A spatial relationship analysis between green space and the pulsar effect

Albert Mugenyi

Department of physical planning –P.O Box 2087, Jinja, Uganda

Brief

This paper focuses on the possibilities of quantifying, costing and mapping the damage and risk subjected to a specific green space due to hosting a particular public event. Data concerning landscape-value and use-capacity has been modelled in a GIS environment to generate useful urban planning scenarios.

Key words: **Green space; Vulnerability; Cost; Damage; Risk; Public event**

Introduction

The allocation of urban land to green space as a land use is an important policy issue in almost all countries. This is on the solid background that green spaces play a vital role in society's well being. The struggle to share the limited urban space among the various urban land uses is the biggest challenge in all the cities today. Some land uses which are considered economically less viable like green spaces, have constantly been threatened with use conversion. Its no surprise to mention that some individuals still refer to green spaces, existing in our urban areas, as vacant land that must be put to other meaningful land uses. While there are plenty of community benefits attached to green space, this paper will only outline a few and instead attempt to analyze the impact of some of those uses that put the resource's existence at risk.

New desires in life arising from accelerated modernization and public excitement appear to be the major cause for massive green space destruction. Cases of large crowd-pulling occasions like Olympic games, world cup, international concerts, trade fairs, scientific congresses, cultural/religious festivals, tourism resorts etc are responsible for such crisis. These activities hold both positive and negative implications to the hosting cities as they offset both ecological and economic balances. Most significant danger, however, lies in the hanger-over effect and the quest for the city to recover and function normally again. A lot is done to prepare for the occasion but next to nothing is done to cater for the after effects. It is true that the majority of these activities take place directly or indirectly in the green space. Pulsar effects like bio-diversity suffocation, loss of landscape beauty and excessive infrastructure break down, require a lot of time and resources to restore. In some cases restoration is close to impossible.

Therefore, there's a need to undertake both qualitative and quantitative assessment of green spaces in connection with their usage by exploring a diversity of GIS modeling possibilities. Plenty of values are attached to green space and this should appear as the cause for this kind of study.

The study is based on Zamalek, Cairo in Egypt. Zamalek is an island within river Nile and lies almost at the heart of the Cairo city. Data sets used include; a digital ikonos image of Cairo (2000), analogue maps, ground photographs and socio-economic data. This work was also backed up by the author's practical field experiences within the study area. Data

processing was done in a GIS environment specifically under *arcview Gis 3.2a* and *ilwis 3.1* softwares.

Thus, this paper is structured into four main sections, these are; introduction, review of green space literature, the modeling methodology, results / discussion, conclusions

Review of green space literature

Many element of nature have been monitored with considerable interest. This is especially true for the developed part of the world. Elements with long-term records of monitoring include; water quality, forest coverage, air standards and general atmospheric conditions (Krishnan,1990). Accurate monitoring and mapping of these elements has been enhanced by the use of computer-assisted survey involving the use of geographical information systems and remote sensing.

Accurate evaluation and monitoring of the potential sustainable use of the green space resource appears to be yet another outstanding challenge. The possibility to predict and quantify the risk subjected to a specific green space due to a particular public gathering is paramount. This is the ultimate purpose for this kind of modeling. Modeling is a synthesizing tool, which puts analytical results together to give an overall picture (Joprgensen,1989). This implies that with models, spatial patterns and linkages can be generated in order to accurately quantify human impacts on the green space.

The modeling methodology

The model discussed in this paper relates closely with the natural disaster management models (Van Western,2002). Likewise, it also depends on six major input parameters. These are; vulnerability, elements at risk, cost, damage, probability, and total risk.

*Elements at risk [**E**]* refer to the natural or man-made features that get affected when an event occurs. They include; trees, grass, buildings, tracks, animals, economic activities, household property and population. Hence a detailed inventory of all green space elements must be made. Full characterization of each element based on height, type and area occupied is made.

*Vulnerability [**V**]* is the degree of loss of an element at risk resulting from the occurrence of an event. It is directly dependent on the nature and magnitude of the event. Its absolute representation values range between 0 and 1 inclusive. A vulnerability value of "0" implies that the occurrence of such an event does not in any way affect the elements at risk Meanwhile a value of "1" implies a situation of total collapse or destruction of the elements at risk should the event occur.

Vulnerability of each element at risk depends on the form of public gathering e.g. games, musical concerts, religious functions, exhibitions and public rallies. Each of these gatherings presents unique impacts on the green space largely due to differences in group composition and size, duration of the occasion, and position of the center of attraction. Some occasions like musical concerts attract large crowds mostly composed of the youth. This category of society is in most cases associated with some form of resource destruction. Therefore a public gathering of such a type will generate higher vulnerability values for all the elements at risk.

*Cost [**C**]* is the current market value of each element at risk. This value depends on the individual doing the costing and on the specific purpose for which it is intended. Resource costing varies from ecologist, sociologist to economist. Thus it is dependent upon specie type, resource locality and prevailing market forces. Cost is expressed as a monetary figure in any preferred currency.

*Damage [**D**]* is a measure of losses incurred as a result of an event occurring. It is expressed as a product of cost and vulnerability.

Expected damage = vulnerability * cost

*Probability [**P**]* is the chance of a particular event being performed in the green space. Its representation values range between 0 and 1 inclusive.

*Risk [**R**]* is the expected degree of loss arising out of the occurrence of an event in a specific green space. It is expressed as a product of probability of an event occurring and damage.

Expected risk = probability * damage

This relation confirms the actual influence of probability and cost on the magnitude of expected risk. A high probability coupled with a high cost will generate a high risk. This is clearly observed in the resultant risk maps.

Parametric values are selectively assigned to all elements at risk and the GIS analytical domain is applied to generate the necessary maps, tables, graphs and charts for scenario-I. Applying a new probability function generates scenario-II. This new function depends on the characteristics of the expected public event.

Results and discussion

Results of this work are mainly in form of maps and graphs. The GIS operations enabled the mapping of elements at risk, cost of elements, vulnerability of the elements, expected damage and risk.

Figure1 shows the detailed geographical position of each element. Full characterization reveals the position of the elements in terms of type (tree, grass, building, or concrete surface) and their heights (low, medium or high).

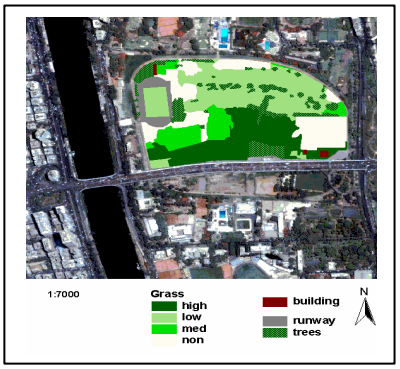

Figure1: Mapping of Elements at risk

Recognition of the ground distribution pattern of each characterized element serves as a basis for vulnerability value allocation. Thus, figure2 shows the position of all the elements at risk and their respective vulnerability values.

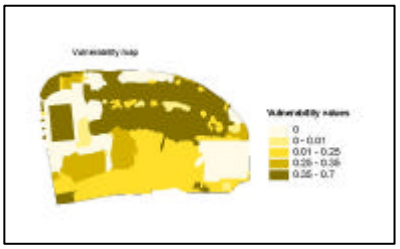

Figure 2: Vulnerability map

Using this vulnerability map, it is easy and possible to identify, especially for purposes of strict resource preservation, those areas that are highly vulnerable.

The cost map generated provides a quick display of market value of all the existing elements at risk. These cost values can be compared to the expected benefits accruing from hosting a public gathering in the green space.

Figure-3 acts as a basis for concern in the use of green space. Damages indicated in monetary terms show the value of expected loss that arises out of hosting an occasion in the green space.

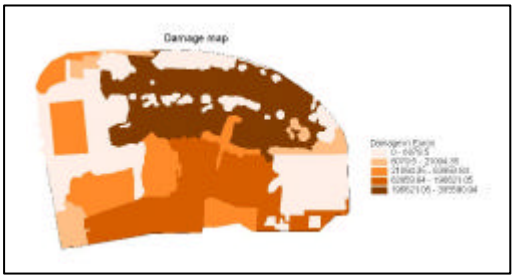

Figure- 3: Mapping of expected damage

This damage value is directly dependent on vulnerability and cost of each element at risk.

A risk map (fig-4) generated through crossing a damage map with the probability of hosting a particular public event, acts as a basis for taking meaningful decisions over the use of a specific green space for that purpose.

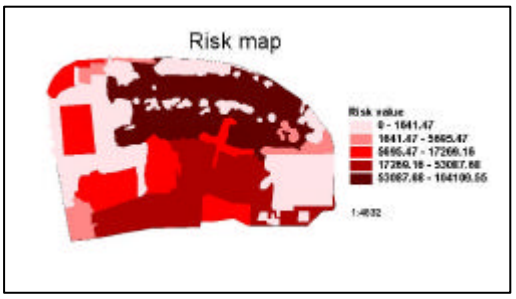

Figure-4: Mapping of risk

Areas with a risk value of 0.00 confirm the absence of any risk arising from that public event. In such a case that area would be fit for hosting a public occasion, other factors being in agreement. This implies that risks vary from one point to another depending on element characteristics

Conclusions

Planning and management of green spaces is deemed to be of paramount importance to both local and central governments. Many policy initiatives to provide for and preserve green space have been a major concern for various governments. This study and its outputs can help contribute to the analysis, design and implementation of these policies.

The application of this model can help in targeting the establishment of specific green spaces that can be used for public gatherings with a potentially low and regulated risk. It is important to recognize the events taking place in the green spaces as constituent parts of our day today society's well being and should be planned for. An influx of people into a particular green space acting as a trade-off from another large public event should be considered with concern and accommodated in the plans.

The parametric variables used in this study and the resultant curves demonstrate a perfect relationship between all the green space elements and the actual expected public event. However special care needs to be taken while determining vulnerability values for input purpose. These values depend largely on; locality, specie value, human effort in resource establishment and maintenance.

Since these green spaces will continue to be used, a further search for answers to the following pertinent questions in form of a research is needed;

(1) Which of these uses offers better possibilities of sustainable green space use?

(2) What other uses of the green space are physically possible, economically viable and socially relevant?

(3) What is the most ideal pattern of green space usage?

Acknowledgements
Special gratitude is extended to the International Institute for Geo-information science and Earth Observation (ITC) – Netherlands, for providing me with an enabling environment to undertake this kind of work.

References
Ratcliff.J;1974. An introduction to Town and Country Planning. Hutchinson Educational Ltd p180-182.
Roberts.M; An introduction to Town Planning techniques , p327-371.
Greater London Council; 1965,The planning of a New Town, p74-77.
United Nations;1996 ,Manual on GIS for planners and decision makers.
Pushkarev.B.S, Zupan J M,1975.,Urban space for pedestrians -A report of the regional plan association, p2-10
Biswas,A , Khoshoo.T.N, Khosla.A (1990) Envionmental Modelling for Developing countries.-Tycooly publishing ISBN 1-85148-041-2.
Cook,E,A ;Van lier,H,N 1994, Landscape planning and ecological networks; Elsevier science B.V publishers -Netherlands.
University of Minnesota Sea Grant programme report - [http://www.enn.com] March05-2002.
James,B ;Greenspace fosters social ties [http://www.enn.com] October05-1999.
Gies.E; Ten shades of green illuminates sustainable architecture [http://www.enn.com] Jan03-2002.
Zhuikov marie, [http://www.enn.com] March05-2002
Prince,s; Envisioning smart growth, [http://www.enn.com] March05-2002