infrastructure and functioning;
- will lead to survival of the population and protect the population's health in case of different scourge and turbulence;
- will protect the environmental situation from getting out of control;
- will prevent settlement's environmental quality deterioration to level then itself will become a catastrophic factor.

3. Materials and methods
Method of system analysis was applied on collected field observations data. It was used to identify the possibility of green areas in stating the resilient of a settlement. Observation data contained information about structural features and functional zoning of more than 50 Russian cities (Irkutsk, Moscow, Melenki, Angarsk, Usolye-Sibirskoe, Kaliningrad, Vladivostok, etc.) and foreign cities (Paris, Amsterdam, Istanbul, Berlin, Ho Chi Minh City, etc.).

4. Results and discussion
Each settlement consists of a complex of functional zones - objects that in one way or another, in addition to building elements, driveways, buildings, structures must be greening. It is plantations that
perform a huge range of ecosystem services (environment-forming, global, resource, ecological, sanitary-hygienic (health), medical-social, decorative and planning, scientific and educational) and functions [3]. Eventually, the structure of the settlement, its resilient, safety, economic stability and social stability directly depends on the structure of each greening object and on their general classification. Its relevant version consists of 30 types and 4 categories:

1) General use category includes objects that residents can use for recreation without any restrictions.
   1. urban forests
   2. parks
   3. squares, groves, gardens
   4. boulevards
   5. gardening at administrative, public facilities
   6. stadiums
   7. alleys

2) The limited use (partly restricted) category is greening areas that are visited by certain groups of people, often at limited time intervals.
   8. greening of educational institutions
   9. greening of health facilities
   10. greening within a residential multistoried building
   11. greening of the private sector, gardening
   12. greening of places of worship, temples, monasteries

3) A special-purpose category is a group where green areas are protecting the environment from the influence of the object surrounded by these areas and being part of its object. Also green areas are protecting the object itself from outside influence purposely. This category is usually not or very limited used for visits by residents.
   13. sanitary protection zones (buffer zone) of enterprises, facilities, factories, industrial sites
   14. cemeteries and its sanitary protection zones (buffer zones)
   15. water protection zones of rivers and streams
   16. water protection zones of lakes, reservoirs, seas
   17. greening on roads/highways
   18. greening at rail
   19. greening at river and sea ports
   20. greening at airports
   21. greening under power lines
   22. greening near pipelines
   23. specially protected natural areas
   24. greening of resorts
   25. flower-warmhouse, greenhouse farms, nurseries
   26. greening at restricted access and closed facilities

4) The category of the reserved area is objects that are de facto awaiting a decision on their effective use (possibly with the exception of garbage collection sites).
   27. inarable land
   28. wasteland
   29. places for garbage collecting, placing garbage containers
   30. garages, parking.

This classification may be applied in any city in the world. Each type of greening areas has its own structural and functional features. Every type is distinguished by a set of components of both quasi-natural and anthropogenic origin. Only a certain set of all these elements and their condition allows fulfilling the tasks and functions aimed for the greening object. Accordingly, monitoring of each landscaped area is significant to prevent its degradation and to in time restoration of the plant component.
Each greening object is evaluated according to the author’s methodology, which includes an assessment of 31 indicators (e.g. debris, area of disturbed land, the presence of unique species, the intensity of the load at survey time, etc.) and estimation of six classes of hemerobicity: normal, satisfactory, hectic, critical, crisis and catastrophic [4]. The total score of these indicators is the coefficient of the environmental situation of the object.

The fulfilled work indicates the high efficiency of the method. For example, urban forests are usually estimated as the second class of hemorrhagicity. This class means a satisfactory condition. The primary reason of such evaluation is a high degree of litter. If this problem solves, hemorrhagicity class of urban forests will increase to normal. Indeed much more issues have to be addressed with objects such as garbage collection places, but even its condition can be improved at some criteria. It should be noted that a high class of hemorrhage (from 4 to 6) often has an adjacent-house area where even the residents themselves do not take part in the improvement of the territory. The opposite situation is noted when “upgrading and betterment” leads only to deforestation and an increase in the share of impenetrable, asphalted surfaces. It's reducing the ability of a green area to perform its ecosystem functions.

5. Conclusion
The results of this work experimentally showed the efficiency of the method. Applying this technique could evaluate the current state, compare objects and monitor the dynamics, it also may help to carry out corrective/remedial measures to reduce the class of hemorrhage and analyze the effectiveness of these measures. This indicator is a convenient tool for city logistics decision-makers and public environmental organizations.

6. References
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