

“The green poster” A method to evaluate the sustainability of the urban green structure

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Abstract

Universal indicators on the sustainability of the urban green structure independent of the specific culture of the country, the region, and even the town, seem to be difficult either to establish or maintain because the opinions differ so much as to their applicability. This notwithstanding, this paper addresses the possibility of establishing a set of relevant indicators. Some of the proposals contained herein are given based on the ideas emanating from the 1987 World Commission on Environment and Development. The importance of the local context as well as the need for more knowledge of the green structure values is also stressed in the paper. “The green poster”—which has been developed in Norway during the last 10 years—is introduced as a potential to evaluate the sustainability of the urban green structure. As an analytical tool, it has the advantage of providing both a numerical as well as a visualized picture of the situation. © 2000 Elsevier Science Inc. All rights reserved.

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1. Introduction

The green structure is generally looked upon as an unquestionable good in urban areas, and even as an indispensable requirement in the development of more sustainable cities. If we take a backward glance into the history of town planning, the picture becomes a bit more complicated. The answer to what a sustainable green structure looks like becomes far from obvious.

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One important question today concerns whether to locate the green areas inside or outside the towns and the cities. In fact, this is a further aspect of the urban density debate that has been going on for most of this century. To what extent should the growth of the cities be inside or outside the existing built-up areas?

The arguments for and against the different strategies have changed quite a lot over the years. At the end of the last century, doctors, philanthropists, and reform-friendly people argued for better living conditions for an increasing working class. The remedy was to divide towns into zones, and to bring sunlight to unlit areas, to establish parks and gardens in built-up areas. One of the new ideas was that of the garden city, which strongly has influenced town planning, not the least in Norway. Although there are few garden cities in the strict sense in Norway [6], the basic ideas found expression in the form of garden city suburbs, i.e., areas surrounding the towns with detached or semidetached housing.

This has been the leading principle for town planning in Norway up until now. The result has been a growth of the towns, which has had impact on important areas to do with biological diversity, food production, and recreation. The need for private cars and large energy requirements are also a result of the town planning principle based on areas of detached housing. These are all tendencies, which today are considered to be unsustainable. Among others, Næss [7,8], for instance, argue that the way to reach a higher degree of sustainability is to develop the compact city. The century-old town-planning concept dream has, ironically, turned into the opposite solution.

Nevertheless, there is no consensus that the compact city is the most sustainable direction to move towards in the future. The counterargument is that we face losing recreational areas, the green lungs, and other areas of biological value within the cities. It is even questionable if cities can be said to be sustainable at all if there are no areas left for children to play in.

The ecocycle town is an important part of this discussion, too. According to some people, proposals to use the local green areas to treat the wastewater and storm water, to create compost, for local food production, etc., are incompatible with the compact city idea. Others maintain that doing so is indeed possible in a compact city, but that wastewater, etc., must be treated just outside the town, thus making use of an infrastructure that is already in place. In their opinion, it is the farmers living just outside the compact city who, in a modern society, handle food production in the most efficient way. These issues will not be discussed in this paper, but are highly relevant for the Cost C8 action as a whole.

Another element, which makes the picture even more complex, is that opinions might differ in different countries and in different cultures as to levels of density and the need for green areas. Even within the same country views on these matters differ quite a lot.

2. Is it possible to develop indicators of the sustainability of the green structure?

Because opinions vary so much, is it possible to agree on what a sustainable green structure should look like? Before addressing this question, it is necessary to discuss the idea of sustainability, and especially the connection between green structure and sustainability.

The idea of sustainability has its origins in the science of ecology, which demonstrated the conditions essential for the ecosystems to survive in the long term. One of the main contributions of the Brundtland Commission ([12], pp. 42–44) was the connection they established between ecology, sustainable development, and the fulfillment of basic human needs. According to the Commission, this means taking care of natural resources in a way that satisfies the basic needs of the world's poor in particular. This has to be done without curtailing life opportunities of future generations. The principle of precaution is, therefore, an additional reason to take care of natural resources.

Both aspects are relevant when evaluating the sustainability of the green structure; it is a part of the natural resources of the town, and should be managed, in a long-term perspective. For many people the green areas also meet needs connected with quality of life, which, in a way, are related to the basic needs. This, however, raises new questions. What kind of green structure will take care of the resources in the best way? What kind of natural resources are we talking about? What does it mean to attend to the basic human needs concerning vis-à-vis green areas?

As far as the first questions are concerned, we have some guidance, for example, in the Rio Convention on biodiversity, which aims to preserve genetic diversity, the diversity of species, and the diversity of biotopes. This means that areas of diversity at all these three levels should be protected as well as species and biotopes, which are rare or perhaps typical to a specific region or country. In the towns and the cities, this implies that areas consisting of spontaneous nature should be evaluated as important to the sustainability of the green structure. One problem, however, is that the knowledge of the urban nature is still at a rudimentary level at least in Norway.

The question concerning people's basic need for green areas is perhaps even more recondite than the first one. As mentioned in the introduction, there will be large variations between cultures and countries in this area. Even between people in the same town opinions will differ. Using the Brundtland Commission as guide once again, we could consider the supply of green areas as a question of juste distribution that especially takes the life quality of the poor people and vulnerable into account. Because we know from statistics that the poor generally do not have cars, and only move short distances from their homes, green areas near to where they live would be of great importance [4]. Several studies lend support to such a standpoint. If a park is located more than 10 minutes away from where people live, 50% of the people will not use it ([5], pp.111–112).

Even if children in general do not need to belong to the group of poor

people, they are similar in that they seldom venture far from home. Thus, opportunities to play in their immediate neighborhood are of special importance to them. Because children's freedom to play without surveillance of grownup has such high status in the Scandinavian countries, this aspect will be of great importance to many people in their views on the sustainability of the green structure. Another similar aspect is the right of children to be able to move freely in their neighborhood without meeting dangerous traffic. This is a matter of the ongoing discussion. To some people the ability of a compact city concept to solve transport problems is superior to other town plan solutions. They say that the central parts of the towns are just not suitable for families. Other questions issues like the size or content of the green areas are even more difficult to pin down. A study carried out in Sweden some years ago [1] indicates that what people find important is the variation in the green structure, i.e., that the opportunities it presents in the population are diverse.

As mentioned in the introduction, the questions of ecocycles and food production are also important when discussing the criteria with which to evaluate the sustainability of the green structure. Because we have few examples where "The green poster" has been used for these purposes, these issues will not be developed further here.

To sum up, some of the criteria to measure the sustainability of the green structure when talking about people's needs and biological values could be: (1) closeness of the green structure to homes, (2) safety, (3) diversity, and (4) the importance of natural areas with spontaneous vegetation.

3. What is "the green poster"?

3.1. The structure of "the green poster"

"The green poster" is a method of analysis to be used as a support in land use planning. In this connection, a landscape-ecological approach has been used to look at the different *values and functions* of the urban green areas. *Values* can be esthetic, like taking care of the beauty of the landscape or ethical like taking care of biodiversity. *Functions* of the green structure are the opportunities it provides for walks, wildlife corridors, recreation and play, wastewater treatment, etc. When viewing the urban green areas as a *multifunctional* structure, the term *green structure* needs to be given a wide definition. Thus, the green structure consists of all green areas of a city, private as well as public, gardens as much as areas of meadowland, woodland as much as parks or church yards, and even rivers, wetlands, ponds, etc.

"The green poster" is based on an arrangement in which the different values and functions of the green structure are analyzed separately. This is a traditional approach in land use planning, but still there are many

reasons for doing so. First of all, it is necessary to show that functions and values may differ according to whether the focal point is human beings or biodiversity. It is not obvious that corridors for people also benefit frogs. Areas valuable for wastewater treatment might not coincide with areas that provide for outdoor play, etc.

The figure below shows how the process of collecting the basic information can be managed in an efficient way, and is used as a thematic map for the actual issue under investigation. It might even be possible to use some basic information on different maps. Usually there is a lot of knowledge about the green structure at the county level as well as in the municipalities. The first step is to get a good overview of all knowledge available so as to avoid a lot of registration work that may have been done already. “The green poster” can, in fact, be looked upon as a tool to organize a lot of knowledge.

In Norway several municipalities have made use of the method in recent years. Almost all of them have focused on three main functions/values: (1) values and functions for recreation and play; (2) esthetic values/landscape values; (3) natural values/biological diversity. The green structure values for some smaller parts of Oslo have been analyzed for local climate purposes. Several of these municipalities have used GIS systems when making “The green poster.” In this paper, the municipality of Tønsberg will be used to illustrate how “The green poster” is developed and how it works.

Tønsberg is situated about 50 km south of Oslo. In 1995, the municipality decided to make a “Green poster” for the whole area as a basis for a variety of ongoing land-use planning purposes. Tønsberg’s “Green poster” consists of the three separate analyses mentioned above. The thematic analysis has not been digitized in Tønsberg, only “The green poster” itself. Figure 1 shows the structure of “The green poster” of Tønsberg. In this paper, only the analysis of recreational values and functions and the natural values and functions will be described as well as the poster itself.

For each topic a thematic map is put together, in which the values and functions of that specific thematic area are analyzed. The criteria must be described carefully to make the evaluations as transparent as possible. This is important when using “The green poster” in a Local Agenda 21 process, for instance. It is also important to show exactly how the criteria are used in the different areas of the city. The criteria consist of different types and estimates in which municipal and possibly government objectives may be important. In addition, the planner’s own practical knowledge, the knowledge of various organisations and the population in general make up necessary elements.

3.2. How can urban vegetation be investigated?

The distribution of the vegetation represents, of course, important data when evaluating the green structure. The problem is that very few municipalities have worked out vegetation maps; it is difficult, moreover, to use

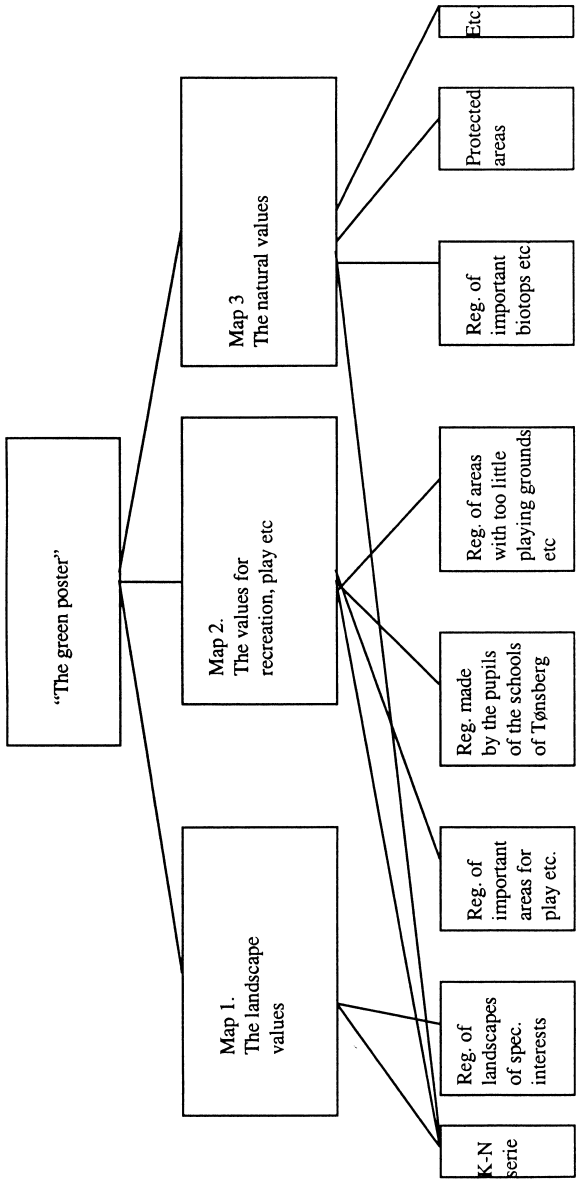


Fig. 1. "The green poster" of Tønsberg.

the traditional mapping methods based on vegetation sociology because most of the vegetation is imported and modified. To investigate the green structure several municipalities of Norway have decided to use the so-called K-N system, which has been developed in research projects in Norway over the last years [2,9]. The method is based on investigating *the structure of the vegetation* by using aerial photos and GIS systems, which make it easier to track changes over time. In a pilot project [3] the use of satellite data has also been tested. The vegetation cover is plotted on a scale from 1 to 4. Category 1 areas have a tree cover in excess of 40%. Areas in category 4 are open without any tree coverage at all. A division has been made between modified vegetational areas (K) and natural vegetational areas (spontaneous vegetation), (N), as shown in Fig. 2.

The map, which was constructed in Tønsberg, has been useful in limiting areas of natural vegetation, areas with water and wetlands, and areas with well-developed tree layers important to insects, birdlife, etc. All these are important to the biodiversity of the town. Tønsberg did not digitize its findings, but some Norwegian municipalities possess results from different times, which made it possible to express the changes within the different categories over several years (see Fig. 3).

3.3. *The natural values of the green structure of Tønsberg*

The investigation and analysis of natural values and functions are based on two main approaches. The most traditional of these is to use the database on localities and biotopes, which is available at the county level, by local nature conservation organisations, etc. The other is a landscape-ecological approach based on the size of the areas, the connections between them, and their content. The evaluation of the natural values is ranked according to four categories: category 1: areas of great importance for natural values; category 2: areas of importance for natural values; category 3: areas of natural value; category 4: areas of little natural value.

In what follows, a description will be given of the criteria for category 1 only [11].

Category 1: areas of great importance natural value. The criteria are as follows: (1) areas of special interest for science mapped at the county level. Mostly areas of national interest; (2) extended unbroken natural areas; (3) all green areas connected to areas of water such as lakes, rivers, brooks, wetlands; (4) continuous undeveloped areas along the coastline; (5) areas or systems of areas of importance as corridors for animals and vegetation; (6) deciduous woodlands of the nemoral zone; and (7) areas with regard to natural biotope diversity.

In the evaluation special attention was given to the areas belonging to the N-system category (i.e., areas of spontaneous vegetation) and areas near stretches of water, rivers, brooks, etc.

<p>The natural system (N system) Areas belonging to this category are dominated by native species. The ground layer is not changed at all or only slightly changed by man-made stress, e.g. limited trampling.</p> <p>1 N > 40 % tree coverage 2 N < 40% tree coverage, often in successive stages, bushes, some trees. 3 N Semi-open areas, some trees and bushes in groups or as solitaires. The areas might be grazed or mown. 4 N Open areas without trees or bushes. Climax plant societies. e.g. wetlands or early successive stages as a result of forestry, ruderal areas, and even grazed or mown areas. 5 N Water, brooks, rivers, ponds, lakes, and seas.</p> <p>The cultivated system (K system) Areas with imported as well as indigenous species. The ground layer is totally changed consisting of, for instance lawns, crop lands.</p> <p>1 K > 40 % tree coverage 2 K < 40%tree coverage, often a well-developed bush layer and some trees. 3 K Semi-open areas, some bushes and trees in groups or as solitaires, some parts with lawns or meadowland. 4 K Open areas without trees or bushes. Lawns, meadowland 5 K Grey areas, areas without green elements, sealed surfaces.</p> <p>In both systems (N and K) there might be buildings or other signs of human activity.</p>

Fig. 2. The K and N system.

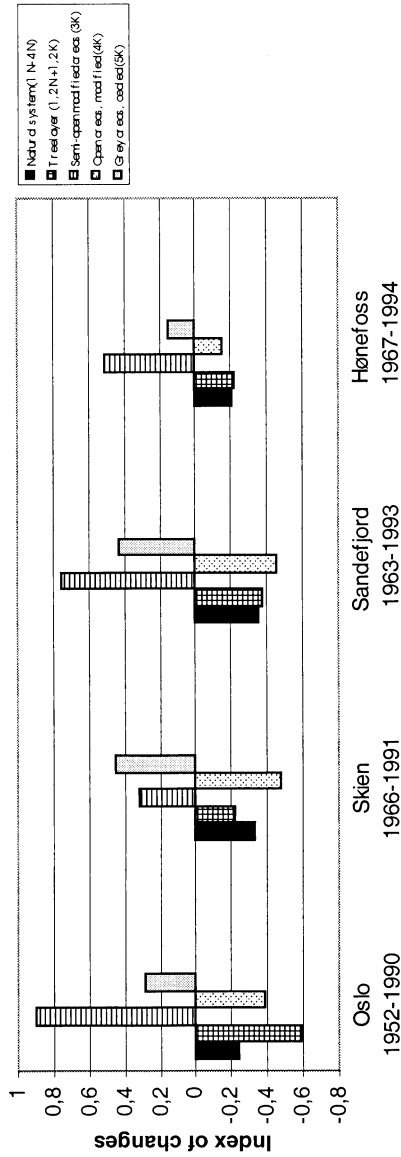


Fig. 3. The diagram shows changes occurring in selected categories of the K-N system over several years in some Norwegian towns. Based on digitized data.

3.4. *The recreational analysis of Tønsberg*

To analyze the recreational/playing areas, data were collected from field studies, from local inhabitants, from school pupils, from the county administration, from existing reports, etc. Meetings were arranged in all local communities to elicit as much information as possible, and the schools were engaged to conduct surveys by the pupils.

Also in this analysis the evaluation was ranked according to four categories; an extra category was included for areas with restricted playing grounds. Only the criteria for category 1 and for the category of restricted playing grounds are given below [11].

Category 1. Areas of great value to recreation: (1) recreational areas in the land-use plan; (2) recreational areas restricted by by-laws; (3) natural areas (areas with spontaneous vegetation) within the built-up zone; (4) much used ski tracks; (5) footpaths and bicycle tracks; and (6) important areas for bathing/swimming.

The K-N system map was used to limit areas with spontaneous vegetation and areas in the vicinity of water. In this analysis ownership rights are not taken into account.

Criteria to illustrate the areas with restricted playing grounds: to illustrate the needs a map showing areas with and without adequate playing areas according to relevant by-laws.

3.5. *“The green poster” of Tønsberg*

“The green poster” is the end of the process. The number of topics that can be analyzed depends on the needs as well as the capacity of the municipality. “The green poster” summarizes the values from each individual map and the different topics are weighed together and classified in different categories. The actual process of making “The green poster” was carefully described when it was evaluated. Category 1 consists of areas *very important* for the landscape, recreational, and natural areas; category 2 consists of areas of *importance* for these functions, etc. In addition, the map provides extended information on landscape values, recreation values, and natural values such as important wildlife corridors, areas containing broad-leaved deciduous woodlands, which are rare in Norway (see Fig. 4).

“The green poster” is intended to function as a dynamic tool for planners, and if the green structure changes, “The green poster” must be changed as well. That is why there are many good reasons for using GIS systems when making it.

4. Discussion

“The green poster” of Tønsberg was not established to measure the sustainability of the green structure of the town. The last question concerns

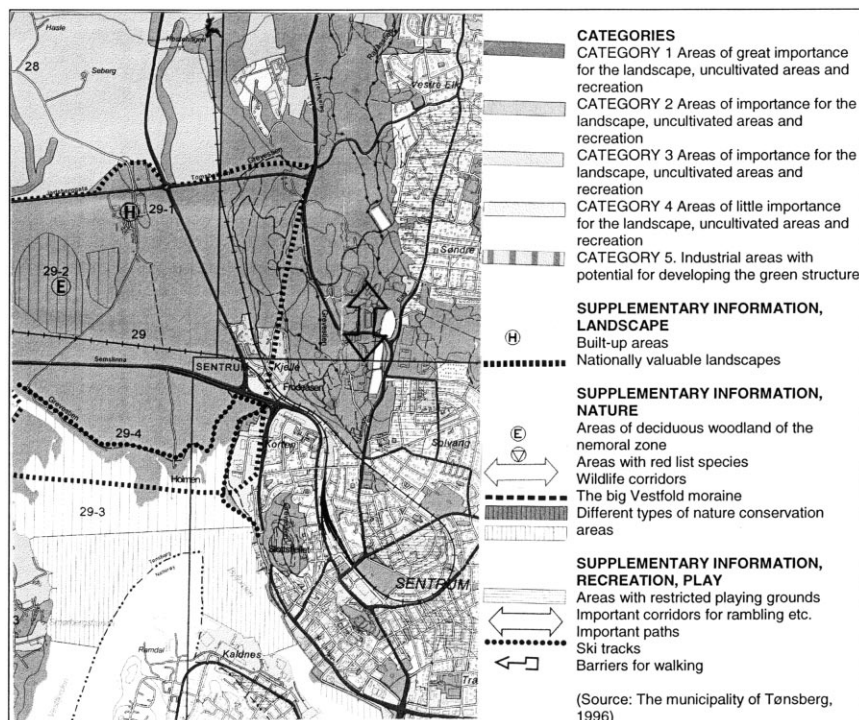


Fig. 4. A section of “The green poster” of Tønsberg.

the extent to which “The green poster” can be used to indicate the degree of the sustainability of the green structure.

The OECD [10] divides indicators into different groups: (1) influence indicators; (2) conditional indicators; and (3) response indicators. “The green poster” is an indicator showing the conditions of the green structure at present (number 2 above). To measure sustainability, it is necessary to go a bit further because knowledge of conditions today does not say enough about the future sustainability of the green structure.

But if the municipality decides to apply some kind of criteria to measure the sustainability of the green structure, “The green poster” might be used even for these purposes. The case of Tønsberg has demonstrated that this is possible, even though the notion of sustainability was not mentioned in the description of the criteria used in the evaluations. Many of the criteria used in Tønsberg and other Norwegian municipalities are similar to those presented in the beginning of this paper.

When addressing the sustainability of the green structure, the most important areas are those evaluated in category 1, on “The green poster.” If “The green poster” is digitized, it is quite easy to obtain a numerical

expression of the situation as well as of the changes over time. The question as to whether the green structure is moving in a more or less sustainable direction can thereby be answered.

“The green poster” used as an indicator not only provides a numeric gauge, but also gives a visual and immediate presentation of the situation. This is important because a numerical expression on its own gives very little information about the distribution of the green structure within the city, and the extent to which the distribution is just, especially where needs are greatest. For politicians as well as the public in general, it is easier to understand a visualization than a number.

The thematic maps and individual investigations can also be used as indicators to describe the direction of the changes in the green structure. For instance, one possibility would be to utilize the K and N system records from different years to express changes that are mentioned earlier in this article. The lack of recreational areas and playing grounds visualized in the analysis of recreation could also be used to follow the situation over years.

Another good reason for combining the idea of “The green poster” with ideas concerning green structure indicators is that “The green poster” is useful for many other purposes with regard to managing the green areas of the town. The work on indicators is not simply a separate input in the planning process; it constitutes necessary steps in the analysis and, in the last resort, the plans or programs.

5. Conclusions

The most important conclusions in this paper can be summarized as follows:

1. “The green poster” seems to be a promising tool when measuring the sustainability of the green structure because it provides a numerical as well as a visualized expression of the situation. It is a transparent method, which is important today when establishing processes based on democratic decisions and the thinking behind LA 21.
2. The big challenge in the future is to agree on and develop the criteria for sustainability of the green structure. General green structure indicators seem to be impossible to achieve, because the local context is so important. More knowledge about the green areas within the urban zone is also needed to analyse more of the functions and values connected to the urban green structure. It would also be of interest to look further into the issues related to the ecocycle.
3. In Norway, another challenge for the future will be to maintain the databases, carry out investigations, and develop and modify the analysis in line with changes in the green structure itself. If this is possible “The green poster” represents a dynamic tool in the elucidation of all these concerns.

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