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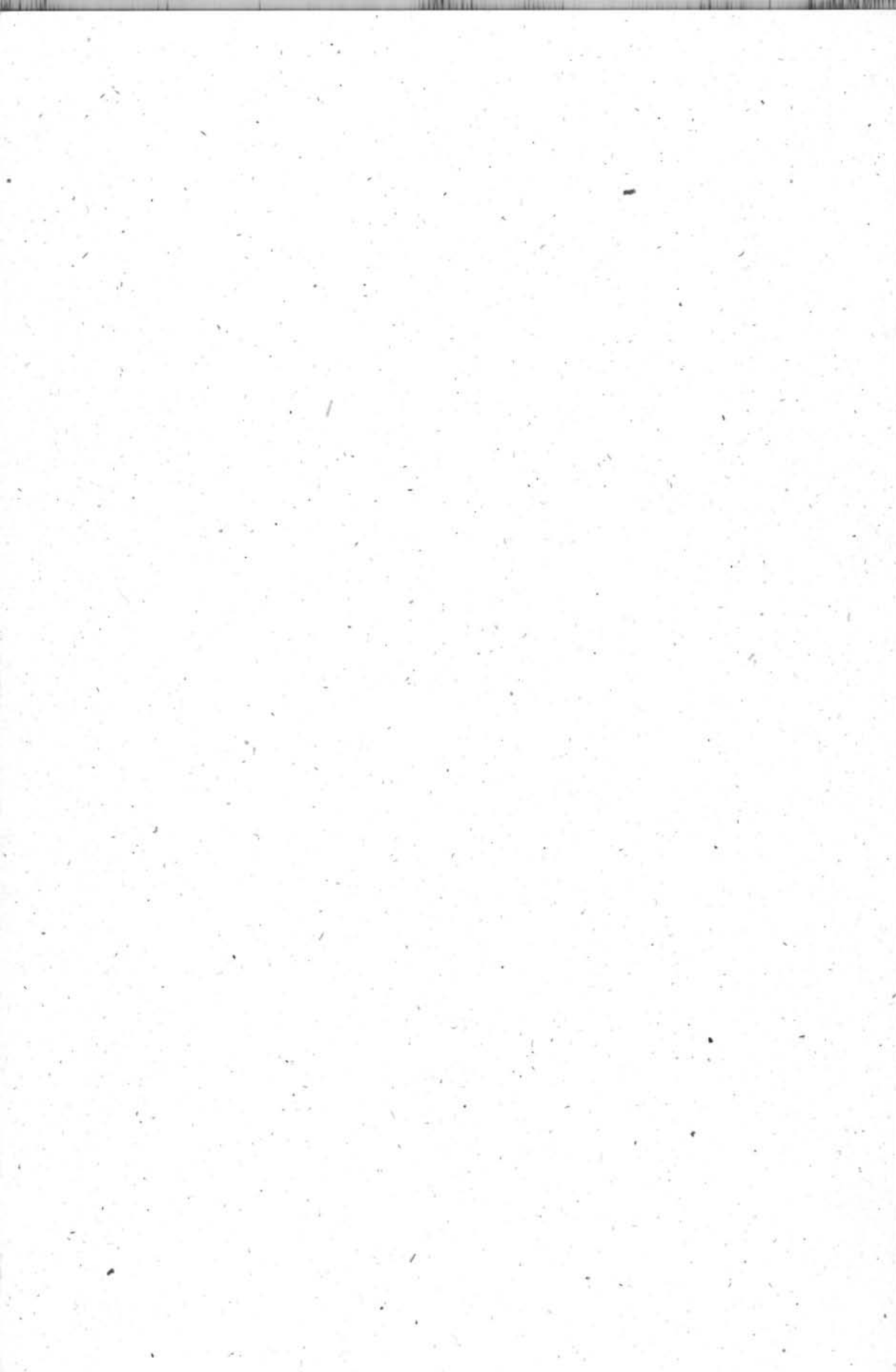


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SUSTAINABLE URBAN DEVELOPMENT: RESEARCH AND EXPERIMENTS

Proceedings of a PRO/ECE-workshop held in Dordrecht, november 1993



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# **Sustainable Urban Development: Research and Experiments**

*Proceedings of a PRO/ECE-workshop held in Dordrecht, november 1993*

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# Sustainable Urban Development Research and Applications

Proceedings of a Workshop on Sustainable Urban Development, 1991



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*Editors:*

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# Preface

As chairman of the Consultative Programming Committee for Spatial Research (PRO) it is a great pleasure for me to present to you this publication. The theme of this publication, sustainable urban development, is one of the major issues of today.

In its Vision on Planning Research in the 1990's, PRO has given priority to several aspects of sustainability, as part of this important research field at the interface of spatial planning and environmental policy. Attention has been especially requested for both research into elements of spatial design which facilitate and encourage environment friendly behaviour, and for research into the pre-conditions for and results of applying ecological principles in cities. These two priorities can together be regarded as the focus of a cluster of interrelated research questions.

PRO has formulated these priorities in order to indicate the direction in which research projects ought to develop. As a result of the overall aim to coördinate and synchronise important research for spatial planning, PRO is not only a platform for discussion but also an intermediary and catalyst, facilitating the type of specific consultation that is needed to coördinate research efforts. In this respect PRO has been active in facilitating this publication on sustainable urban development, in order to promote research coöperation, both nationally and internationally, with respect to the cluster of questions mentioned above.

These activities may be seen as typical for the general functioning of PRO, because PRO is a platform for consultation in which all parties involved in spatial planning research, discuss general topics to be developed and the facilities for this research to be carried out. The studies and advice provided by PRO, are intended to direct attention to questions in management practice and its related research that are not easily solved or do not receive the attention they require. In general these are questions which are connected to new developments in society - developments whose consequences for environmental planning have not been translated into policy problems.

I am sure that the various papers will provide a great deal of interesting information about the state of the art. As the topic of sustainable urban development is still quite new and in progress, I am also sure that this information will reveal a variety of contrasting approaches.

Jan Laan, Chairman of PRO.

the Commission of the European Communities (the 'European Commission') in a report published in 1987 on 'The European Commission's Policy on the Environment' (the 'Report'). The Report states that the Commission's policy on the environment is based on the following principles:

(a) the Commission's policy on the environment is based on the principle of sustainable development, which is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs; (b) the Commission's policy on the environment is based on the principle of precaution, which states that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation; (c) the Commission's policy on the environment is based on the principle of the polluter pays, which states that the polluter should bear the costs of pollution; (d) the Commission's policy on the environment is based on the principle of integration, which states that environmental protection should be an integral part of the Commission's other policies; (e) the Commission's policy on the environment is based on the principle of public participation, which states that the public should be involved in the development of environmental policy.

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# ***Part I***

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## ***Introduction***

## Introduction

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# The Workshop

*Henri van der Vegt*

## 1.1 Introduction

In the agenda for the first session of the Working Party on Sustainable Human Settlements Planning (Committee on Human Settlements, United Nations-Economic Commission for Europe), the Working Party is requested to contribute to the continuing efforts of the Committee to promote sustainable development of human settlements in the ECE region. In particular, guidelines for sustainable human settlements planning and management should be prepared on the basis of material emanating from functions organized under the auspices of the Committee, i.e. the Seventh Conference on Urban and Regional Research (Ankara, Turkey, June/July 1992), the relevant colloquia and workshops preceding this Conference, and the Workshop on Sustainable Development and Urban Morphologies in European and Mediterranean Cities (Poitiers, France, May 1993). Both in Ankara and Poitiers there was consensus on the desirability of holding further meetings with a view to establishing a network for the exchange of knowledge and experience as a basis for developing and maintaining the required guidelines.

Bearing this in mind, the delegation of the Netherlands organised a workshop from 1 to 3 November 1993, in the city of Dordrecht, Netherlands. Several other functions concerning aspects of city ecology, which Workshop-participants could attend, took place in Dordrecht in the days preceding the Workshop. The theme of the Workshop was 'Sustainable Urban Development: Research and Experiments'.

## 1.2 Background and aim

The Ankara Conference concluded that there was an urgent need for exchange of information, views and experiences with respect to ecologically sound urban development, so as to foster national and international coöperation between researchers, planners and designers (Report of the Seventh Conference on Urban and Regional Research). Amongst other things, the Conference stressed the importance of case studies and pilot projects with a view to creating conditions for learning processes focusing on several aspects of sustainable urban development. Illustrative case studies as well as general concepts and methods should be developed and discussed within the context of national and international exchange of information and research networking.

In the Netherlands, many institutions are active with respect to research and planning aimed at procuring insight into sustainable urban development. Research-coöperation in this field is furthered by the Consultative Programming Committee for Spatial Research (PRO), a government-financed committee of the Netherlands Institute for Physical Planning and Housing (NIROV). In 1992, at the request of the Minister of Housing, Physical Planning and Environment, PRO issued a report on research priorities for the 1990's, including priorities with respect to the spatial problems related to sustainability. In a further report interrelations between the various prioritized research themes were analysed. This led to the conclusion that two of the themes, i.e.

- research as to elements of spatial design which facilitate and encourage environment-friendly behaviour, and
  - research as to conditions for and results of applying ecological principles in cities,
- could together be regarded as the focus of a cluster of interrelated research questions, some of which, e.g. time-space behaviour and traffic, relate only indirectly to ecological subjects. PRO decided to focus its activities on promoting research coöperation, both nationally and internationally, with respect to this and suchlike clusters of questions.

Studies concerning sustainable urban development vary widely in scope and methods. This is fortunate, since it enhances learning opportunities arising from exchange of information. The following types may be recognized:

- theoretical studies, i.e. with respect to conceptual problems;
- empirical research within various disciplines (biology, hydrology, energy technology, economics, sociology, geography etc.);
- design studies;
- case studies and experiments at various levels of scale;
- plan evaluations and policy analysis.

Thanks to the Ankara Conference, it is known that the various types and subtypes of sustainability research are unequally represented in different countries. For instance, with respect to design studies, case studies and experiments the Netherlands offers a rich variety of small-scale urban expansion schemes, but very little research has been done as to ecologically sound renewal of existing neighbourhoods. Again, the geographical characteristics of the Netherlands are conducive to the study of the role of water in urban environments, but less attention is paid to conditions for flora and fauna in such environments. In other countries researchers and planners have specialized in different directions. Exchange of knowledge will thus be highly rewarding.

In view of the above, the Workshop in Dordrecht aimed at:

- providing a platform for exchange of topical knowledge and experience on sustainable urban development, with a view to enabling a learning experience for participants;
- identifying possibilities for research coöperation between institutes in different countries (e.g. by comparing case studies and experiments and developing common theoretical frameworks);
- providing inspiration for further research and planning in the field of city ecology;
- contributing to the development of guidelines for sustainable human settlements planning.

### 1.3 Themes for discussion

It was recognized that to achieve concrete results, the theme of the Workshop had to be further specified. The Workshop would focus on three sub-themes.

#### **Sub-theme 1: Design of differential sustainable neighbourhoods**

Human behaviour, including those aspects of this behaviour which at present cause the grave environmental problems we are all aware of, comes about as a result of many interrelated values, responsibilities, conditions and constraints. Habitat characteristics are amongst the factors which play a role: they may either counteract or enable environment-friendly behaviour. It is thus highly desirable to discover design principles for neighbourhoods which conduce ecologically responsible behaviour. Since people differ with respect to values and responsibilities, differential neighbourhoods are required to this end.

Various approaches may be followed to obtain design principles. In fact, interdisciplinary analysis is needed. Such analysis often takes the form of case studies and action research. For instance, in the Netherlands many experimental new neighbourhoods have been developed which enable behaviour contributing to sustainability in different ways, and which are thus suited to diverging life-styles. Similar experiments have taken place in other countries, sometimes with more attention for adaptation of existing neighbourhoods. Though evaluation of such neighbourhoods has taken place, there is as yet insufficient insight into the validity of generalizations based upon the findings. It is, thus, not known in how far the design principles employed lend themselves to extensive application, and in which direction further experiments are needed. To obtain such insight, comparison of many different cases - hence, cases in different countries - and confrontation of case studies with sociological, economic and ecological theory would seem indicated.

#### **Sub-theme 2: Spatial strategies for sustainable flow management**

To achieve sustainability, responsible management of the flows of water, energy, materials (including waste) and traffic which pass through urban settlements is essential. The Ankara Conference concluded that such strategies require technical facilities and policy incentives at the decision-making level (national or regional), urban projects at the intermediate level (district to regional) and preventive effects by individuals and businesses at the local level. The term 'urban projects' in this conclusion should be interpreted so as to include the attunement of flows to the urban fabric and vice versa. Various planning strategies to achieve such attunement, especially with respect to water and traffic, are being developed and evaluated in diverse countries. Such strategies involve finding solutions to technical, social, and administrative problems. International comparative analysis of experience obtained with respect to these strategies should be highly rewarding in terms of solving the problems in a way which is not only effective and efficient, but also in itself sustainable.



### **Sub-theme 3: Spatial strategies toward solving supranational sustainability problems**

Present-day (in terms of Pitkaranta's paper for the Ankara Conference, second-generation) environmental problems are of course of supranational, even global dimensions. Spatial policies of one country may have serious environmental consequences for - or, alternatively, be beneficial to - other countries. For instance, spatial developments in the Netherlands with respect to agriculture, woodland, wetlands etc. affect air pollution and avifauna in other regions of Europe. Conversely, the environment in the Netherlands is influenced by location of industry in France, Belgium and Germany, or changes of conditions in Russian nesting grounds of migratory birds. Analysis of such interrelations might lead to insight into possible improvements in policy which would benefit all countries concerned.

Specific international problems relate to the numerous transborder flows of water, energy, materials and traffic. In this respect, the study of flow systems, using advanced methods and concepts, might yield important results. Cases in point are, for instance, river basins and tourist flows. The former have, of course, already been studied extensively, at least in the case of such rivers as Rhine or Meuse, but new insights may still be obtained. The other example given, tourist flows, with their economic benefits but ecological dangers, would certainly warrant more integral study.

The Workshop should provide an opportunity for exploring possibilities for further international coöperation with respect to the problems indicated, in as far as they affect the sustainability of settlements in the countries concerned.

#### **1.4 Organization and participation**

The Workshop was organized by the Consultative Programming Committee for Spatial Research (PRO) in coöperation with various other institutions, including the Netherlands Ministry of Housing, Physical Planning and Environment and the City of Dordrecht. It was held in the Town Hall of the City of Dordrecht.

The host authorities provided documents discussing the main features of the problems to be dealt with. Participants were invited to submit papers on all aspects of the Workshop theme which they feel warrant attention. In particular they were urged to provide documentation which might serve to identify possibilities for international research coöperation.

The Workshop was the last of a series of four functions concerning sustainable urban development which are grouped together under the name: Dordrecht Ecological Week. The other three functions were:

- Wednesday through Friday, 27 - 29 October 1993: Workshop on Sustainable Urban Development, Exchange of Experience.
- Saturday, 30 October 1993: Congress on Ecological Strategies for Cities: 'A Growing Need for Care'.



- Sunday, 31 October 1993: Technical Visits to ecologically relevant planning and building developments.

The Workshop on Sustainable Urban Development: Exchange of Experience was organized by the City of Dordrecht together with other cities within the European Community in the framework of the Exchange of Experience Programme of the European Commission. The Congress on Ecological Strategies for Cities was organized by the Dutch Platform for City Ecology. It aimed at presenting insights into sustainable urban development to a large audience, to which end some well-known experts from European as well as non-European countries have been invited. All of the functions were organized in coöperation with the Ministry of Housing, Physical Planning and Environment.

The Workshop on Sustainable Urban Development Exchanges of Experiences was organized by the City of Dortmund together with other cities within the European Community in the framework of the Exchange of Experiences Programme of the European Commission. The Commission in Dortmund has signed the 1992 Declaration by the Dutch Minister for City Ecology. It aimed at promoting sustainable urban development in a large number of urban and rural communities across Europe as well as non-European countries. It has involved all of the human resources in cooperation with the Ministry of Housing, Spatial Planning and Environment.

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## The Dordrecht Ecology Week

*Henk ter Heide*

### 2.1 At the Crossroads

In an organizational sense, the *Workshop on Sustainable Urban Development: Research and Experiments* stands at a crossroads.

The one road is that of the series of meetings devoted to sustainability organized under the auspices of the Committee on Human Settlements of the UN Economic Commission for Europe. Highlight of this series was the *Seventh Conference on Urban and Regional Research*, which was held in Ankara (Turkey) in June/July 1992 (see *Urban Ecology* 1992). It was preceded by colloquia in Piestany (Slovakia) and Copenhagen (Denmark), and followed by a workshop in Poitiers (France). Hopefully, the series will be further extended. The Ankara Conference concluded that there was an urgent need for exchange of information, views and experiences concerning ecologically sound urban development, so as to foster national and international cooperation between researchers, planners and designers. Amongst other things, the Conference stressed the importance of case studies and pilot projects with a view to creating conditions for learning processes. The Conference thus helped inspire the aims for the Dordrecht workshop:

- providing a platform for exchange of topical knowledge and experience on sustainable urban development, with a view to enabling a learning experience for participants;
- identifying possibilities for research cooperation between institutes in different countries (e.g., by comparing case studies and experiments and developing common theoretical frameworks);
- providing inspiration for further research and planning in the field of city ecology;
- contributing to the development of guidelines for sustainable human settlements planning.

The *second road* signifies the Dordrecht Ecology Week: a nine-day period running from October 27 through November 4, 1993. Two categories of components of the Week may be recognized. One of these (smaller functions such as technical visits, a task force meeting to formulate guidelines on sustainability for use at a Habitat conference, and various social get-togethers) need not concern us here. The other category is that of the three main components of the Week:

- the Workshop on Sustainable Urban Development: Exchange of Experience (October 27-29);

- the Congress on Ecological Strategies for Cities: a Growing Need for Care (October 30);
- the Workshop on Sustainable Urban Development: Research and Experiments (November 1-3).

These three events can be seen as complementary in respect of their objectives:

- the first workshop: exchange of practical knowledge and network building at a policy-making and practitioning level;
- the Congress: presentation and discussion of excellent examples of sustainable urban development;
- the second workshop: further examination of practical examples as well as principles of sustainability, and network building at a research level.

In view of this complementarity of objectives, summary accounts of the first workshop and the Congress have to be presented in the framework of the second workshop. First (sections 1.1.2 and 1.1.3) brief descriptions of these two events are given. In view of the overlap between the two functions the conclusions emanating from them are assembled in section 1.1.4 (for a summary account of the whole Week see Weeda, 1994.)

## **2.2 Sustainable Urban Development: Exchange of Experience**

The Workshop on Sustainable Urban Development: Exchange of Experience was organized as part of the Exchange of Experience Programme of the European Commission. In the context of this programme, the City of Dordrecht had agreed to organize this workshop in cooperation with three other towns in the European Union: Agrinio and Glyfada in Greece, and Omagh in Northern Ireland.

The programme of the workshop consisted of presentations from various cities, both within and without the European Union. These presentations and the ensuing discussions can be summarized under four headings: methods for sustainable development; environment and building; environment and planning; and sustainable projects.

### **Methods for sustainable development**

The various presentations showed that there is a great deal of similarity in approaches toward sustainability. Policies, however, tend to focus at different aspects of sustainability, for instance at either local or global impacts of pollution. In addition to Tjallingii's study (see chapter 1.2), four presentations described methods of sustainable development in a general sense:

- In *Dordrecht (Netherlands)* an urban ecologist has been appointed to initiate and coordinate activities aiming at sustainability. An important aspect of her work will be stimulating communication between city departments and with citizens. To this end, workshops are organized around various themes in which practical possibilities for making the environment more sustainable are discussed. (The paper on these workshops which Tjallingii presented under the title "The junction: sectoral departments in search of a common language", will probably be published in the Netherlands Journal of Housing and the Built Environment.)

- Ecological strategies in *Omagh (Northern Ireland)* focus on greening urban and rural areas. Diversity and mosaics are considered important, and so are citizen participation and environmental education. In this context, various small-scale experimental projects have been set up.

- In *Sydney (Australia)* concepts of sustainable development are created in the context of the preparations for the 1996 Olympic Village. Greenpeace Australia won the contest for the design of this village, which is to be erected in a polluted area. The plans encompass a range of environmental protection measures which can be applied more widely, including the use of solar power, recycled water and environmentally friendly building materials, and modern systems of public transport.

- Citizen participation is aided in *Duisburg (Germany)* by means of a detailed opinion poll on environmental problems and other problems that weigh on people's minds. Unemployment is the problem most felt. Of environmental problems, waste and air pollution are considered by citizens the most important.

### **Environment and building**

Principles of environment-friendly construction were formulated by an Omagh representative (Tom Woolley): making use of the local climate and of local materials, and saving energy, materials, and water by means of available techniques. Two Dutch cities presented alternative methods for implementing these principles:

- *Dordrecht* employs checklists 'building and environment'. There were two checklists, one for new housing and one for renovation and maintenance. They give advice on the use of materials; energy saving; preventing and recycling waste, both at the building site and in providing facilities for waste separation by the future residents; and water economy. The checklists make use of the so-called Four Variants Approach developed by BOOM Consultants and the Technical University of Delft, which identifies four levels of ambition with respect to furthering sustainability: D, present practice; C, corrective measures; B, minimum environmental impairment; A, autonomous sustainability.

- *Rotterdam (Netherlands)* grants subsidies for environmental construction measures. A list of 64 options for environment-friendly building is used to determine subsidy entitlements. Actual investment in environmental measures is often twice the amount of the subsidy. In addition a more specific example of sustainable building was presented by the town of *Ede (Netherlands)*. This town experienced serious sewerage problems, which were solved by placing a device in the sewers which separates the waste water into upper and lower layers. The upper layer is relatively clean and can be discharged into surface waters where it is cleaned biologically, while the heavily polluted lower flows are sent to a purification plant.

### **Environment and planning**

Case descriptions from the Netherlands and Greece showed the necessity as well as the difficulty of integrating, in settlements planning, social and economic functions, the maintenance of natural systems, and traffic control aspects. At the focus of many of the problems stands the treatment of density. This is exemplified by the 'compact city paradox'. Compact city policy aims at concentrating development as much as possible in and immediately adjoining existing cities. This counteracts urban sprawl and long-distance commuting and aids the preservation of nature in rural areas; but against that, it

creates local problems with respect to noise nuisance, air pollution, lack of urban open space, etcetera. Several cases were examined during the workshop.

- In *Amsterdam (Netherlands)*, the council felt the compact city policy left them no choice but to plan a new residential area in a nearby valuable wetland. A special EIA method was devised to minimize environmental effects.
- Ecologically sound treatment of water and design of roads receives increasing attention in the planning of new neighbourhoods in *Breda (Netherlands)*. Gradually, higher levels of scale come into the picture (cf. Verburg et al. 1994). A regional ecological model has now been developed (see chapter 2.6).
- For *Dordrecht* the compact city policy is required in view of the fact that the city borders on a wetland of unique value, a national park. At the same time, the potentials of the international water-, rail- and highways which run through the city must be realized.
- *Glyfada (Greece)*, a mainly residential community of 80,000 inhabitants, is situated on the coast at only 12 km. from Athens and Piraeus, and thus has to deal with very heavy weekend traffic. A rehabilitation project includes a pedestrian link between the disrupted coastal functions and the urban core.
- In *Agrinio (Greece)* too, pedestrianizing of narrow historic streets and covered-over streams solved many livability problems. In order to achieve this, citizen involvement, including use of private property for public purposes, had to be agreed upon.

### **Sustainable projects**

These were presented by three of the towns participating in the workshop:

- *Agrinio* has developed a low-income housing project in harmony with local environment. The neighbourhood includes ample greenery and social services, especially for children. Use is made of passive solar energy and thermal isolation.
- A plan for a new neighbourhood in *Dordrecht*, called City Fruitful, is based on the idea of mixing housing and glasshouse cultivation. This enables combined use of space (e.g., greenery) and energy (e.g., by means of the total energy principle). It is not yet known whether the neighbourhood will actually be built. (City Fruitful has been described in Dutch and English in Wallis de Vries 1992.)
- The Ecolonia project in *Alphen aan de Rijn (Netherlands)* consists of 101 dwellings in which diverse ecological techniques have been applied. Open space around them was designed so as to enable rainwater retention, but this turns out to result in maintenance problems.

There were several additional presentations, including one by a town not yet mentioned, i.e. *Bamenda (Cameroon)*. Analysis of all of the presentations and discussion showed that 11 themes had been looked at: policy and strategies; community development and education; housing; economic activities (including tourism); energy; water; landscape, nature and agriculture; infrastructure; building materials; liquid and solid waste; and environmental quality in general. Levels of scale considered went all the way from building details to the national level, though the focus was on neighbourhoods, cities and regions. Several conclusions could be formulated. These will be gone into in 1.1.4, in combination with the conclusions of the Congress.



### 2.3 Ecological Strategies for Cities

The Congress on Ecological Strategies for Cities was organized by the Dutch Platform for Urban Ecology, in cooperation with the Ministry of Housing, Physical Planning and Environment, and the City of Dordrecht. The motto of the Congress, and in fact of the entire Week, was: *A Growing Need for Care*. The Congress was attended by some 120 participants.

In addition to information concerning the two workshops, the programme of the Congress contained six presentations. One of these, Tjallingii's paper on ecologically sound urban development (see chapter 1.2 below), in fact was presented thrice during the Week, albeit in different ways. Two of the presentations were already mentioned above because they had also been given during the first workshop:

- At the request one of the hosts, Hein Struben of the City of Dordrecht, *Celia Spouncer* repeated her presentation on Omagh. She introduced the concept of intergenerated equity and was one of the speakers paying attention to the role of children (cf. section 1.1.4).
- The plans for the Olympic Village in Sydney were again presented by *Peter Droege*. These plans clearly illustrate the relationship between levels of scale in environmental planning (see Greenpeace Australia 1993). Both organizations involved in setting standards for the planning, the IOC and Greenpeace, operate on a global level, and in fact for Greenpeace Australia the project started as a kind of by-product of their coastal areas campaign.

The former mayor of Curitiba (Brazil), Jaime Lerner, had been invited to address the Congress, but he was unable to come and was represented by *Liana Vallicelli* of his institute. Since she stayed on for the second workshop she was, as a matter of course, invited to repeat her presentation to the workshop; hence it is to be found below as chapter 2.1. (See about Curitiba also Rabinovitz 1992.)

This leaves two papers which were only presented during the Congress:

- *Hans Leeflang*, one of the directors of the Netherlands National Physical Planning Agency, spoke on behalf of the Minister of Housing, Physical Planning and Environment. He referred to two recent policy documents outlining national environmental and spatial policy in the Netherlands: the National Environmental Policy Plan Plus and the Fourth Report on Physical Planning Extra<sup>1</sup>. The former aims at integrating three policy approaches: cycle-oriented policy, target group policy, and area-oriented policy. The Fourth Report Extra relates spatial developments to the limits set by the environment. Strategies include: priority for railways and waterways; priority for development adjacent to existing cities; public-transport oriented location policy for economic activities; demonstration projects which suggest high-quality, sustainable design solutions at the micro level (City Fruitful, mentioned above, is one of these demonstration projects). In relation to these prevailing policies Leeflang discussed lessons to be drawn from the

<sup>1</sup>

Summaries in English (and other languages) of these reports, and brochures concerning aspects of Dutch spatial and environmental policy, may be obtained from the Publications Distribution Centre of the Ministry: Distributiecentrum VROM, P.O. Box 351, 2700 AJ Zoetermeer, Netherlands, phone +31-79-449449. See also, e.g., Faludi et al. 1991, Faludi & Van der Valk 1994.

ESUD project (see chapter 1.2). He suggested a number of conclusions concerning policy development and laid three questions before the Congress.

- *Arno Schmidt* discussed the ecological redevelopment of the river Emsch within the framework of the Emscher Park International Building Exhibition of North-Rhine Westphalia, Germany. The Emsch is a tributary of the Rhine running through the Ruhrgebiet. The Emscher Park project aims at purifying both soil and water, restoring the landscape, safeguarding industrial monuments, introducing new ('clean') economic activity, and generally upgrading the quality of life. Principles adhered to in this project are that planning takes place at all levels of scale (the catchment area as a whole, and regions as well as localities within it), and that economic and ecological reconstruction go together. One of the goals strived after is heightening awareness of the environment; this necessitates, inter alia, maintaining identity of place, and completing the open space network not only for ecological purposes but also to provide possibilities for extensive hiking and biking trails. Schmidt referred to legal problems encountered; for instance, the quality of rainwater which has fallen on roofs is such that it need not be discharged via sewers and purification plants, but legally it is regarded as waste water (cf. the note on Ede in section 1.1.2).

The Congress programme of course also included time for general discussion. Vallicelli, in particular, had to answer several questions, inter alia about the process character of developments in Curitiba and about the educational programmes.

## 2.4 Conclusions

On reviewing the first workshop and the Congress a number of conclusions can be drawn. Not all of these were in fact made explicit during these events. The conclusions can be arranged (albeit in some cases perhaps somewhat arbitrarily) under the headings of the three elements of Ecopolis as constructed by Tjallingii (see next chapter): flows, areas, and participants.

### Conclusions with respect to flows

- Experiences in many towns show that the careful integration of *water flows* into settlement structures is an essential requirement of sustainability. This is true whatever the hydrological situation, but solutions of course differ.
- The main aim of *traffic flow* control, reduction of private car traffic, can be furthered by various measures, for instance: provision of efficient public transport such as buses (Curitiba, city bus project Dordrecht), pedestrianization (Glyfada, Agrinio).
- *Waste recycling* can be made profitable (Curitiba, Bamenda).
- Much can be done for promoting sustainability during *building processes*: building materials can be chosen in an ecologically sound manner, building waste can be separated and recycled, and building design can enable sustainable behaviour.

### Conclusions with respect to areas

- Ecological strategies should focus on diverse *levels of scale*, and take account of the need for consistency as between measures at different levels of scale (cf. the problems with legal conditions in Emscher Park).



- At the level of *large conurbations*, traffic structures and open space in particular demand attention.
- *New urban extensions* should be differentiated in relation to diversity of landscape and culture.
- In *existing built-up areas* ecological redevelopment is often necessary, e.g. improvement of greenery.
- It is very important to maintain or establish *identity of place* so as to instill in residents a feeling of pride and a wish to participate in bringing about and maintaining spatial and environmental quality.

#### **Conclusions with respect to participants**

- The most successful urban ecological strategies and policies are characterized by high degrees of *interdisciplinarity* and *sectoral integration* (Curitiba being a prime example).
- Instruments toward involvement of participants include social *data collection* (Duisburg) and *workshops* (Dordrecht).
- There is a danger of recognizing only the more obvious *target groups*. Application of the concepts *cultural diversity* and *intergenerated equity* will counteract this tendency. - One target group often ignored are *children*. Experience in Curitiba and Omagh shows how they can be involved to great advantage.

In addition to these conclusions, the first workshop and the Congress of course generated many questions. In fact, the conclusions themselves give rise to questions and uncertainties as to how they should be worked out. The questions may be summarized by saying that there is a need for, on the one hand, new *technical skills* directed at including ecological precepts in the design, (re)development and maintenance of human settlements; and for, on the other hand, new *orgware* enabling efficient cooperation of participants - politicians, citizens and experts - in bringing about sustainability. Numerous learning environments will have to be created to achieve progress toward sustainability. The present workshop is one of them.

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## An Ecological Approach to Urban Planning: Strategies and Guiding Models

Sybrand Tjallingii<sup>1</sup>

*Addressing the challenge of building 'Ecopolis', the city where humans live in harmony with the environment, it will be necessary to devise environmental policies that make the urban system more self-reliant, stable and circulatory, in many ways similar to natural ecosystems.*

*White Paper, Japanese Environment Agency, 1989*

### 3.1 Introduction

In recent years a number of workshops and conferences on sustainable development and urban environmental planning have taken place at the local, national and international levels, demonstrating a growing awareness about these issues.

Under the auspices of the Human Settlements Committee of the UN Economic Commission for Europe, meetings have been organized at Piastany (1990), Copenhagen (1991), Örebro (1992), Ankara (1992) and Poitiers (1993). The Dordrecht workshop has been the next in this series.

This discussion paper has been written for the workshop,

- to provide a framework and incentives for the exchange of views and experiences and, beyond that,
- to give starting points for more European cooperation in the learning process related to fundamental strategies and practical guidelines.

The 'starting points' developed here are based on the findings of previous meetings and relevant reports. They include:

- a conceptual framework to be used as a fundamental strategy and, connected with this strategy,
- 'guiding models', representing prototype solutions for certain categories of planning problems.

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<sup>1</sup>

Institute for Forestry and Nature Research (IBN -DLO), P.O. box 23 NL, 6700 AA Wageningen, The Netherlands.

The participants of the workshop are invited to comment on these 'starting points' for a research programme, and to come up with alternative and supplementary proposals. In addition to the introductory remarks in the workshop announcement this discussion paper will focus on three themes:

- Strategic Concepts (3.2)
- Planning of differential sustainable neighbourhoods (3.3)
- Spatial strategies for sustainable flow management (3.4)
- European cooperation in research projects (3.5).

## **3.2 Strategic Concepts**

### **3.2.1 Introduction**

From a wide variety of publications on urban environmental issues three reports have been selected because they show some characteristics of a framework for research directed to formulating and improving strategies. They have been carried out almost independently and this creates an opportunity to compare their general approach and basic concepts.

### **3.2.2 Environmental Policies for Cities in the 1990's (OECD, 1990)**

The OECD report (OECD, 1990) is the result of a three year inquiry including the analysis of twenty case studies and a general conference. Following a description of innovative and successful approaches it provides 'policy guidelines' for action at local, national and international levels.

#### **Aims and objectives**

The report aims to provide a starting point in establishing new policy guidelines within which urban policy makers can frame individual policy initiatives and specific projects.

The follow-up is the new OECD Urban Programme that started in 1991. The programme will focus on international comparative assessments concerning three themes:

1. To develop further understanding of the ecosystems of urban areas and how these inter-relate with the global environment.
2. Evaluation of exemplary initiatives and good local practice in improving the urban environment and contributing to sustainable global development.
3. Assessment of cooperative arrangements between local authorities, the private sector and individuals beneficial to the environment at the local, national and international levels.

Two key priorities for further OECD studies have been selected:

1. Urban travel and sustainable development.
2. Environmental improvement through urban energy management.

## Conceptual basis

### *Definition*

The 'urban environment' is defined as " including such physical elements as water and air quality, waste disposal, noise levels, neighbourhood conditions and availability of open and green space. It also includes ecological conditions, opportunities for recreational activities, aesthetic quality of architecture and landscape, and urban amenities (defined as characteristics and qualities which contribute to the pleasantness, harmony and cultural quality of the surroundings)."

'Sustainable urban environments' are defined as " those which develop and grow in harmony with the changing productive potential of local, national and global ecosystems."

### *Problems*

The main issues are:

- pollution, (air, water, urban waste, noise)
- pressure on land for urban development (more intensive land use, more land demanded for low-density suburban expansion)
- deterioration of the quality of urban life, (congestion, pollution)
- degradation of urban landscapes (built environment and related cultural heritage)

In the report three priority themes are discussed:

1. urban area rehabilitation.
2. urban transport.
3. urban energy efficiency.

### *Approach adopted by the report*

The leading approach in the report is to learn from innovative initiatives related to the main environmental issues. The learning process first leads to the formulation of general objectives, '*policy principles*'. The next step is to develop more concrete recommendations for policy tools that have been found successful in relation to certain categories of problems: '*policy guidelines*'. Following the present report the two '*key priorities*' mentioned above, will be further investigated.

### **Policy principles**

The policy principles recommended to enhance urban environmental quality are:

- developing long-term strategies
- adopting a more cross-sectoral approach
- facilitating cooperation within the public sector and between public and private sectors.
- enabling the producers of pollutants to absorb environmental and social costs.
- setting and enforcing minimum environmental standards.
- increasing the use of renewable resources, prevention, recycling.
- encouraging and building on local initiatives.

Two policy principles explicitly refer to *sustainable* urban development:

- the principle of 'functional and self-regulatory growth' (internalizing environmental and social effects in prices, redesigning urban charges and taxes)
- the principle of 'minimum waste' (recycling mechanisms)

In the report the guiding principles are further elaborated for organizational integration and economics.

### **Policy guidelines**

A number of economic and organizational instruments is assessed. It is the joint effect of these 'portfolio' of policy instruments that is decisive for their success in efficiently handling the adverse environmental effects encountered in an urban area at a particular time. Policy guidelines are further elaborated for the three selected 'key issues' in the urban environment.

1. Urban area rehabilitation with special reference to an assessment of waterfront restructuring experiences.
2. Urban transport, with special reference to programmes aiming at a reduction of private car use.
3. Urban energy efficiency, with special reference to energy conservation and pollution reduction.

### **3.2.3 Greenpaper on the Urban Environment (EC-Commission, 1990)**

The European Commission-Greenpaper is the result of a study including six conferences. Following an analysis of urban environmental problems and their deeper roots an outline is given of a strategy and more specific guidelines for EC-action to support urban initiatives.

#### **Aims and objectives**

The report aims to formulate a first step towards an EC strategy for the urban environment. By developing a strategy on the basis of a better understanding of the deeper causes and wider connections of environmental problems related to urban development, this strategy should provide a framework for the coordination of EC sectoral policies. The abatement of urban problems is perceived to deliver a major contribution to the alleviation of global environmental problems. The EC policy should further stimulate the exchange of information and experiences between cities.

#### **Conceptual basis**

##### *Definition*

No specific definitions are given, but still the report is using some central concepts about the quality of the urban environment. A central concept is the view of the city as an urban-ecological 'project', aiming at a multifunctional, creative and dynamic city that is also the least polluting and the most liveable city. This includes the reduction of the contribution of cities to global pollution.



### *Problems*

The main issues are:

- pollution (air, water, noise, soil, urban waste)
- degradation of the quality of the built environment
- degradation of nature, green areas, plant and animal life in cities

The report states that these immediate problems are rooted in underlying urban processes and planning concepts such as:

- functionalism (separation of functional compartments, causing unflexible structures that are unable to cope with the dynamism of the living city)
- production and the organization of work (increasing emphasis on the creation of infrastructure related work-locations, increasing competition between cities)
- distribution and consumption ( car oriented shopping centres in the urban periphery, urban monocultures)
- hotels, restaurants and dwellings ( the 'office culture', post-war residential monocultures, urban sprawl, the effects on car infrastructure)
- tourism (negative effects on old inner city areas)
- communication and mobility (congestion, parking problems, the difficult position of public transport)

### *Approach adopted by the report*

The analysis of urban development processes has been deepened in six conferences focusing on the following themes:

- Abandoned industrial areas.
- The urban periphery.
- The quality of open space and green areas.
- Pollution in northern and southern European cities.

The analysis deals with problems and underlying processes. Next the most important *constraints* for action are described. Focusing on EC action then some general *guiding principles* are formulated followed by a short survey of feasible *policy instruments*. The next section of the report describes *areas for action*. Finally *priorities* are selected. The present report will be discussed by the European Parliament, by the Economic and Social Committee and by the Council of Ministers. It is also sent for consultation to the mayors of major European cities and to organizations of professionals and volunteers active in this field. The EC Commission will decide upon further action.

### **Guiding principles**

The following general guiding principles for EC action are developed:

1. Coordination-integration. The interdependency of economic development, social policy, transport and the environment calls for more integrated decision-making on policy and investment. The prevailing sectoral approach asks for integration both 'horizontally' (between agencies and actors at the same level) and 'vertically' (between different levels of organization)
2. Responsibility. The ambition of a non-polluting city should include the responsibility of the city to prevent pollution of the surrounding areas.

3. Sustainability. Not only short-term but also long-term targets should be set to develop a sustainable basis for economy and environment.
4. Subsidiarity. Higher levels of governmental organization should only act in cases that can not adequately be dealt with at lower levels.

### **Areas for action**

1. improving the physical structure of the city.
2. alleviating environmental impacts of urban activities.
3. supporting local and regional initiatives.

### **Priorities**

1. Urban planning.
  - a - developing guidelines for the integration of environmental aspects in planning.
  - b - stimulating research on treatment-technology of contaminated soils
  - c - supporting experimental projects to revitalize underprivileged urban areas.
  - d - creating more funds to support urban renewal and the urban environment.
2. Urban transport.
  - a - supporting coordinated planning of public and private transport.
  - b - encouraging innovative approaches to public transport, non-polluting vehicles, and traffic regulation-systems.
  - c - stimulating the exchange of information on urban transport management.
  - d - financing and evaluating the use of economic instruments (like 'road pricing') to abate environmental problems caused by traffic.
3. Protection and renovation of the architectural heritage
  - a - providing more financial means.
  - b - introducing an EC system of classifying buildings and urban areas.
4. Protection and improvement of nature in cities
  - a - considering a programme of experimental projects to assess the use of plans and operational programmes for green areas.
  - b - stimulating local governments to revise their policies for public open space and to use opportunities for extension.
5. Urban industry
  - a - taking appropriate steps to enhance the development of small and medium-sized enterprises in harmony with the urban environment.
  - b - enabling these entrepreneurs to absorb environmental costs.
6. Urban energy management
  - a - intensifying current EC activities to stimulate urban energy planning and learning from experimental projects, especially about energy conservation in buildings.
  - b - considering EC-legislation about environmental standards for insulating building materials.
  - c - assessing economic instruments to stimulate energy conservation in buildings.
  - d - activating governments to set the good example in its own buildings.



## 7. Urban waste management

- a - making clear to local governments the need to plan for short and medium-term problems related to collection and disposal of urban waste.
- b - providing financial means for experimental projects to encourage public awareness of the need for separating waste at the source and to investigate new ways to re-use waste products.
- c - stimulating the exchange of experiences in urban waste management

### 3.2.4 Ecologically Sound Urban Development

#### 3.2.4.1 General outline

'Ecologically sound urban development' (ESUD) is a study project in which the Netherlands National Physical Planning Agency, the Directorate General for the Environment and the municipalities of Breda, Dordrecht and Zwolle cooperated with the Institute for Forestry and Nature Research. In addition there was a close link with the conference in Ankara in July 1992, initiated by the Environment and Human Settlements Committee of the UN Economic Commission for Europe. The English version of the ESUD study has been published as ECOPOLIS (Tjallingii, 1994).

#### Aims and objectives

The reason for the ESUD project was the growing need to find answers at the international, national and local levels to the problems of the environment and urban development. The project aimed at providing tools for policy formulation at the local and national level. The objective of the ESUD project was to form a planning strategy, to indicate steps which can be taken at the local level and to draw up priorities for research, design and policy.

#### Conceptual basis

##### *Definition*

The city is conceived as a dynamic and complex ecosystem. This is not a metaphor, but a concept of the real city. The social, economic and cultural aspect-systems can not escape the rules of abiotic and biotic nature. Guidelines for action will have to be geared to these rules. The city ecosystem is built up out of smaller ecosystems and is itself part of the global ecosystem. A strategy for ecologically sound urban development has to take the sustainable development of the global system into account. Even in the case of a multidisciplinary study of the city, the ecosystem concept can provide a useful framework though it is clear that within this framework alone no explanations for social or economic phenomena can be found. However, the ecosystem concept is an instrument for analysing the relations between society and abiotic and biotic factors, and this analysis can contribute to a strategy for the city. This is one reason to regard the city here as a (complex) ecosystem. Therefore, this study is not primarily concerned with ecology *in* the city but with the ecology *of* the city. The city can also be regarded as an ecosystem, just as the same city can be regarded from other angles as a socio-economic or spatial system.

### Problems

To apply the ecosystem approach to planning in urban areas a simple conceptual model is introduced that originated within the study group Urban Design and Environment at the Delft University of Technology. In the education and research by this study group it was found to be practicable when ecological views were consciously applied to the design of urban areas and buildings. Environmental problems are indicated here in the same way as they are described in the Dutch handbook on Environmental Science. The two groups of problems distinguished in this book are clearly to be seen in the model as internal and external problems. Many problems occur particularly as a result of the large extra supply and discharge flows. It is also characteristic that the internal problems in urban systems are generally 'solved' by increasing supply and discharge. The external problems are hereby only aggravated.

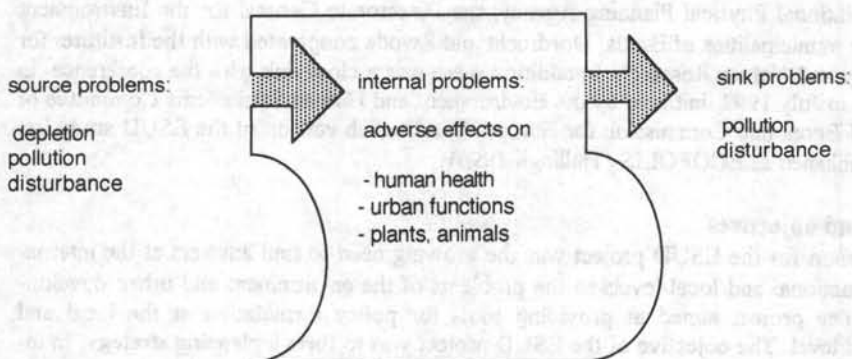


Figure 1. The 'ecodevice' model applied to environmental problems

### Approach adopted by the report

A cyclic working method was chosen. The starting point is a short description of 'urban ecological' practical projects in which the relationship between spatial design and management is the main issue. These practical experiences, at various levels, give rise to a great many questions. The analysis of these questions leads to the ECOPOLIS 'strategy framework' in which the ecological objectives for urban development are indicated. Consequently, 'guiding models' for specific categories of problems are elaborated in order to stimulate this development. In this case the term 'guiding models' is used to mean models for consistent, useful and feasible combinations, consisting of an objective with the accompanying organization of technical, economic, social and spatial possibilities for achievement. They are concerned with *guiding models for chains*, models for links at various levels of the scale which together make a sound 'chain management' possible. Another category is represented by *guiding models for areas*, solutions in principle for spatial-functional compositions with flexibility in the elaboration of details. Also of relevance here are *guiding models for organization*, useful combinations of administrative and management measures.

For a concrete plan a choice has to be made from these general guiding models which are the guarantee for a basic quality. Ecological views must form a part of this

basic quality. Adjustment and incorporation of the guiding models in the nature and culture of the local situation leads to the creation of the concrete plan.

The 'guiding models' can be seen as hypotheses. They arise from the learning process of the experience with ecological projects in the city. They form possible and desirable steps in the perspective of an ecologically sound urban development. Whether or not these steps are feasible can be tested in experimental projects.

*Priorities for research, design and management* related to these experimental projects are given in the final recommendations of the project.

### 3.2.4.2 Strategy framework

If we are striving for a sustainable 'common future', as pleaded by the Brundtland Commission (1987), then we shall have to develop a strategy for avoiding source and sink problems. *We shall then have to pay more attention to the selection and regulation principles of the concave and convex sides of the model in each urban plan.* This is the strategy for ecologically sound urban development in its most general form.

For the planning and management of the city, demands are made on urban systems aimed at long lasting life in the ecosystem earth. In every plan, therefore, there should not only be planning for site qualities but at the same time planning for flows. In actual decision making on urban projects this appears to be a difficult message because taking into account flow-qualities it is not connected with direct quality improvement in the urban environment. Reducing the use of tropical hardwood for window frames is a current example from the building materials flow. Because the model points attention to the concave and convex sides, the planners are obliged to take great care to analyse the ways in which a contribution can be made within the system itself to the restriction of 'source' and 'sink' problems. This also points attention to the ecological potentials of the specific situation in the plan area. What type of soil is present? What grows in the park if no pesticides are used? Where can rainwater be stored? Where can attractive cycle routes be projected?

In the relation between man and the environment, much depends on the involvement of inhabitants and users of urban areas. It has been revealed from the 'urban ecological projects' mentioned in the introduction, that motivation is strong in some groups. But a strategy for the entire city requires that all 'human resources' are tapped. All participants in the development and management of the city must be able to contribute and to develop a durable commitment in their own way.

These considerations have led to a strategy framework for planning and management related to 'flows', 'areas' and 'participants':

As a result of the input and output flows which preserve the city system, environmental problems occur: depletion, pollution and disturbance. The city must not carelessly pass on these problems to higher levels or future generations. The design and management of

urban areas have to be geared to a responsibility for the quality of the environment outside those areas too. In order to put ecologically sound urban development into practice, strategies will have to be worked out concerning the regulation of 'flows' (chain management). The motto for this main theme is **The Responsible City**.

<i>motto</i>	<b>THE RESPONSIBLE CITY</b>	<b>THE LIVING CITY</b>	<b>THE PARTICIPATING CITY</b>
<i>object</i>	<b>flows</b>	<b>areas</b>	<b>participants</b>
<i>social objective</i>	- production - quality	- usefulness - attractiveness	- prosperity - well-being
<i>problems</i>	- depletion - pollution - disturbance ( <i>'push off problem'</i> )	- health - functions - pl. & animal life ( <i>loss of differentiation</i> )	- alienation - indifference
<i>ecopolis objective</i>	- sustainable flow management - planning for prevention	- sustainable use of areas - planning with local potentials	- sustained commitment to ecological relations
<i>policy theme</i>	- source oriented 'chain' management	- effect oriented area management	- target-group policy

Figure 2. The Ecopolis Strategy Framework

Problems also occur within the city due to the fact that insufficient regard is paid to ecological rules. The urban ecosystem is a living system. It has to offer a healthy habitat for people, but also the tree which we plant in the street must be able to flourish. The use of local ecological potential (climate, water, soil, vegetation) can contribute to the healthy city, but also to the identity of the city as a whole and to the environmental differentiation fitting various ages, lifestyles and activities. The city should not only be good for the 'environment', care for the 'environment' should also contribute to the quality of the city. In order to put ecologically sound urban development into practice, strategies will have to be worked out for built-up and open areas (spatial policy). The motto for this main theme is **The Living City**.

The city is for the people, but the city also belongs to the people. Urban (environmental) problems such as vandalism, noise pollution and waste are connected to a lack of involvement by the people with the environment. This can be due to ignorance. But more

important is the organization of urban society which does not call for involvement, sometimes even counteracts it. Strategies will have to be developed to increase the involvement of people in the management of their daily environment. This is an independent goal but it is also a condition for achieving the strategies of the 'responsible' and 'living' city. In order to put ecologically sound urban development into practice, strategies will have to be worked out for various lifestyles and types of business (target group policy). The motto for this main theme is **The Participating City**.

The general strategy does not contain detailed static target images or standards, but indicates a general line. Belonging to this are a number of 'guiding models', planning instruments applicable to certain categories of problems. *Strategic guiding models* indicate the direction of planning solutions for 'flows', 'areas' and 'participants' respectively. *Instrumental guiding models* are developed to give guidance to the making of concrete plans in specific categories of situations.

### **3.2.5 Basic concepts of the three reports**

At first sight, the basic concepts and aims are not contradicting each other.

The OECD report strongly relies upon an assessment of innovative case studies to draw more general conclusions. Valuable and interesting conclusions refer especially to energy and traffic flow policies, to urban rehabilitation projects, and to economic and organizational instruments. These focal points correspond to priorities labeled under the 'flows', 'areas' and 'participants' headings in the ECOPOLIS strategy framework.

The EC-Greenpapers 'areas for action' also show a striking similarity to the distinction of 'flows', 'areas' and 'participants' as fields for policy development. The Greenpaper emphasizes the cultural identity of urban areas and also rightly includes urban nature in its strategy. The concept of the city as an 'urban ecological project' draws attention to the making of plans, which is also the main focal point of the ECOPOLIS approach.

The ECOPOLIS strategy provides a fundamental and comprehensive framework that can absorb valuable elements of other approaches and may well serve the specific objective of offering starting points for research. It is therefore chosen here as a basis.

In the next chapters the strategic and instrumental guiding models developed by the ESUD study are further elaborated. It will be made clear how they originate from an assessment of actual discussions about urban ecological issues.

### **3.2.6 A Strategic Guiding Model for Flows**

#### **Centralized or decentralized?**

What can best be arranged at which scale? That is a key question concerning chain policy returning each time urban ecological projects are being developed. Is it possible to learn something from the four flows discussed so far? In practice, there appear to be two approaches: the centralized and the decentralized. For the purpose of the discussion, the contrast between the two approaches will first be highlighted.



In the case of the *centralized approach*, the emphasis is upon big facilities serving large areas. Supply and discharge are organized at higher scales. The problems are either regarded as a 'shortage' of or 'demand' for water, energy, materials or access roads or as an 'excess' of polluted water, remaining heat, or waste or of traffic congestion. Solutions are sought particularly in the provision of facilities for improving the supply and removing the excess. The accent lies on policy directed at effect, and the 'economy of scale' leads to large central facilities: power stations, pumping stations, sewage purification plants, waste incinerators and the motorway network. Planning and management of these facilities is in the hands of strongly organized sectoral services, such as electricity companies, sewage treatment boards, waste disposal and 'public works' departments in the municipal organization.

In view of the responsibility carried by these services, it is understandable that there is an inclination to play 'safe' with the planning. One does not want to run the risk of there being not enough energy or incineration capacity. It is difficult and risky to incorporate prevention in this planning. The effects are uncertain and prevention policy is often the task of other services, or, even more difficult, of all departments.

The city dwellers profit by the central facilities, but these are hardly visible in the city. Waste water, for example, flows away via sink, toilet or gully-hole in the street and what happens to it further is not seen. The public pays for the services and relies upon them. The critics feel that the atmosphere surrounding this approach is one of the powerful machine which wants to control the matter. But this, of course, is exactly what the technical services are responsible for.

The *decentralized approach* is especially directed at the lower scales. Environmental problems are mainly connected with the individual behaviour of citizens and businesses. Prevention and separation at the source are the primary objectives. An ounce of prevention is worth a pound of cure. But this is not a theoretical preference: new motorways do not really solve congestion problems, the sewage treatment plant leaves us with the sludge and the waste incinerator leaves us with the slag. The central approach tries to remove the effects but shifts them to other areas rather than solving them. But to most citizens the problems disappear and are 'out of sight, out of mind'. The system does not encourage active involvement.

Most recent policy documents on the environment give priority to a source-directed decentralized approach but do have great difficulties in implementing this policy. Over the last two decades this approach has been practised by highly motivated pioneers in the environmental movement. A number of these people went to the countryside where they built their 'autonomous homes' or 'ecovillages'. The critics of the decentralized approach are afraid that adopting this policy will lead to primitive, anti-urban ways of living and working with sometimes ingenious, but not generally applicable 'self-sufficient' systems. Some trends within the environmentalist movement indeed give cause for this fear. Growing your own food, composting your own organic waste and building your own house requires a high level of community cooperation, but also much time to spend and much available space. This seems contrary to the division of labour and the compact

spatial organization that were essential conditions for the origin of cities and urban lifestyles.

The centralized approach removes the problems from the city, the decentralized approach seems to move people out of the city. Recent urban ecological projects, however, clearly demonstrate a wide range of decentralized measures that fit very well in typical urban environments. The analysis of the four flows in this chapter makes it clear that at the lower scales, there are plenty of possibilities which comply very well with different lifestyles and types of business. However, in this field there is a great need for visible examples.

By highlighting the contrast between centralized and decentralized with the accompanying stereotypes, the development of a really integral chain management becomes delayed and frustrated. But even if we assume a policy in which elements of both approaches play a part, there is still a dilemma: how must we choose between the certainty of centralized solutions, to which we see more and more disadvantages, and the uncertainty of a decentralized solution, the advantages of which are obvious? Although the first steps are being made, not much preventive, source directed policy is being practised so far. If we really give it precedence, don't we run the risk of being caught later with energy shortages or unmanageable surpluses of waste?

#### **The 'Sandwich strategy'**

A possible escape from this dilemma is indicated here as the 'sandwich strategy'. This strategic guiding model is illustrated in the diagram in figure 3. It is conceived to guide the making of environmental policy plans at different levels.

The primary task of the *top layer*, representing the municipal and higher authorities is to create technical, economic and organizational conditions for prevention and other source-directed measures. In an active target group policy, incentives and regulations must be sought which fit the different lifestyles and types of business. Supply and discharge facilities only follow as a second task, to be organized in a way that enhances the performance of the first task.

Under the influence of this policy, the *basic layer* of individual citizens and companies develops behaviour and suitable measures for saving water, energy and resources, for the separation of waste and for environmentally sound mobility. Sometimes old and tested techniques, such as the bicycle, should be given fresh chances. Often new techniques are also needed, such as photo-voltaic cells and telematics.

The stick in the 'sandwich' does not indicate a top-down regulation, but a source directed policy, in which central conditions like tariffs, tax regulations, and physical facilities for separation of waste, create a stimulating environment for environmentally friendly behaviour of citizens and businesses.

The *intermediate layer* is the area for initiatives on the neighbourhood, city and regional levels of the scale. Many projects can be realized here, for example in the fields of rainwater retention, district heating with combined power and heat production, return



and second hand shops, and attractive and safe cycle routes. This is where ecologically sound urban development is given its spatial and visible shape.

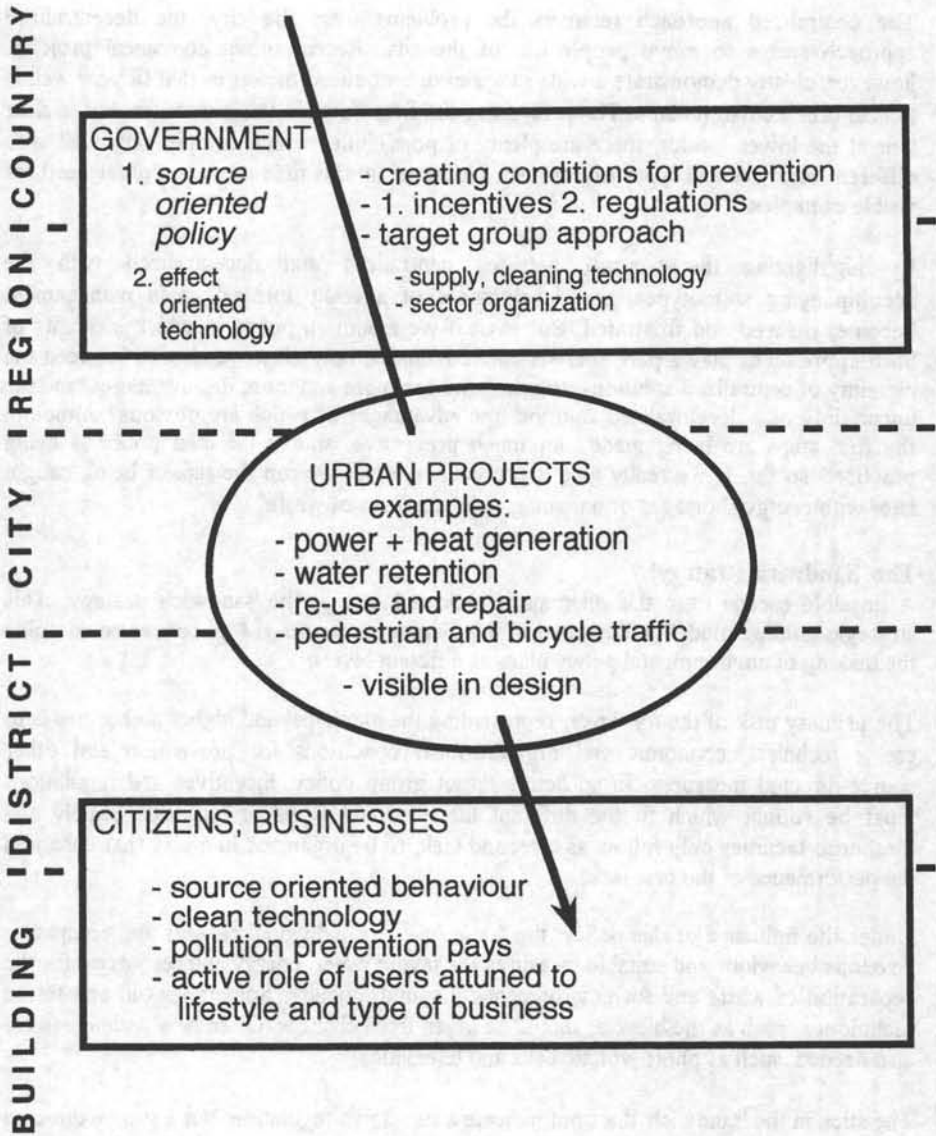


Figure 3. The Sandwich Strategy

Central technical facilities are indispensable in the top layer, but if preventive policy is to be given a chance, then flexible planning is imperative. In The Netherlands, the construction of a new power station near Rotterdam was recently postponed, due to the success of decentralized projects for combined power heat production. Planning smaller

units is more flexible and may more easily be combined with performing practical experiments with the 'sandwich strategy'. Thus step by step the feasibility and the effects of a source-directed policy can be tested and more reliable basic information can be obtained for the forecasts necessary when planning larger central facilities. An overcapacity of such facilities means that it becomes in the government's interest not to conduct a preventive policy.

The 'sandwich strategy' belongs to the chain policy. It fits in with The Netherlands National Environmental Policy Plans aim to move from 'shifting on to controlled feedback'. The strategy introduces the field of influence of the 'responsible city' to urban areas, in which the strategies of the 'living city' and the 'participating city' can flourish. In reverse, the 'living' and the 'participating' city create conditions which are of great importance to the realisation of a 'responsible city'.

### **3.2.7 A Strategic Guiding Model for Areas**

#### **The 'compact city' discussion**

Discussions concerning concentration and deconcentration of urbanization have been held for decades in physical planning, in The Netherlands and elsewhere. The idea of a 'compact city' is attractive from an ecological point of view for a number of reasons:

1. The possibilities for an environmentally sound solution for traffic are increased (Naess, 1992).
2. The utilization of central facilities, also in the field of the environment, is more favourable (Mar, 1981).
3. The visual contrast between city and countryside can be kept as large as possible.

But to realize these objectives, there are a number of important conditions attached to the general idea of the 'compact city' which can be learned from the previous chapters, especially from the three guiding models for areas :

1. Encouragement of the use of the bicycle and public transport does not only require compact building and, if necessary, expansion of the city alongside public transport axes. It will be necessary also to resist to the pressure for suburbanization and for peripheral locations for companies and offices employing many people and transporting many goods. In as far as they are already present, these locations must be connected as well as possible to the railway network. This also applies to busy recreation areas.

In the city, prior to the choice of location, careful attention must be given to the creation of good networks for bicycles and public transport.

2. In accordance with the 'sandwich strategy', when planning chain management, attention must primarily be focused on preventive and other source directed policy. There are a number of facilities needed for this at neighbourhood and district level, which require space. Public open space plays a large role here. That means that there are limits to the density within the city. Instead of building as compactly as possible, a better goal would be an urban ecosystem as compact as possible. Compact building must not lead to a greater transfer of environmental problems. The 'guiding model for an old urban area' shows that with a density of 100 to 150 dwellings per hectare, a reasonably well

functioning system is possible. In this respect, this density seems to be close to the limit. But there is still a great deal of investigation to be done in this field. Multi-storey buildings, up to 5 or 6 layers, offer the most perspective. Real high-rise building often means a deterioration of the urban climate. Another question is whether enough people will be prepared to adopt the lifestyle which goes with this density. Resistance already found in cities like Amsterdam amongst the inhabitants of districts for which plans to increase the density are proposed, shows that the possibilities are restricted.

3. The protagonists of the 'compact city' want to save the green countryside, or, as they say to save 'nature'. However, the contrast between the city and the 'open space' in the rural area is chiefly a visual aspect. From an environmental point of view, it is not either black or white. The city is not so black and agricultural areas are certainly not white. The question is whether a residential function is a bad choice everywhere, for instance if land is released as a result of overproduction in agriculture. In urban building rich in contrast, as aimed for in the lobe model, the 'guiding model for the city', there is more space for green areas and for urban fringe functions including urban agriculture and urban woodlands. Here conditions for a rich plant and animal life are more favourable than in intensive agricultural areas. But in order to retain something of a visually open meadow landscape, some restriction will be necessary, especially of low density urban or suburban extensions. If more people choose detached houses, this will lead to fewer visually open areas at the regional level. The question is whether an urban environment 'rich in contrast' such as in the 'new' lobe model, with a higher building density, is an attractive alternative to living in suburbs for the higher income groups. An outstanding example of the 'rich in contrast' approach, applied to the restructuring of a whole catchment area is provided by the 'Don and Waterfront Scheme' in Toronto (Crombie et. al. 1992). An interesting aspect in this scheme is the major role played by the water and traffic systems as carriers of contrast in urban planning.

### **The Strategy of the Two Networks**

How could urbanization be geared to ecologically sound regional development? A spatial strategic guiding model is required which, in a regional framework, can guide the developments of various types of land-use. To perform this role the 'Strategy of the Two Networks' is presented, emphasizing the strategic role of water and traffic networks. The strategy bears on the idea of the 'casque concept', developed in The Netherlands for landscape planning in rural areas. The main steps in the process of thought are the following:

The starting point is that a general approach should be found to a number of fundamental uncertainties in regional planning:

1. The time factor, both for ecological and for economic and social developments. Predictions concerning agriculture, industry and trade, but also trends in living and processes such as individualization, can only be made at relatively short notice.
2. The possibilities to control these processes are limited. Cooperation of public and private sectors is needed, but so is a definition of tasks. In large parts of an urbanized region, the government can only set limiting conditions and create terms.

With an eye to these fundamental problems, in the 'casque concept' (Sijmons, 1991) a distinction is made between 'high dynamic' and 'low dynamic' functions or land-use types. The former display strong spatial changes and great ecological fluctuations (for example agriculture). However, 'low dynamic' functions such as 'nature' require spatial and ecological continuity. In the case of the 'high dynamic' functions, management is in the hands of private owners and is dependent in development on many uncertain market factors. In the case of the 'low dynamic' functions, the role of the government is much larger and the uncertain market plays only a small part. The 'casque concept' is directed towards spatial grouping of these two categories into a 'framework' (safeguarding continuity for the low dynamic functions) and an 'operational space', left free for the high dynamic production functions. Basically the 'casque concept' is a conservation strategy. The water system often acts as a carrying spatial structure for the framework.

It appears that important elements of the 'casque approach' can also be used for an urban region: to create a sustainable framework in the spatial structure in which protection is provided for vulnerable functions, and besides this, to leave spaces open which, under certain prior conditions, can develop freely. However, in urban areas there are large differences internally which are not discussed in the literature on rural areas, but which are nevertheless of great importance. Living, in particular, occupies an interesting intermediate position between 'high' and 'low dynamic'. Inherent in living is 'having both sides of one's bread buttered', the facilities of the city centre nearby and yet also easy access to nature and recreation facilities at the edge of the city. In the city the residential function can be planned between, on the one hand, the 'high dynamic' zone with a public transport link connected to the city centre, the motorway, the business area and the railway station and, on the other hand, 'green fingers' with their 'low dynamic' functions.

Another lesson to be learned from urban regions is about infrastructure planning, meaning, before everything, creating optimal accessibility for motorized traffic to enhance a good 'business establishment climate'. It is widely recognized that creating conditions for traffic is a steering instrument for economic activities in spatial planning.

Obviously both the water and traffic network have an important steering potential in physical planning.

The traffic network, indeed, can be seen as a carrier of 'high dynamic functions'. Manufacturing industry, trade and commerce, but also mass recreation and most types of modern agriculture are highly dependent on traffic facilities. In this context the polarity between urban and rural is irrelevant. The dynamics of development are more important. The traffic network is not always linked to high dynamic functions. It also includes public transport and cycle track networks, providing conditions to reduce the role of motorized vehicles in areas that need tranquility. As a planning instrument, however, in all these cases the traffic network can be very effective in steering dynamic human activities, either by stimulating them or by preventing them.

The water network, indeed, can be seen as a carrier of 'low dynamic functions', like nature development and conservation and quiet recreation. By providing space for rainwater infiltration and retention, it may create conditions for durable quality of green

areas but also for sustainable drinking water production and for other ways of using groundwater and surface water resources. But also more dynamic waterways for river vessels belong to the water network. As a planning instrument, the water network, including brooks and rivers, but also protected areas for infiltration, can be very effective in steering the optimal use of ecological potentials of the local, more or less urbanized landscape.

It is this combination of steering activities and using the carrying capacity of landscape and resources that makes the water and traffic network useful as vehicles of the role of spatial planning in sustainable development.

The 'strategy of the two networks' offers an alternative to the traditional 'red and green' models used in spatial urban planning such as the classical 'finger' and 'lobe' models and the 'poly-nuclear' model. The 'guiding model for the city' demonstrates that the strategy can also be used to enrich old concepts and give them a new meaning.

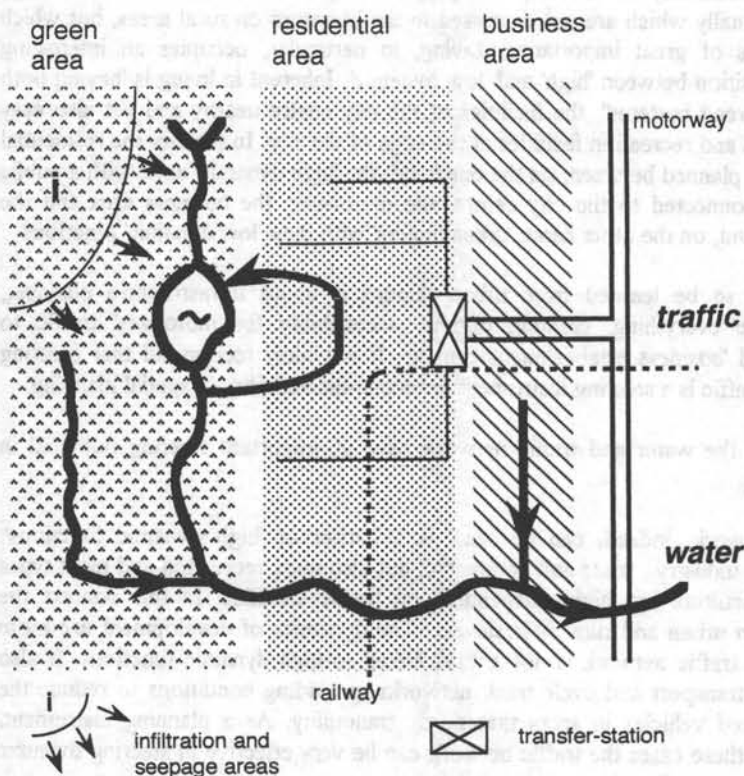


Figure 4. Strategy of the two networks



The three major advantages of the 'strategy of the two networks' are:

1. By shifting the emphasis from 'red and green' to 'black and blue' a durable spatial structure is created that is guiding the uncertain future land-use development which is otherwise left free under some environmental conditions. Thus a tool for spatial planning is provided that enables us to implement the concept of 'sustainable development'.
2. The water and transport networks are excellent links between 'flow' and 'area' management, thus providing relevant planning tools for ecologically sound urban development in which both processes and patterns are important.
3. The two networks provide a basis for a town and country planning focussing on rich contrasts rather than sticking to an urban-rural polarity that has become obsolete in modern urbanized landscapes with industrialized agriculture.

### **3.2.8 Strategic Guiding Model for Organization**

#### **Regulations and incentives**

In an attempt to control environmental impairment ( water, soil, and air pollution, noise and other intrusive effects), governments tend to increase the number of regulations. However, to implement these regulations is getting more and more difficult. On the one hand businesses and residents resist to growing bureaucratic and technocratic structures. On the other hand, due to financial and organizational constraints, governments fail to implement efficient control of compliance to complicated regulations. No one tends to abandon regulations altogether, but there is a growing tendency to test the feasibility of incentives that create conditions for more self-organization.

The market is a powerful mechanism for economic self-organization, but clean air , water quality and nature are not sold on the market. To overcome this difficulty economists have tried to attribute monetary values to environmental qualities. Leaving apart the methodological difficulties involved in this approach, these monetary values and the resulting proposals unfortunately are not always accepted on the market. The recent discussions on energy-tax proposals and on the implementation of the 'polluter pays' principle, clearly reveal the difficulties. Nevertheless, tariff incentives have been successful in a number of cases and further research is required to discover the conditions that are essential for effective implementation.

'Social self-organization' has been successfully applied for instance in attempts to improve the safety of public open space, by increasing social control. When they go home in the evening, people feel safer on cycle tracks leading through inhabited areas with good lighting, than on those leading through dark woodlands. The planning of a good routing system for cyclists can create the physical conditions for this.

Many initiatives of residents to improve the environment in their neighbourhood have shown that both the social organization and the commitment to environmental issues have been enhanced. In this respect public participation in management and improvement of their environment has been far more successful than participation in decisionmaking on big plans.

Possibly, the two essential factors in social self-organization related to environmental issues are:

1. There should be a feed-back of information on the environmental effects caused by human activities to the actors.
2. There should be a real possibility for groups and individuals to undertake action that matters.

In the 'sandwich strategy' priority is given to policies that create conditions for environmentally friendly behaviour by citizens and businesses. A recent Dutch report (Commissie Lange Termijn Milieubeleid, 1990) described the policy instruments that can be applied to implement this strategy in the following categories: policy instrument implementation principles.

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1. Influencing	Information, psychological pressure, persuasion
2. Facilitating	Physical facilities
3. Stimulating	Subsidies, financial incentives
4. Repelling	Levies, (substance)deposit money, liability
5. Limiting	Physical restrictions, quotas, vouchers
6. Commanding	Prohibitions, strict regulations

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The actual plans making use of these instruments should be evaluated with three criteria:

1. Effectiveness. The intended effect must be achieved.
2. Efficiency. The effects must be achieved at the lowest possible costs or losses in welfare and
3. Legitimacy. The policy must be experienced as being just.

The policy making of municipal authorities is limited by the rules set by regional and national governments and even by international standards, but within their own territory still a wide range of options remains open. In experimental projects the cities may even discover new practical 'selforganization' approaches to problems for which the national government has only developed regulations. The 'sandwich strategy' indicates that 'urban projects' in the intermediate layer may play an important role. Here it is possible to conceive a 'strategic guiding model'.

#### **The Forum - Pilot Project Strategy**

Many sectoral departments within the municipal organization find it difficult to deal with a source directed approach to flow management. Even more difficult is the integrated area management. And if participation by all actors is also concerned, the problems clearly exceed the territory, the policy-instruments and the responsibility of the sector. If one follows Pirsigs distinction between 'static' and 'dynamic' quality, then most sectors are well equipped to maintain and improve the static quality in their field. But for dynamic quality, the capacity to adapt the whole municipal system to new developments and new challenges, a different organization is required. Urban ecology is not an assignment for one urban ecologist, but for a learning process of all sectors and services involved.



Therefore the creation of a *'forum'* is proposed, a panel for setting up and evaluating urban ecological *'pilot projects'*. A learning process for cooperation in urban development can hereby be set in motion which is not connected to the daily responsibilities and the short-term interests of the various sectors. The long-term orientation and the link with learning from experiments creates the possibility to engage researchers and various professional and voluntary organizations in the work of the forum.

Experiences from the Berlin *'Stadtforum'*, from *'Round table committees'* in Canadian cities (Runnals, 1991) and from various initiatives in The Netherlands, like the Dordrecht Committee on the Quality of Daily Environment may be used to further elaborate the idea of the *'forum'*.

Urban ecological *'pilot projects'* are advocated by many policy documents, They do have a long history in making visible how things could work, what the results look like and how the public and private participants are reacting. At the ECE Ankara conference, Karen Attwell (1992), among others, stressed the need for smaller demonstration projects: they are convenient as practical experiments, are easy to evaluate, and if they fail the damage is restricted and much can be learned from them in any case. Successful projects can provide important examples and become the basis for policy on a larger scale.

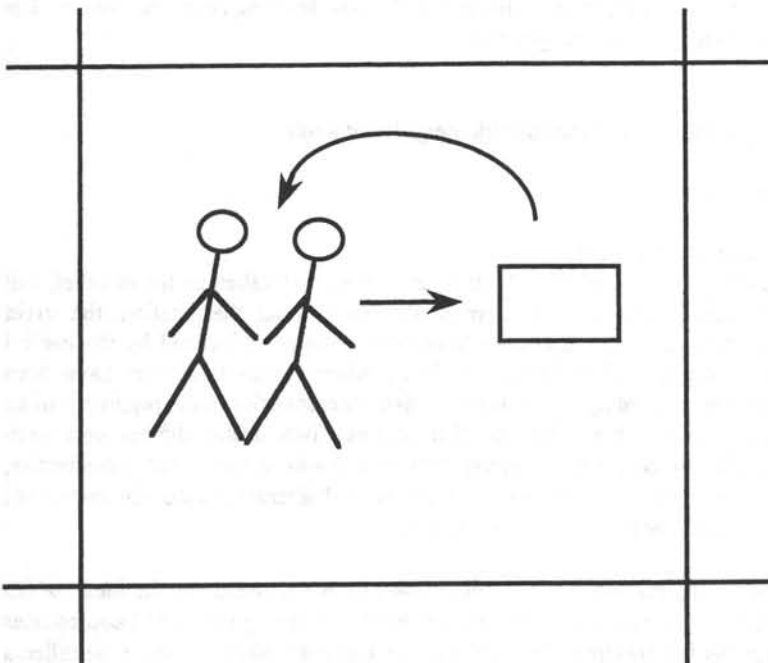


Figure 5. The Forum-Pilot Project Strategy

The Demonstration Project Programme that belongs to the Dutch Fourth Memorandum of Physical Planning generated several hundred of highly innovative pilot projects over the last five years. Experience in the Ecologically Sound Urban Development project has taught that linking local projects with the development of strategic planning at national level can be extremely productive. An excellent example of a pilot project programme that is a pioneer for a large scheme is provided by the International Building Exhibition 'Emscher Park' in the German Ruhr area (IBA Emscherpark, 1992).

The pictogram of the 'forum-pilot project strategy' also draws attention to *the frame* that marks the territory chosen or given to the learning process. How can the boundaries of the system to be improved be defined?

Some examples may illustrate this:

- Optimizing decision making on drinking water production, choosing technologies and locations, is of limited importance as long as savings in consumption do not enter the frame.
- The problems of public and private transport cannot be solved if the frames for decision making do not include both.
- For the redevelopment of waterfronts or old industrial areas, special 'task forces' are set up that are authorized to cross the barriers of traditional sectoral competence.

Learning about the tools for the 'participating city' is also learning about the frames. The forum should also study the planning context.

### **3.3 Planning of differential sustainable neighbourhoods**

#### **3.3.1 Introduction**

##### **Urban design and differentiation**

During the building of many historical cities, great care was taken as far as relief, soil differences and water courses are concerned. Decisions about the location, the street pattern, squares and parks in these cities have been strongly influenced by the natural differentiation in the pre-urban landscape. Even where urban structures have been designed in one step, according to a geometric idea, discrepancies in the regularity often betray the influence of the underlying natural structures. These design choices were often connected with the limited technical means. Now that we have many more possibilities, technically speaking, it has become necessary to take a deliberate choice whether or not to utilize the ecological potentials of a certain place.

Urban building in this century is clearly dominated by the influence of the idea *not* to take existing nature into account. This view has been inspired by the CIAM conferences and by Le Corbusier in particular. His ideal was the 'Unité d'habitation', which he called a 'machine for living', a large and tall residential building, which is a world on its own. It stands on legs, thereby literally breaking the contact with a concrete place on earth. For his ideal of a city, the 'cité radieuse', he also argued in favour of one universal value which became visible as a rational chessboard, with a lot of high-rise buildings and a

strict separation of functions. Le Corbusier himself continuously developed his ideas, and in later projects came to quite different concepts (Guiton, 1981). The worldwide implementation of the unshaded basic ideas, especially in big post-war housing construction schemes, has led to an endless monotony of districts full of blocks of flats all over the world (Castex, a.o.1980). In The Netherlands, all soil and water variations were generally covered by a layer of sand, and the city of the future was built on this 'tabula rasa'. The urban development principle solutions were used as 'stamps' to build them everywhere. Some people enjoy living in these areas, but the large scale application does not do justice either to the social or the ecological differentiation in the urban landscape. From an urban ecological point of view, it is very unfortunate that this concept in particular has made such a mark on the urban development of this century. After all, the idea of the 'cité radieuse' is characterized both by aesthetic and technical arrogance with regard to the ecological potential of the existing landscape.

But ecologically sound urban development is also not benefited by a link to one other design concept. Neddens (1986) is of the opinion that an ecological approach to urban development is linked to 'organic' design, which he sees as an undercurrent in the history of architecture. The awakening of ecology and the revival of 'organic' architectural views in the 1970's also show that this combination does appeal. But the result is that during the design discussions of the 1980's, the baby of ecology was thrown away with the - water of the bath of organic design. This experience has led to the 'instrumental' interpretation of ecology in the ESUD study, as 'the language needed for every story'. As the language is a source of inspiration for novelists and poets writing in different styles, so ecology might be a source of inspiration for designers of different schools.

In various recently built Dutch districts, such as the Haagse Beemden (Breda), Tanthof (Delft) and Lunetten (Utrecht), the nature of the soil, the variations in height and the water flows have been deliberately chosen as starting point for the design. This does not necessarily lead to irregular or 'organic' structures. It is just this contrast between rational shapes and the irregularities arising from the existing landscape which can lead to high quality urban development. Using this approach, water can be an important entry, both for beauty and health.

### **Green areas and urban open space**

It is obvious that urban open space in general and green areas in particular, next to and between buildings, play an important role with the guiding models for areas. It is in the design of the 'urban garden', as a real part of the urban environment, that the possibilities for utilizing ecological area qualities are large. A condition is that open space is not regarded as and designed as a vacant space which is left over between the buildings, but as an indispensable part of the urban fabric. This notion is described in more detail in the guiding models. Green open space is not only given the significance of 'green areas to look at' or as recreational 'green areas to use', however important these functions may be. These values may be supported by other functions which are vitally important to life in the city. Many practical examples of an ecological approach to the design of urban open space are described in the books by McHarg (1971), Krusche e.a. (1982), Hough (1984) and Spirm (1984), which have almost become classics.

The following aspects are of great importance.

1. The regulation of the climate in the city. This concerns, for example, the supply of cool, damp and purified air to the dry, dusty and polluted densely built up parts of the city, especially in the summer (Neddens, 1986). In our windy climate in the Netherlands, the provision of shelter is important as a supplement to technical measures against discomfort caused by wind in streets and near buildings.
2. The provision of habitats and connecting paths for plants and animals. Lately, a great deal of attention is quite rightly paid to the 'ecological infrastructure' in environmental planning. But the prefix 'infra' can better be left off. It is pointless to provide connecting routes if there are too few places where plants and animals feel at home.
3. Water-retention. In the guiding model for the 'water chain', to be discussed in the next chapter, the great significance of water storage for urban water management will be emphasized. In the spatial guiding models, attempts have been made to combine the functions of green areas and water in the open space in each district.
4. The green open space can also play an important role as pedestrian and cyclist route. The first step in forcing back the harmful effects of car traffic is to provide attractive alternatives. Green zones with water hereby form an excellent opportunity in urban development.

All cases point to the need for a connected green structure at the urban and regional level with continuing green routes, whereby each district is located in a part of this structure and forms a whole with it.

### 3.3.2 Guiding model for an inner city area

This model is an example of a district which is about a hundred years old. The guiding model is based on the study by Gommans & Hendrikse (1991). We refer to this report for the elaboration in the details and for the environmental effects of the proposed operations. This concerns an extremely compactly built district where, within the scope of urban renovation, various measures can be taken which have been indicated in figure 6. The building blocks in the diagram each now contain approximately 200 dwellings.

To the left of the park, a situation has been sketched, which could be created after renovation. In this situation there are measures concerning water and energy saving and the separation of refuse which can already be implemented at household level during 'major maintenance'.

The sewage system can also be adapted during a more drastic renovation and re-design of the public open space, with rainwater collection next to the houses and rainwater discharge from roofs to the canal. At this stage the district can also be made restricted for cars. The park may possibly play a role in a cycle track network. By simultaneously improving public transport, alternatives for the car can be made attractive. A recycling centre can be established in the space created by demolishing one block, possibly in combination with a city farm, like the one constructed in a similar district in The Hague.

In the case of a possibly necessary phase of *demolition and new building*, the opportunity can be taken to re-orientate blocks of houses towards the sun. This is

indicated in the diagram to the right of the park. Also, by constructing multi-story buildings on the north edge, space can be created for open water with a retention function. If necessary, parking garages can be built under the houses on the fringes.

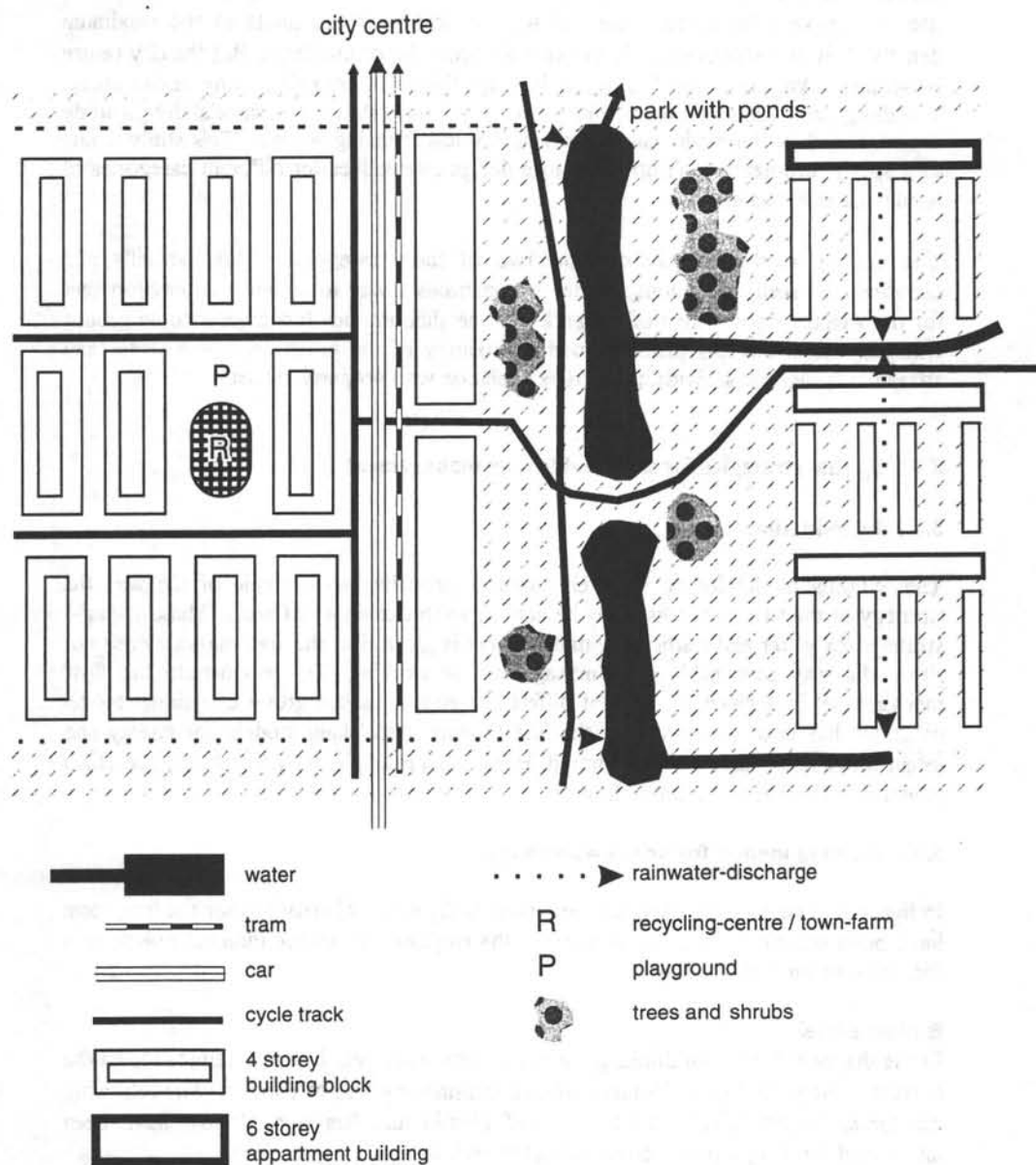


Figure 6. Guiding Model for an inner city area



Clearly the 'two networks', traffic and water play a key role in spatial organization and zoning. High density building can be combined with environmentally sound measures. The density after renovation or demolition/new building according to this guiding model, including an ecologically sound programme, is 100 to 150 dwellings per hectare. The use of passive solar energy and rainwater retention create limits to the maximum density. Private gardens are only possible for groundfloor dwellings. But the city centre is within walking distance. For some lifestyles this is an attractive living environment. The design and variation possibilities are manifold, as is shown by a special design study commissioned by the Netherlands National Physical Planning Agency. This study is one of a special programme set up to explore design-alternatives for different categories of residential environments.

The guiding model actually contains two of these categories. Thus, socially and economically seen, the guiding model demonstrates a way to combine an environment for the wealthy on the edge of the park with neighbourhoods for lower income groups who may none the less profit from the proximity of the green area with water and attractive cycle routes. Evidently there is a relation with property values.

### **3.4 Spatial strategies for sustainable flow management**

#### **3.4.1 Introduction**

The 'guiding model for an inner city area' is providing an example of the way the 'strategy of the two networks' may be applied to this category of areas. Thus, a spatial strategy for water and traffic-flow management is given. But the area-diagram does not show the way sustainable flow management is working. To demonstrate the flow management in a chain of areas of different scales, a special group of guiding model diagrams has been developed. In the ESUD study also 'chain models' for energy and urban waste flows have been elaborated. Here, as an example, we present only the 'chain models' for the water and traffic flows.

#### **3.4.2 Guiding models for urban waterflows**

In figure 7, a number of linked and environmentally sound alternatives for the long term have been set out in diagram. In view of the emphasis on source directed policy, it is natural to begin with buildings.

##### **Building level**

In the diagram, the use of drinking water per person per year has been reduced from the current average of 136 to 78 litres without causing any loss of comfort. The following measures, largely based on Mönninghoff (1988) and Reijenga (1990), have been introduced for this purpose into the model household:

The saving in water during cooking and in the bathroom is largely due to special taps and shower heads, which ensure that with higher water pressure, no more water than is necessary flows out.

The use of water for cleaning is halved by the presence of the rainwater tank, which supplies the water for cleaning the car and watering the garden. The greatest saving can be made with toilet flushing. In the diagram the 'grey' water from the bathroom and the washing machine is used for this purpose. Larger collective systems have also been designed for the reuse of 'grey' water, such as that in the famous project on Block 6 in BerlinKreutzberg (Hahn, Thomas & Zeisel, 1988). In this project the grey water from dwellings is conducted to the courtyard of the big building block, where it is purified by a marshland system. After treatment the water is pumped back to the flats to be used for toilet flushing.

The disadvantages of a collective system such as this are that it takes up rather a lot of space and that difficulties can rise from wrong connections or wrong use. A direct coupling of grey water to toilet flushing within one dwelling, as shown in figure 6, seems an attractive alternative proposition. If it is taken into account when the house is being designed, then it is realizable and not too expensive, but in the practical experiments with this system (Mönninghoff, 1988) one problem was not solved satisfactorily: the odour problem emanating from the grey water in the reservoir. Nevertheless, the system has been indicated here as long term guiding model because it seems likely that the technical problems can be solved. Not many inventors have applied themselves to this problem as yet. The importance of its position in the chain makes it necessary for more attention to be paid to this weak link.

This short elaboration on an 'unpleasant detail' clearly illustrates how closely technical questions are connected to spatial and behavioural aspects in the choice of the scale for chain guiding models. A simple technical optimization study is not sufficient. Incidentally, the total amount of flushing water for the WC has also been drastically reduced in the diagram. The most far-reaching solution for this is the 'Gustavsberg system'. The compost toilet, without water flushing, is even more economical in this respect, but this system is thought to be more suitable for motivated inhabitants of houses in rural areas where there is more space, and where the compost can also be used immediately in the garden. In a less far-reaching version of the household system, the toilets are flushed using rainwater instead of 'grey' water. This is a guiding model which is now already applicable. The system has been installed in a number of houses in Germany and in the Netherlands.

### **District level**

The possible effect of the above measures has been investigated by Gommans and Hendrikse (1992) in the situation of a late 19th century district in Amsterdam. For this urban renewal area the costs and effects of water saving measures are compared for three alternative planning options: 'major maintenance', 'renovation' and 'demolition/new-building'.

In a typical building block, covering 0.8 hectares and containing 208 dwellings, the existing consumption of drinking water is 142 litres p.p./p.d. By making water saving measures a part of the three different schemes, against low extra costs the water consumption can be reduced to 116, 87 and 62 litres respectively. The discharge of waste water into sewers has been reduced in the three schemes by 8, 35 and 56% respectively.



But at neighbourhood level other measures are also possible. Rainwater from the hard surfaces can be infiltrated into green areas or discharged into the surface water instead of into the sewers. The 'mixed sewer system' is hereby reshaped into a 'separated system'. This can also be done in smaller areas to the benefit of the watersystem as a whole. A simulation study by Bruun and Kristiansen (1991) shows that if these measures are implemented, fewer peak discharges take place, which leads to a reduction of 97% in the volume of the annual sewage water overflow. This is directly beneficial to the quality of the surface water. However, other pollutants taken up by water flowing off roofs and from the streets now land in the canal. The quality of this run-off water can be significantly improved by avoiding the use of zinc gutters and galvanized street furniture, and by concentrated parking-lots with oil separators in the gully-pots of the parking areas.

These are examples of preventive (P) and 'source control' (S) measures, which are indicated at the district level in the diagram.

This guiding model is developed for lowland conditions with out and inflowing surface water. The water flows out of the neighbourhood into the peak/seasonal storage which is able to hold enough rainwater to get through dry seasons without the intake of polluted outside water. The intake only has to work in emergency situations.

Reeds or rushes have been planted in the storage lake for wetland-purification (W), which add to further improvement of the water quality. The water is once again circulated from the storage back into the neighbourhood. This circulation system has been described in the study by Tjallingii (1993) and has been applied in several pilot projects in the Netherlands.

The circulation system is not appropriate as a guiding model for hilly situations with only outgoing surface water. The other guiding models have been developed based on infiltration of run-off water, after sedimentation and marshland purification. This principle has been applied in a number of pilot projects, for example in Germany, the USA and Australia.

#### **Urban level**

Due to the above measures, the Sewagewater Purification Plant has less waste water to deal with and no longer any run-off rainwater. Thus the purification plant will work better and the effluent-receiving waters will benefit.

In existing built up areas however, it will be difficult to implement these measures. In the Cremer district scenarios it was therefore decided not to disconnect the heavily polluted opening-road run-off from the sewage system. Still, by implementing the disconnection programme to roofs and green areas, 48% less water from the district is discharged into the sewage system. (Gommans & Hendrikse, 1992).

In principle, the drinking water-sewage water circle could be closed by using the purified effluent as raw material for the preparation of drinking water. But in order to achieve this, the purification efficiency of the existing purification plants would have to improve considerably.

At the urban level, the circulation systems of various districts can be coupled to storage lakes which form part of green belts and parks.

### **Regional level**

In many places ground water can be replaced by surface water collection as source for the production of drinking water. For this purpose reservoirs taking up river water have been constructed for the drinking water supply of many cities.

Recently in the Netherlands pilot projects have been planned in which drinking water is no longer produced by pumping up groundwater but by collecting seepage water at the foot of the hills. Thus the drinking water production can be combined with the development of wetlands resulting from the storage of seepage water. In this way also recreation and nature development may greatly benefit.

Plans such as these naturally have great spatial consequences for the layout of these areas, thus also putting the position of agriculture at issue. The ever increasing productivity in agriculture and the resulting overproduction are responsible for changings in land use. Thus new conditions are created for restructuring the regional urban landscape.

In the guiding model the role of water is indicated in linking different forms of land use. Connections can be planned in series or parallel. The underlying ecological principle in the guiding model diagram is that 'water must flow from clean to polluted'. This is the only way that clean water areas can stay clean. Taking the purification possibilities within areas with a certain land use into account, according to this principle, a series of functions occur in which one function, for example, can make use of nutrients discharged by another. The waternetwork, like a bloodstream, holds the system together. Several planning and design exercises have already been carried out with this regional guiding model.

Industry and Intensive Agriculture have been excluded from the circuit because the combination possibilities with other functions via the water flow are only slight here or else vary considerably.

If we interpret the whole diagram in figure 7 as a guiding model for the management of the water chain, then the water first flows from regional collection to the building level and then subsequently from below to above in the diagram. It has been attempted to design 'selfresponsible' and 'selfeliant' systems at each level. Decentralized measures at the building and neighbourhood levels can greatly limit the input of drinking water and the output of sewage water, but these do not become superfluous. However it is clear that large 'safe' investments in plants for drinking water production and sewage purification can have a restraining and frustrating effect on preventive, source directed policy.

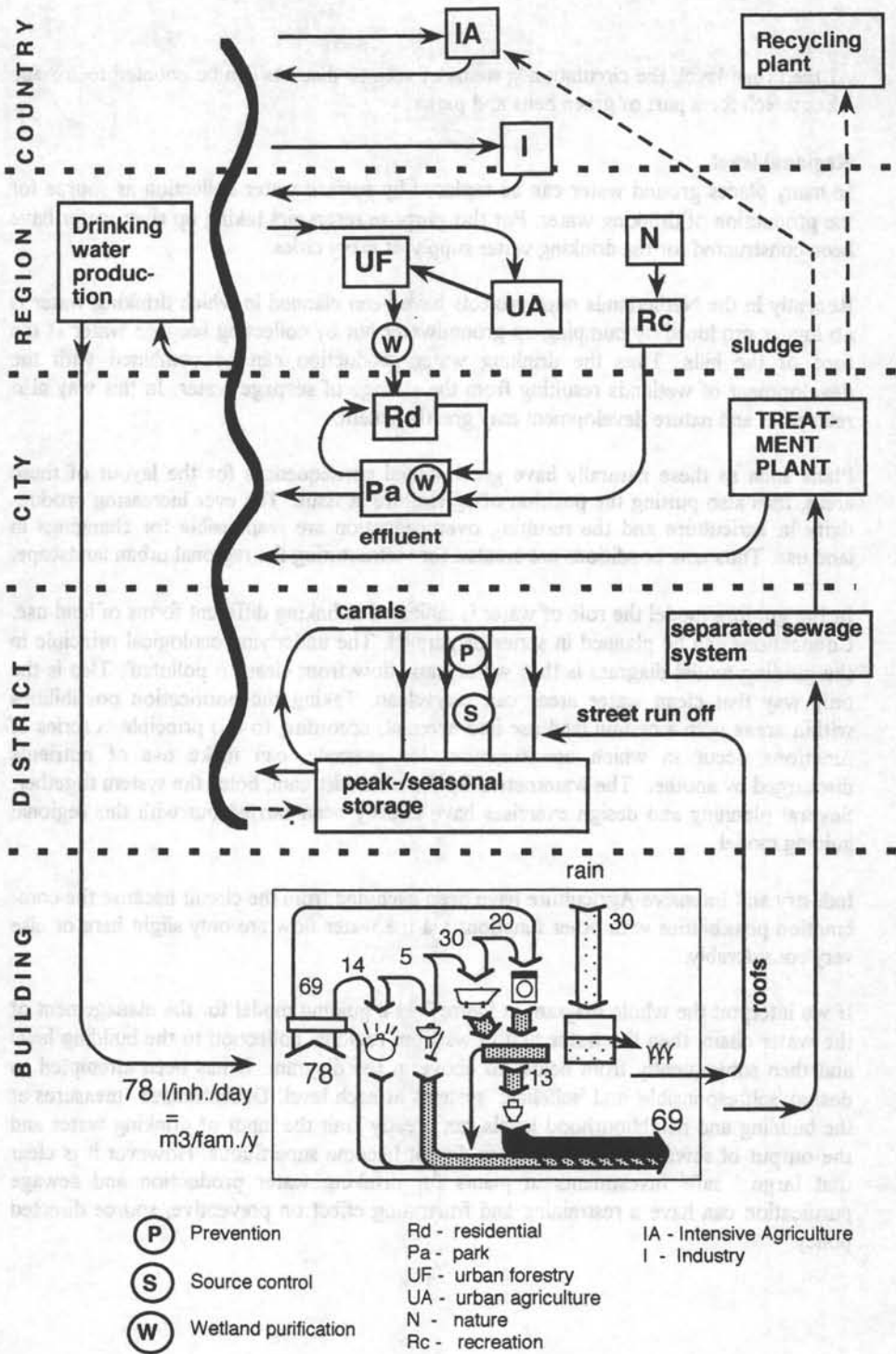


Figure 7. Guiding models for urban waterflows

### 3.4.3 Guiding models for urban traffic flows

There is a growing awareness that 'chain management' is also necessary in traffic planning. Not only by giving precedence to 'source directed' measures for limiting traffic, but also by paying a great deal of attention to the relationship between measures at different levels. The creation of conditions for good home - bicycle - train - walking - work connections is an example. In figure 8, a number of long term guiding models have been linked to become a traffic chain model.

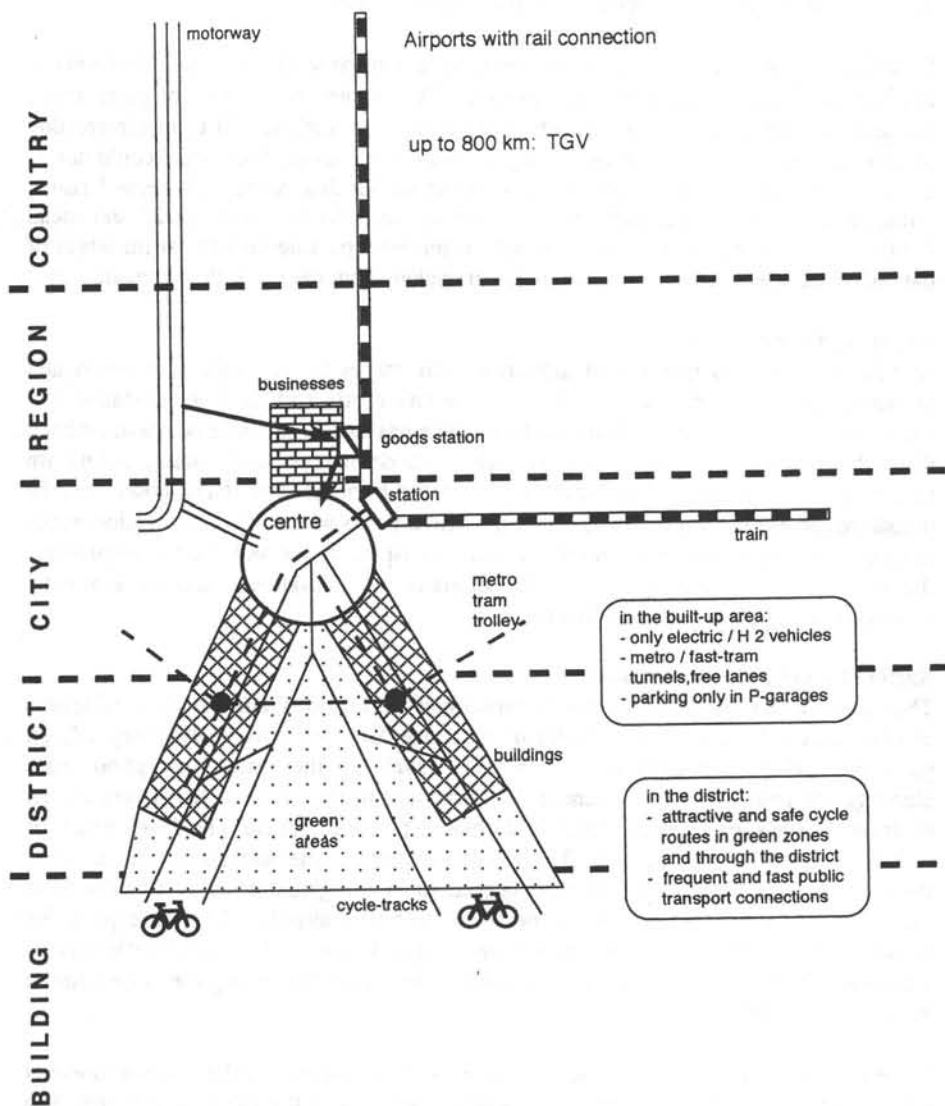


Figure 8. Guiding models for traffic flows

### **Building and district level**

The ministry for Housing, Physical Planning and the Environment commissioned a model study for a neighbourhood where cars are restricted (Ministerie VROM, 1990). The design of a new district (Amsterdam Sloten) with 5600 dwellings, was geared to a car ownership by only 10% of the households, good accessibility for visitors, goods and services and in all other aspects, a 'normal' programme. Starting points are: good connections to pedestrian and cycle routes and public transport, and accessibility of the houses for fire brigade, waste collection and the ambulance. Special accessibility provisions are made for cars of disabled and elderly people.

In addition to the advantages for the environment provided by the restricted vehicle traffic, there is also a remarkable gain in space. This implies more room for green areas, playgrounds and water. The hard surface can be kept to minimum. It is also interesting to note that there is a considerable saving on land costs. This guiding model could not be drawn in the diagram. It represents an ultimate model that seems still beyond reach, though pilot projects could make us more familiar with the technical, spatial and social implications. An intermediate model is conceivable with parking facilities at the edges of the residential area. Thus car ownership is not excluded but car use is discouraged.

### **Urban and regional level**

At this level, a good network of attractive cycle routes is very important. Short and attractive routes between residential areas, the city centre and the railway station can easily be combined with the green structure. There has to be a safe alternative route back through inhabited areas for cycling at night. The changeover and transfer points are indicated in the diagram. The latter is part of the business area. Here goods can be transferred to electric vans that take over the delivery tasks in the city. The location of the businesses beside the railway stimulates goods transport by rail and, for the employees, the accessibility by train. Large recreational areas and amusement parks must also be served by good public transport facilities.

### **National and international level**

The large role played by the motorway network at both national and international levels, can be reduced by a fast and efficient train service. Utilization particularly depends on good pre and post-transport facilities at lower levels on the scale. Here good chain planning for traffic flows is essential. For distances up to 800 km, fast trains are an environmentally sound and comfortable alternative to the aeroplane. The development of a TGV network provides possibilities for curtailing the expansion of airports. Possibilities for a fast changeover from intercontinental flights onto fast trains can form one of the elements of competition between European airports. This concept is for instance being recommended for Amsterdam Schiphol Airport. For environmental reasons a possible division of tasks including complementary functions among the large airports is especially important.

If the chain is considered as a whole it becomes clear that the district guiding model is not prerequisite to measures at higher levels. Rather, it is the other way round. The development of attractive alternatives to the use of the private car could create conditions for acceptable restrictions at lower levels. The European Federation for



Transport and Environment (1993) has made a proposal for 'getting the prices right', for internalizing environmental costs in fuel prices. Such economic incentives could create conditions favourable for environmentally friendly ways of transport.

### **3.5 European Cooperation in Research Projects**

#### **3.5.1 Scope and Organization**

Among professionals and citizens working in daily practice of urban planning and management there is a widespread scepticism about general 'strategies'. Each plan is trying to solve its own problems in its own way. The need for general strategies and more specific guidelines becomes clear, however, as soon as we ask: What may be learned from previous experiences?

Thus, indeed, each plan should be attuned to local conditions and potentials, of the existing physical landscape as well as of the institutional, social and economic 'landscape'. Concrete on-site research is necessary to support the planning and design process.

But the individual plan is also a case study, from which we can learn for other cases. Here research may focus on developing general strategies, strategic guiding models and instrumental guiding models. International comparative assessment of case studies seems to be an appropriate way to provide more general research projects with the relevant empirical data.

The strategic concepts and guiding models discussed in this paper may be considered as hypotheses that need further testing. They may therefore guide the structuring of concrete research proposals.

It may be suggested here to follow the recommendations of the Ankara ECE-conference. They include the adoption of a 'table-model' in which the table-top represents the general research projects to be undertaken jointly by research institutes in different countries. The table-top should rest on many legs, representing case studies that can be started in many countries. Future workshops could then provide an opportunity to exchange case study experiences and to further develop more general strategies, guiding models and methodologies.

The OECD and EC policy documents clearly show this approach could be funded by forwarding concrete research proposals to these and other international organizations. But there are also national and local funds available to support research projects that fit in this scheme.

### 3.5.2 Priorities

#### 1. The 'learning process' of cooperation

To learn from cooperation projects is the most important priority. Not only researchers but designers and policy makers too learn by experience. On the one hand there is a need for learning '*in the breadth*', exploring ways of cooperation and linking together planning approaches for 'flows', 'areas' and 'participants'. The ECOPOLIS strategy framework may serve as a set of criteria to assess the integral quality of plans and to generate proposals for enhancing the conditions for self-organization. On the other hand there is a need for learning '*in the depth*', testing and further deepening the 'guiding models' for chains, areas and organization that have been proposed. The learning process encompasses the cycle: Strategy > Projects > Strategy > Etc..

#### 2. Priorities for researchers

First there is a need to develop practical tools for differentiated source directed policies. This is an important part of the sandwich strategy, directed at the 'top layer' and the 'basic layer'. Secondly, research should be directed at the urban ecological projects in the 'intermediate layer'. *Social economic research* is necessary for increasing insight into the material and intangible desires of various lifestyles and types of business. An analysis of urban ecological projects should reveal more practical possibilities for cooperation and for creating conditions for self organization and commitment to environmental aspects of 'normal work'. For increasing insight into the practical alternatives in the use of energy, water and materials, waste separation and choices of transport, *technicalecological research* is necessary. Which materials and techniques are available, and what are the environmental effects of these, including those at the global level?

#### 3. Priorities for designers

Design solutions are very important for the 'sandwich strategy', especially at the level of the 'basic layer' (houses and buildings) and at the 'intermediate layer' level (neighbourhood-city fringe). The challenge for designers is to make ecological relationships visible. In addition to 'guiding models' (layout principles), site-specific designs in which great attention is paid to form are extremely important. It is the use of the ecological potentials of the site with various contrasting ideals concerning shape and style which is so meaningful. The association of ecologically sound urban development with one particular style of design has to be avoided. Ecology, like mechanics, should be explored as a source of inspiration by various design schools. *Architects, urban designers and landscape architects* each have an important role to play.

#### 4. Priorities concerning policy

Policy initiatives are necessary, both at the local and higher levels, for the development of organizational 'guiding models' (stimulating policy, district management and regional and local planning). Here, the priorities are the development of a policy framework for environmental and spatial planning and the setting up of practical experiments in which the mutual attunement of target group policy, area directed policy and chain policy can be developed, take priority. The 'forum -pilot project strategy' here should find its testing ground.



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## ***Part II***

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### ***Case studies***



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# Curitiba

*Liana Vallicelli*<sup>1</sup>

## 4.1 Introduction

I am here in the difficult role of replacing someone whose reputation precedes him: Mr. Jaime Lerner who, for last-minute reasons, beyond his control, was not able to come. I will therefore deliver his lecture, and convey Curitiba's ecological strategies.

A few years ago, in an article about the 100th anniversary of the Brooklyn Bridge, Paul Goldberger wrote a sentence that Mr. Lerner has kept until today: "A real monument should represent a kind of shared cause that links the different segments of society."

Cities, like monuments, should represent this shared cause. Any city, large or small, can be improved, if those who are responsible for it can transform each problem and each potential into a cause shared by the whole community.

Therefore, to manage a city is - above all - to make a collective dream come true.

For this to happen, a strategic vision of cities is necessary.

- Cities can change the energetic profile of a country.
- Cities can better solve the problem of children.
- Cities can better solve the housing problem.
- Cities can help solve the environmental problem, because it is precisely in cities that most ecological problems are generated.
- CITIES CAN CHANGE A COUNTRY.
- But, for that, central governments must have a strategic vision of the local power. And, above all, city managers must also be the managers of change.

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<sup>1</sup> Text accompanying a slide presentation.

## 4.2 The Curitiba Experience

Mr. Lerner's belief in the potential of cities is largely derived from the experience he had in his own city.

He was mayor for three alternating terms, totalling 12 years, of Curitiba, capital of a largely agricultural state in southern Brazil.

Curitiba was a very provincial city, with little more than 500,000 inhabitants, when he took office for the first time, in the beginning of 1971.

It was a time of cheap oil, and Brazilian cities were too much geared to cars.

Major cities started to loose control of their growth, accelerated by the rural migration at that time, when the increased mechanization of agriculture was freeing huge contingents of farmhands.

Just to give you an idea, Curitiba had its population tripled to 1,5 million over the following 20 years.

What we did in Curitiba was essentially in partnership with the people.

We made citizens aware of the possibility of an ecological city, thus radically changing the position of the population.

The idea was to propose a city that wasted the minimum and saved the maximum.

Disorderly growth gave way to a linear structure integrating land use, mass transport and road network.

Mass transport gained priority over individual transport. The city possessed no resources for underground or elevated systems.

Thus, a surface system was developed based on buses, increasingly improved to the point of reaching nowadays the performance of a subway and the agility of boarding/deboarding and in number of passengers transported: 1,300 thousand a day.

The whole bus network is integrated by means of terminals and tube stations. The system gained special agility with double-articulated buses, with capacity for 300 passengers.

The quality of mass transport caused 28% of car owners to opt for buses, representing a 20% average economy in fuel in comparison to other cities of similar size.

Can you imagine cities like São Paulo, Rio de Janeiro, New York, Chicago with 30% less cars running in the streets? And 30% less fuel, less energy? And 30% less pollution!



This reduced highly the need for road works, mainly overpasses and elevated roads, that most of the time only transfer gridlocks from one place to another, and also disfigure cities.

The city of Curitiba redesigned itself, without losing its essential characteristics.

It harnessed its growth and recovered human proportions. Pedestrian areas received special treatment, promoting encounter of people.

Curitiba received at the same time a network of bicycle paths - over one hundred kilometers - for leisure as well as for transport.

Another great ecological leap forward: four years ago, the city invested in two simple solutions for the garbage problem.

First, it began trading garbage for food or bus tickets in slums. In reality, this program served as a first approach to these needy populations, who from then on became targets of an intense environmental education program.

Afterwards, the whole city was invited to separate organic from recyclable garbage, at home and in the workplace. It was the "Garbage that is not garbage", that won the popular support according to opinion polls.

Environmental education has permeated the whole school curriculum.

In needy communities, informal schools are attracting children to environmental activities.

From the "Garbage that is not garbage" a toy factory was born, operated by children and geared towards developing creativity.

This is a very significant example because it involves great economy of energy and raw materials.

Only by recycling paper, Curitiba prevents the daily felling of 1,200 trees. How many trees would be saved by all the cities together?

But the physical transformation of the city had to be followed by a profound social change, capable of guaranteeing the basic needs of large segments of the population, afflicted by the economic recession of the country.

Children have been viewed as a fundamental priority, the needier receiving a more careful follow-up to avoid the delinquency that has been more frequent due to the growing impoverishment of the people.

Over a little more than 20 years, the city has built and maintained 200 day-care centers, 82 health-care centers, full-time schools and job training.

Old buses were transformed into professional-training centers. It is the "job-line" that runs around the outskirts of town, taking along professional training. More than thirty thousand adolescents were trained in the last two years in the "job-line".

Curitiba had in 1970 only half a square meter of green area per inhabitant, and has today about 52 square meters, thanks to the implementation of 16 large parks and the planting of one million trees.

The city, far from the sea, was immersed in green, and this reinforced the ecological awareness of its citizens.

The parks, in addition to providing leisure and recreation, preserve riverside areas and headwaters, and prevent floods.

Where there was an abandoned stone quarry, the Open University for the Environment was born.

This university provides short courses on good environmental practices, destined mainly to opinion leaders: teachers, policemen, housewives, taxi-drivers, concierges.

Architecture was highlighted in the new equipment.

In the greenhouse of the Botanical Garden, built on old farmland preserved from developers' greed.

In the 24-Hour Street, in the heart of town, harboring bars, restaurants and convenience shops, permanently open every day of the year.

And in a 2,500-seat theater, encased in a former quarry, that received the name "Ópera de Arame" (Wire Opera-House).

New equipment was combined to a policy of cultural revival and to the awakening of an identity between the inhabitants and their city.

An old gunpowder depot became a theater.

An old glue factory was transformed into a cultural center.

An old storehouse was converted into a popular mall.

An abandoned quarry is now being used as an amphitheater for concerts that attract up to 50 thousand people.

Respecting the paths of its history in the deepest sense of the identity of its people and the several ethnic groups, Curitiba now commemorates its 300th anniversary, heading towards the future, following the trail and the memory.

These examples of Curitiba are intended to reinforce the need for proposing scenarios of success to the population.

Mr. Lerner has been greatly helped by a multidisciplinary group in his work. And we architects have this commitment with the proposal.

We are in essence professionals of the proposal. And we must be committed to change.

And he believes that the next century will be the century of cities. But for that it is fundamental that city managers also be managers of change.

The cities of the future will not be scenarios from Flash Gordon as some people imagine.

Nor scenarios from Blade Runner, as others, tied to an over-pessimistic view, fear.

In fact, third-millennium cities will not be very different, in their configuration, from the cities of yesterday or tomorrow.

What will render them different is their ability to reconcile with nature and their inhabitants.

Environmentally sound cities.

Cities that save the maximum and waste the minimum. And this vision concerns the whole planet.

It is local action as a guarantee of global survival.

It is fundamental to awaken this strategic view in populations.

Waste is the greatest source of energy. You only have to imagine how many power plants a country can avoid by fighting waste. That's why cities can change the energetic profile of a country.

Design must be the determinant in the process of harnessing and steering city growth. But it can never lose the human reference. The human scale should prevail, always.

Thinking like that, we don't have to fear for the future or the scale of cities.

Even megacities can preserve the human scale.

The so-called inviability of megacities is only the fear of scale.

We have the instruments for

- controlling growth.

- choosing technology

- integrating the formal and informal sectors

In broad lines, these are the premises that will guide third-millennium cities.

All of them converge to a basic understanding of the city as a shared cause, a collective dream.

Thank you.

## 5

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# Densification while preserving quality: Green Structure Project

*Signe Nyhuus and Anne-Karine H. Thorèn*

### 5.1 Introduction

#### 5.1.1 Background

The background to this project is the idea that urban development which emphasises densification (that is more effective use of floor area through use of lofts etc., extensions to buildings, demolition of buildings followed by new building on the same site, new building through sub-division of lots, large building projects on vacant lots in a building zone) will have several positive impacts on the environment simultaneously: on the use of energy for transport, on the landscape and nature in the vicinity of the city, and on peoples' everyday lives. We know that a more concentrated city will be a less resource intensive city, but it is important how the densification is achieved. Within today's urban areas there is a strong potential for serious conflicts between the need to maintain the green structure and the need for development. Ill-considered densification can destroy valuable urban green space and architectural features which we cannot afford to lose. This means that we must study both the quantitative and the qualitative aspects of densification; we must find out what we can achieve in terms of centrally located floor area, seen in relation to the consequences for the green structure, architecture and assets (qualities) for users.

#### 5.1.2 Objectives and themes of study

Densification has always been an aspect of urban development. This means that we can use today's cities as material for empirical studies of densification. The research project 'The physical consequences of densification' is intended to provide experience on where, to what extent and how cities and urban districts have become more concentrated, and study the consequences of the practice of densification in recent decades. The experience will be used to prepare material and guidelines on how to plan densification in the future: how can we achieve densification and simultaneously guarantee quality? The material is intended primarily for municipal land use planners.

The main focus of study is the relationship between urban structure and green structure. We shed light on this relationship partly by reviewing the historical development in selected parts of the city, and partly through a more detailed documentation and analysis

of the present situation. An important question to be answered is what kind of areas should receive priority for development and what kind should be preserved as green areas. We should also investigate which forms of densification are best suited to existing green areas of the city and make a detailed study of all nature areas in the different plots selected for more concentrated building.

We are also studying the consequences of densification on the use of residential areas and on the building structure. Does today's densification make effective use of the available plots? What does it produce in terms of floor area and numbers of dwellings? What is the effect on public areas for outdoor recreation close to dwellings? What about sunlight, views, and privacy with regard to neighbours? Densification can lead to drastic changes in architecture and in the character of the district, whether this takes place as a gradual process over a long period of time or as a large, sudden impact. The project will study these consequences, seen through the eyes of both residents and professionals.

### **5.1.3 Organisation of the work**

The project is organised as a process in which experts from different disciplines work simultaneously, study the same geographical area but use the material and draw conclusions in the light of their own respective subjects and approaches. In some parts of the project the researchers will cooperate very closely or may be dependent on the progress made and the results obtained by others. The most important methods are field studies, interviews, collecting and reviewing records of building cases, and the use of maps and aerial photography. The field studies include both biological investigations in the green structures and registration of the pattern of development and the building structure.

### **5.1.4 The project group**

The project group consists of a biologist, a landscape architect and two architects. Associated with the group are a professor in landscape ecology and four university students in their final year. Three of these have helped to collect the data, and the fourth is writing a thesis on the history of art.

### **5.1.5 Work so far**

The work started in the summer of 1993 with biological recordings in the green structure. In addition, the development of the green structure has been documented over a period of 40 years, with simple classification and measurement of areas based on maps and aerial photographs. The general features of the urbanisation of the area have been described, and we have recorded the quantitative development of construction within a typical area containing mainly detached houses.

The work is continuing, including compiling records in other areas of the city and quantitative and qualitative analyses of the consequences of the densification.



## 5.2 The green structure

The green structure is defined as all areas of land covered by vegetation and land which could potentially be invaded by vegetation, such as infill sites (for example, dumps of discarded stone and building materials) or newly excavated land. The definition includes both public and private areas. In Norway, the private green structure, for example, the gardens of detached houses, is often an important component of the green areas. The green structure is regarded as an infrastructure, in the same way as the technical infrastructure and the building structure. It can be studied and planned at many levels; from the international or national level, via the regional level to the local level. In this project we are studying the green structure within the building zone, or more specifically in a defined project area in Oslo.

### 5.2.1 The study theme

Innumerable questions can be studied within the specified theme, the green structure in the building zone. In fact, the problem is to limit these questions, and define them as good topics for scientific research. The difficulties arise partly because very little basic research has been carried out on the green structure in Norwegian cities in general, so we have a very real feeling of "starting from scratch".

In this project we have concentrated on two main themes.

- a. How has the fundamental green structure in the project area changed from about 1950 until today?

We wanted to analyse changes in the fundamental green structure in the study area. This would give an indication of changes in the size and content of the green areas. In other words, we have focussed both on changes in the horizontal distribution of the areas and the vertical structure within the areas. It is our hypothesis that the information obtained will provide a good basis for a more detailed analysis of the possibilities for movement (of humans and of animals and plants), for human enjoyment of the beauty and diversity of nature and for biological production in the urban landscape.

- b. Questions of landscape ecology, such as the relationship between:
  - size of area and diversity of species;
  - age of area and diversity of species;
  - diversity of species of different groups of organisms, such as plants and beetles.

Biodiversity generally covers all types of organisms, from micro-organisms to trees and large mammals, from gene up to species level. In this project we have focussed on certain groups and species depending on their value to humans (flowering plants), their possible value as bioindicators (bats) and their possible value as indicators of the ecology of the landscape (ground beetles). We study the biodiversity only in terms of species diversity, that is to say, the number of different species found in a specific area.

### **5.3 Changes in the green structure from 1950 to 1990. Description and interpretation of the work**

#### **5.3.1 Material and methods**

We have studied, described and recorded on maps the situation in the two years 1950 and 1990, using an economic map, scale 1:5000, as basis. The map records have been supplemented by interpretations of aerial photographs from the same years.

The vertical and horizontal changes in the green structure have been recorded using a method of registration developed in connection with the "NAMIT"-project (Environmentally sound urban development), called the N and K series (after Dyring and Nyhuus, 1990). The basic assumption of this method is that in order to find out how the character of an area has changed it is necessary to obtain a picture of the green structure which is as three dimensional as possible. This implies studying both the horizontal and the vertical structure of the vegetation. The quality and the character of an area also depend on the extent to which the green areas reflect the natural state or are marked by culture, that is cultivation or management. For this reason, a distinction is made between areas consisting of spontaneous, natural vegetation, with little or no preparation of the ground -and vegetation which is distinctly cultivated or planted, with a large degree of preparation of the ground. A map is being prepared to show what the green structure looked like in 1950, and what it looked like in 1990.

#### **5.3.2 Interpretation and conclusions - main features of the changes**

The following is a short summary of:

- a) changes in the horizontal structure, that is to say, in the size, continuity and distribution of the green structure; and,
- b) changes in the vertical structure, that is to say, structural changes in the vegetation.

##### **a) Changes in the horizontal structure**

In general, the green structure has become fragmented. The green areas have been reduced in size and divided by roads and buildings. Specific areas, like Abildsø, Ryen and Kverner are no longer connected, and areas along the River Alna have been divided up. Other areas, such as the Helsefyr area, have been totally altered - from a cultural landscape/building structure with a mosaic-like pattern to a completely built-up, grey industrial area. Other areas, like Etterstad, are characterised by large building projects on previously unbuilt areas, especially natural areas. Densification has taken place in a number of areas, which has led to natural and cultural environments being built on or fragmented, as in the residential area of detached houses at Høyenhall.

##### **b) Changes in vertical structure and content**

The following is a short summary of changes in the content of the areas, as an example. Changes in content occur when trees are felled and are replaced by lawns or vice-versa; when "grey" areas are planted or infills (dumps) become overgrown by plants.

### **From grey area to green**

This has occurred to a some extent in central areas of the city, for instance, by planting trees and other plants in courtyards between buildings (e.g. Schweigårdsgate).

### **From green area to grey**

This is a more usual type of change in various parts of the city and for different kinds of areas. It seems to be particularly common in industrial areas, but some residential areas have also been altered in this way. In residential areas in the centre of the city where old buildings have been demolished, wooden houses and the "chequerboard" pattern of buildings, with some elements of green, have been replaced by blocks of flats and a great deal of asphalt. Any green area that remains consists of flat lawns.

### **From culture to nature**

This type of change has not occurred to any degree, although in some places cultivated land, meadow etc. has been left alone, and has become overgrown. In certain places the same has happened in grey areas that have been dug up or filled in, or where the ground has been drained. Here the natural succession of plants has been allowed to take its course, leading to the growth of some deciduous trees.

### **From nature to culture**

This is a common type of change, particularly in areas where the density of buildings has been increased by erecting new dwellings on plots which originally contained one detached house. Here the natural vegetation disappears and is replaced by lawns and planted shrubs and flowers. This has also occurred on a large scale through thinning and management of the vegetation cover, changing it into grassy areas. A typical example is found around the lake at Østensjø.

### **No change**

Some areas have changed very little since the 1950's. Here we find noticeable differences between residential areas consisting mainly of small houses (semi-detached or terraced houses) and the large satellite towns/suburbs with large blocks of flats on the outskirts of Oslo. These areas became completely altered during the building process, with extensive changes to the terrain, the soil and the vegetation. The lawns established at that time have remained more or less unchanged.

## **5.4 Ecological studies in the landscape. Description of the work**

### **5.4.1 Material and methods**

A number of study areas were selected in the categories "patches of pine forest" and "patches of meadow". Pine forest was chosen because it is and has been a typical type of natural environment in this part of Oslo. Meadows were chosen because they are green areas which people often value very highly. The pine forest patches vary in size and are located on rocky ground with poor soils. They are more or less evenly distributed over the whole project area. The so-called meadow patches vary considerably not only in size, but also in type and location. For example, they also include areas of weeds. The criteria

were no trees or bushes and very little preparation of the ground. The areas were demarcated and shown on an economic map, scale 1:5000.

In both the pine forest and the meadow areas the vegetation was documented by totally mapping 5 squares of 1 x 1 metre and noting the relative dominance of the different species. Species growing outside the squares, but inside the boundaries of the patch, were also recorded. In the pine forest patches the squares were decided at random, but in the meadows they were placed in the vicinity of beetle traps. The method used to record the beetles is not described here.

The diversity of species in the pine forest and the meadow patches was compared with parameters such as:

- size of the area;
- how long the area had remained stable (going back to 1950).

The ground beetle species were determined and the different combinations were examined, such as number of species correlated with size of area, etc.

Bats were also recorded and described, but it is not considered necessary to describe this aspect here.

#### 5.4.2 Interpretation and conclusions

We shall now briefly describe some of the findings, and what they appear to indicate:

- The number of plant species recorded in the different pine forest patches (11 in all) were correlated with the size of each patch. Studies of islands of natural vegetation in the cultural landscape show a distinct correlation between number of species and size of the islands; the larger the island, the more species it contains (Imms, pers. comm. 1993). In this study we found no clear correlation between size of patch and number of species in the pine forest areas. On the other hand, we found a significant correlation between size of patch and number of plant species for the meadow areas. We hope to repeat the study later, and have the time to carry out a more thorough preparation. In urban areas it is likely that several other factors influence the status of the islands of meadow that still exist in the landscape. One conclusion which should be taken into account in the planning of green areas is that not only the size, but also measures such as management and location of routes of public access, e.g. pedestrian pathways and cycle tracks, also have a strong impact on the biological content of the areas.

- Among the meadow patches, it was found that the three that clearly contained the largest number of plant species had existed there as meadow in the landscape for a long time. This comparison was easily visible when these patches were placed in the green structure maps from 1950 and 1990. This finding is of vital importance for planning, because it indicates that history is an important criterion when valuable green areas are to be identified, for example, when planning the various forms of densification.

- The meadow patches with the smallest diversity of plants were shown to contain the largest number of species of ground beetles. These beetles are predators, and therefore

do not depend on plant pollen or various other parts of plants for food. They are of vital importance, however, for the food chain, because they are an important source of food for hedgehogs, badgers and some bird species (Ims, pers. comm. 1993). Unlike plants, beetles are not an obvious source of enjoyment to humans (often quite the opposite!). However, a green area with only few flowering plants may be of considerable indirect value, even if we do not perceive the connection between an "ugly piece of infertile ground" and opportunities for aesthetic experience elsewhere in the environment. This imposes serious demands on information and participation as part of a green planning process. It is necessary to demonstrate the importance of such areas, so that people can develop a more conscious relationship with these "unproductive areas".

- The bat recordings are being analysed. It seems that a new species for Norway has been found near the lake at Østensjø (Ims, pers. comm. 1993). The lake has recently become protected as a nature reserve (only the water surface), but the areas around the lake are not yet designated as protected. The lake and the surrounding area contain qualities that are worthy of preservation in a national context, and from a local point of view, this is one of the areas in the Oslo region most widely used for recreation.

### **5.5 Continuation of the project**

The field work for the project was not well enough prepared, because the start of the project was delayed. Nevertheless, this period has provided valuable experience and must be regarded as a pilot study for a more detailed and more thoroughly prepared investigation. Landscape ecological studies are being undertaken at several locations in the cultural landscape. It will be interesting to undertake such studies in urban areas as well, as a basis both for biological comparisons with other areas, and for planning the green structure. Densification while preserving quality also implies, to the highest degree, identifying the quality in green areas around the actual mass of buildings.

In 1994 the project has been extended to include a medium-sized town, Skien, and a small densely populated area in Romerike (about 50 km north of Oslo). In these cases it will be relevant to supplement the existing basic data in order to achieve more environmentally sound planning of the different forms of densification.





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# Urban Greenspace and Sustainability

**Developing a more effective urban environmental planning methodology by identifying local level actions towards greater environmental sustainability**

Anne R. Beer<sup>1</sup>

## 6.1 Introduction

At the Earth Summit in Rio in 1992 many national governments signed the international agreements on biodiversity and climate change as part of the moves towards achieving greater environmental sustainability. Many countries have followed this by publishing their national policy statements on sustainability, biodiversity and climate change during 1993-1994. Subsequently these national statements have been linked with directives to the regional or city planning level; these ensure that full environmental appraisals must be undertaken of all development plans with the intention of implementing the policies set out in the international and national level documents. In Britain, this has meant that the government's programme towards achieving sustainability, enhancing biodiversity and its moves related to the reduction of carbon dioxide and greenhouse gases have been published by the DOE (HMSO, 1994). However, it remains to be determined how effective these agreements and associated policies will be in influencing the way we plan, design and manage land or how they are likely to affect people's lives. This paper describes a pilot study which aims:

- a) to develop a cost effective environmental planning methodology for identifying, prioritising, costing and monitoring local level regenerative actions. These are the actions needed to allow the implementation of the city and district-wide environmental policies, set out in the local planning documents with the aim of enhancing the level of environmental sustainability.
- b) specifically to test this methodology through investigating its effectiveness in allowing an assessment of the role of local greenspace in aiding the development of locally sustainable land use and land management.

## 6.2 The context

Will the present planning policies at city planning level really improve our chance of enhancing the level of environmental sustainability? How can the policies be effectively implemented? How can we cost effectively monitor environmental factors in a way which will inform the planning and city management? These are questions, which the

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planning process is at present ill-equipped to answer. There are so many imponderables and a great dearth of the accurate environmental data needed to address the issues.

A project is underway in the Landscape Department, University of Sheffield, which aims to investigate aspects of the questions surrounding local level environmental sustainability. The project has taken as its main concern the role of the un-built land in helping achieve an enhanced level of environmental sustainability in the *existing* developed areas of our cities. To do this accurately, site specific environmental data is required and concepts need to be developed to examine the interaction between the physical, natural and social environment. In addition, the economic aspects of adopting different strategies to enhance the state of the environment will need to be assessed. This does not just mean the study is about the role of the 'official greenspace' - the city's open spaces; it is about the role all the un-built land - all the 'outdoors' in the city - all the space between buildings and, therefore, about the existing and potential greenspaces of a city (see Diagram 1).



In its pilot stage, the case study has concentrated on specific aspects of the environment which relate mainly to the abiotic and biotic aspects and related social issues of greenspace in an area of existing development. The study attempts to develop an understanding of the link between the built-up areas and the open spaces of a city and how this link influences a city's capacity to move towards an increased level of environmental sustainability. In other words, to identify what needs to be changed on the ground in specific locations and how these changes can be brought about through applying regenerative techniques for sustainable development. It also intended that ultimately the work will help develop techniques to identify exactly where financial aid for regenerative schemes can be most effectively targeted and where community action could best be stimulated.

The term 'regeneration', as used in planning literature, has tended to have a narrow economic and sometimes social bias; here it is used in a wider sense which includes concern for the abiotic (air, water, land) and biotic (plants and wildlife) aspects of the environment and for those aspects of the social environment which relate to our experience of the quality of life. It is used here in the way Lyle (1994) has described in his book *Regenerative Design for Sustainable Development*, in that book he has developed an environmental planner's approach to identifying regenerative strategies and techniques for environmental sustainability.

The central concern of the Sheffield Project is with the question: how might applying the principles of sustainability change the organisation and management of the existing areas of our cities. This is a particularly important issue in most EU countries which have low population growth rates. Housing accounts for the major part of the surface area of every city. What happens within the housing areas will be critical to our success in enhancing the levels of environmental sustainability in urban areas. For instance, in Britain, it is predicted that over 80% of our present housing stock will still be in use in one hundred years. If that is the case, it is largely what happens in these existing developed areas of the city which will determine whether or not British cities move towards a greater level of environmental sustainability. Of crucial interest is the question of whether the densification policy pursued by the EU is in reality an environmentally sustainable approach. To be in a position to predict this there is a need first develop a greater understanding of the role of the spaces in the urban environment and particularly the role of the greenspace.

### **6.3 Developing concepts for environmental planning at the local level**

This paper introduces the concepts that are being developed to tackle the issues raised by the need to implement environmentally sustainable development at the local level in the existing developed areas of cities. The concepts have been based on the principles of environmental planning. These can be summarised as conserving an environment capable of supporting life by protecting the basic physical requirements (clean air and water, fertile soils), by providing shelter and by providing for human well-being (Beer, 1990).

Fundamental to the development of ideas, to determine what should happen at the local level, has been the concept that developing more environmentally sustainable cities is not just about improving the abiotic and biotic aspects of urban life, it is also about the social and economic aspects of city life and how people react to and behave in cities. How people experience city life, particularly in the places where they reside and work, and how the city supports the life-styles people want to pursue are, therefore, seen as critical aspects in deciding regenerative strategies for more environmentally as well as economically sustainable cities.

Until recently in Britain there was a tendency, in the way the planning process operated, to see environmental problems within cities as relatively uniform across the city; whilst at the same time distinguishing the inner city and the urban fringes as having different problems from the remainder. This is partly due to the fact that much environmental data

is only available in a very generalised form. The environmental problems in the mass of the city have been seen as issues to be dealt with separately by the planning process - air quality, water quality, nature conservation, landscape quality, provision of open spaces all are described as separate issues in planning documents, each needing separate policies on improvement or conservation. The idea that all these aspects of the environment interact and interact with the pre-existing landform, the surrounding un-built land as well as the built form is still missing from most planning statements. Yet it is managing the interaction between these factors which will do much to determine the success of our plans to achieve greater environmental sustainability in urban development.

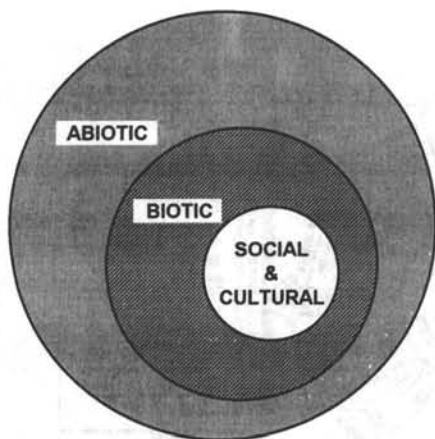
There has been a great improvement in recent years in the way environmental issues are tackled particularly with the introduction of the Unitary Development Plans. These have now been prepared for a high proportion of cities in England and Wales. This system has encouraged a more general recognition of the environmental variations across a city and of the fact that each district has different environmental, economic and social problems to be solved and, therefore, needs a different set of planning policies to achieve these ends. Despite that, the plans produced under this system show little sign of an understanding that it is the interaction of the natural (abiotic and biotic) with the social and economic aspects of the environment which is crucial to the environmental quality experienced by those who live in the different parts of the city. Understanding these variations is crucial to any proposals to increase the level of environmental sustainability.

The local level is of particular importance to issues of sustainability as it is at this level where the changes must really happen on the ground and in people's behaviour patterns, if policies towards sustainability are to be implemented. Therefore, we need to know what to do where in each district. At present action is best defined as *ad hoc*. There are just so many things that need be done to bring about improvements and, without any sense of the underlying environmental interactions, there is no real means of prioritising these decisions - of deciding how most effectively to use the always limited funds to enhance the level of environmental sustainability. Decisions are made almost randomly about which areas to work on and which to leave for the future. This is a problem exacerbated in Britain by the way the government has chosen to set up its new system for supplementing the money available locally for environmental improvements (the Single Regeneration Budget). To all intents because of the massive range of work that needs doing the SRB is a lottery for financial resources, it takes no account of the abiotic and biotic aspects of environmental sustainability in cities or of environmental interactions as it is totally site specific - it stimulates a 'fire fighting' approach to regeneration, rather than one based on any understanding of what environmental sustainability should mean in re-planning and regenerating cities. One of the questions the Sheffield University Study wants to investigate is: can a more systematic approach to identifying the best course of action at the local level be developed?

#### 6.4 The city an ecosystem

The Sheffield University Study has taken as its starting point the ideas put forward by Tjallingii (1993) in his booklet *Ecopolis*. This approach to developing a method of

achieving sustainability essentially sees the city as an ecosystem. From that idea a planning strategy can be developed based on the management of the flows (air, water, energy, materials and waste etc.). Such a strategy needs to become the paramount concern of any planning system intent on achieving greater urban environmental sustainability. It is an approach which assumes that human action on every area of land is limited by the parameters set by the abiotic and biotic aspects of the environment (see Diagram 2). It is an approach which is based on respecting the environmental interactions, which underlie the operation of the city. It is based on the idea that it is possible to prepare city and district-wide plans for total linked systems out of which specific local actions on site specific areas of land can be described.



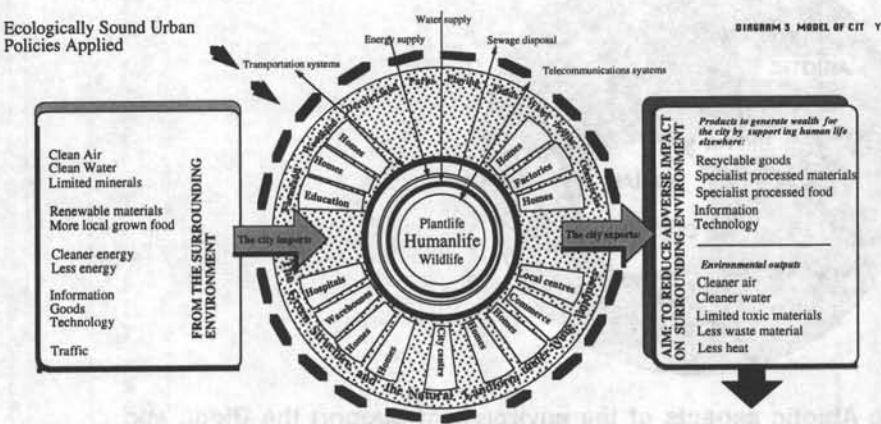
**The Abiotic aspects of the environment support the Biotic and both interact to support Human Social and Cultural and therefore the economic aspects of Life on Earth.**

Diagram 2 The link between the abiotic, biotic and social

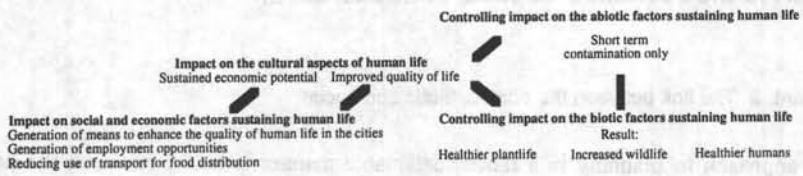
This approach to planning in a more sustainable manner is based on using the natural processes which still underlie every area of development. Diagram 3 indicates how the pre-existing landform and natural processes still underpin the developed areas of the city. These are most obviously still present in the form of the city's greenstructure (the dotted areas on the diagram), the built-up landuses can be seen as sitting on the surface of this pre-existing structure as described by Hough (1983). Recognising that the natural processes still operate, albeit in a damaged manner, allows us to believe that we can reverse some of the damage a city has done to its local environment by applying more ecologically sustainable urban development systems (ESUD in the diagram) to the workings of the city in the manner outlined in Tjallingi's (1993) work. It is an approach which sees the opportunities inherent in the urban greenstructure to reverse the damage that the city has done to the environment in the past.



A city's greenspaces, which tend to be seen by the planning system as to do mainly with recreation and peripherally and occasionally with nature conservation, also can be used to: improve air quality, water quality, increase biodiversity and generally improve the quality of people's experience of city life. But to use the greenspace in this wider way requires the identification of assets preparing of evaluations of the possibilities inherent in the present situation. Such evaluations must be based on the social as well as physical and natural environmental qualities of the greenspaces and assessments of the economic implications, if they are to be used to guide future decision making. In Britain in particular, where open spaces are only justified in the planning process for their recreational value, such spaces are under severe threat of being sold for development. It is, therefore, timely to rethink their role in the city.



**TOWARDS A MORE SUSTAINABLE CITY**



AR Beer Landscape Dept Sheffield

**6.5 Social aspects of urban form - the importance of "environmental settings" for human activities**

It is an important basis of the Sheffield project that, in part at least, the variations in environmental problems across a district can be related to the form of development on the ground and its associated environmental attributes. Similarly the potential for change to a more sustainable environment, as far as the existing areas of a city are concerned, is inherent in that form and its attributes. That there are such variations in urban form across districts is a result of both unplanned and planned actions by developers and city officials and individuals. Understanding these variations, at the same time as developing district wide regenerative strategies to achieve greater environmental sustainability, will



allow us to begin to plan in detail what should happen in each part of the district. Hough (1983) dealt with many of these issues in his excellent book *City Form and Natural Process*.

Improving the liveability of cities has been the long term goal of town planners and government legislation particularly since the last century. In part, it is because of the many different experiments that have taken place over the past one hundred years that such a multitude of differing urban forms have been built. The variations are also due to the level of affluence of those for whom the development is intended, prevailing political thought and financial system and even fashion. Each British city, perhaps with the exception of the New Towns, contains a wide range of urban forms reflecting its social, economic and cultural development through history. Each of these urban forms constitutes a place where people live, work and play. Each has been built on a pre-existing landform and landscape which has influenced the original development and its subsequent operation. Each is a differing social setting for daily life, resulting not just from the social and economic circumstances of those who live and work there but also from the fact that each constitutes a specific 'place', a specific and different 'environmental setting'.

Each 'environmental setting' in the built up areas of our cities is experienced by those who live there and those who visit as a different place. The differences in the built up areas of the city are produced by the interaction between the specific features of the indoor and outdoor spaces and the structures and surfaces defining the spaces. Similarly in the non-built up areas of the city each space varies. It 'feels different to be in', a factor which is dependent on: the underlying landform, the way the landform is 'clothed' with vegetation or constructed elements as well as who lives around the space and for what they use it. These environmental differences in built up and non built up areas of the city can be described through examining data on the specific environmental attributes of each 'place', just as the social and economic differences can be examined through census and employment data. However, few places have ever been examined in this way.

In relation to residential areas, many environmental attributes (for example the tree cover, the area of gardens, the height and width of buildings and their age and condition) can be measured and studied accurately. Other attributes, such as the feeling of safety experienced when using an outdoor space or the quality of the visual experience, or the pleasure experienced in strolling through a particular space can only be understood through subjective judgements. In social terms, some of these places can be recognised as very successful and liveable urban environments; that is environmental settings which support the requirements of the local populations and visitors for a satisfactory quality of daily life. Other places, in the way that they have alienated those who use them, can only be viewed as unsuccessful as support systems for daily life in urban areas. Many of these have become the problem areas of our cities. This is not to say that the "environmental setting" determines the quality of social life but, that it does influence it.

When any level of social disintegration is present a poor "environmental setting" can exacerbate the situation and perhaps even accelerate the development of social problems. Much work was done since the 1970's on these issues by those involved in post-

occupancy studies of housing areas (Cooper Marcus, 1985). These have been paralleled by studies of how people react to open spaces in cities (Burgess, Limb and Harrison, 1988).

## 6.6 The abiotic aspects of urban form

In relation to the abiotic (air, water and land) aspects of the environment, urban form can have a direct effect on air and water quality and air and water flows through the city. For instance in relation to air flow, Ann Spirn (1983) in her book *The Granite Garden* describes the impact of urban form on air movement and shows how this influences the quality of the human experience of life in the city. One aspect of air flow and its link with urban form, is the way in which the built form and its associated vegetation can be used to reduce the heat loss caused by wind blowing against buildings. Reducing heat loss is an important component of developing environmentally sustainable strategies as it reduces the need for energy and, therefore, reduces air pollution (Breheny, 1992). Because some urban forms are associated with higher levels of energy conservation than others there is a need to identify what needs to be done where to reverse heat loss. In some cases the only answer with existing buildings is to improve insulation, in other cases where more modest improvements are needed other less costly methods can be considered. For instance, the introduction of tree planting on a housing estate can considerably reduce wind speed and, therefore, heat loss.

The presence of trees is also an important factor in reducing dust content in the air locally, for this reason those urban forms associated with a high percentage of tree cover have an added advantage for those living there. Through detailed examination of urban form in the Sheffield University Study it is hoped to identify the link between air flow and quality and local urban form. Some urban layouts block the natural flow of air along valleys and so reduce the capacity of the local natural air movements, which currents of air occur even in calm weather. Spirn (1983) shows that, where valleys lead into a city centre such air movements can help disperse the build up of pollution in the 'urban heat island' of the city centre, whilst also lowering the temperature of that part of the city. Where the valleys are well treed the advantages of natural air drainage patterns are accentuated, this is because air under trees is always cooler in warm weather and the cooler air drains down slope along the valley. The role of the car and commuting to work and shopping in reducing air quality is not forgotten but is not at present included in the Sheffield Project as studying this will require costly house to house surveys of behaviour patterns.

In relation to water quality, urban form can have a significant effect on the ability of rainfall to percolate back into the ground water and, therefore, on the rate of flow across the surface. Urban form is directly connected to levels of flash flooding in streams and rivers. Flash flooding disrupts the natural cleansing processes and the capacity of streams to self cleanse; there is, therefore, a need to reduce its occurrence. The effectiveness with which the Water Treatment Works can function is also determined by how consistent the flow of water is. Such flooding is associated with dilution of the foul water and disturbance of the biota on which the cleansing processes rely.

Understanding the varying contributions of different built forms to the flash flooding of streams and sewers can allow identification of where changes in local water management could with benefit be introduced. This could be done, for instance, by increasing the water holding capacity locally. That is by increasing the percentage of porous surface, increasing tree and shrub planting so that water percolates more easily into the soil or through the formation of small 'wetlands'. All of these regenerative strategies are designed to enable the water to enter the soil rather than flow across the surface. Built forms associated with low levels of sealed surface (areas covered by buildings, asphalt or other non-porous paving) have an advantage for on-site water management. But, to be effective on-site water management must be linked to a city wide system for surface storage and natural cleansing of "grey water". The implementation of such a system has the potential to greatly reduce the economic burden on a city's inhabitants of providing the finance for an adequate infrastructure to remove all surplus water through underground drainage systems. Therefore, as a second stage the Sheffield University Study intends to gather data to allow evaluation of local water storage capacity.

### **6.7 The biotic aspects of urban form**

To many ecologists, concerned with the study of the remaining 'natural habitats' and with the need to conserve these from development and exploitation, it may seem unimportant to consider cities as having any part to play in developing 'Biodiversity' strategies. However, cities have developed their own urban ecological habitats (Gilbert, 1989), many of these are valuable for the range of plants and wildlife they support and particularly the pleasure and interest they provide for urban populations. Therefore, in the Sheffield University Study it is taken as fundamental that 'Biodiversity' policies should be developed for each part of the city as a supplement to the present nature conservation strategies.

An important factor in developing these ideas has been the realisation that the present planning process has been more concerned with preserving the remaining fragments of 'natural habitats', than understanding that every part of the city has the potential to contribute to the total biodiversity of a city. Creating this new 'biodiversity' approach for the city will be about building up new self sustaining plant associations and encouraging their capacity to carry a range of wildlife; it will be about creative land and landscape management to increase the range of habitats in every part of the city where the potential exists. For the most part these new habitats will never be similar to 'natural habitats', but still they are habitats that can support plants and wildlife, they are the by-products of mankind's city building activities. Such habitats have a social role for city dwellers of as much importance, if not more, than their strictly biological role.

In biotic terms, some of the existing urban forms that have been produced by the development process do nothing to support the enhancement of biodiversity in the city; whilst others allow the possibility of nature surviving within the city. For instance, through the wide range of exotic plants in private and public gardens they provide another dimension to biodiversity. Gilbert (1989) in a separate study in the Landscape Department at Sheffield university has shown that each different urban form is likely to be associated with a different pattern of vegetation. The variations have been shown to

relate to the age of the development, the prevailing fashions in use of plant material at the time of development, the socio-economic characteristics of the first occupiers as well as the varying amount of unsealed surface left in the development (the surfaces not built over or paved) and the subsequent management of the land and landscape.

The Sheffield University Study aims to identify which areas already contribute to 'biodiversity' in the city and in which areas "biodiversity" needs to be enhanced. From Gilbert's (1989) work, together with the details on local environmental attributes gathered as part of the present project, it is predicted it will be possible to generate ideas on the appropriate range of habitats that could be encouraged in each part of the district.

### **6.8 A tool for local level planning**

To summarise, some urban layouts are more efficient than others in the way they interact with the environment. There is great variation in their impact on the abiotic, biotic and social environment of the city. To understand these variations is to begin to develop a tool for local level planning and city management. Such knowledge would be useful in the existing areas of our cities, it could help identify where the environmental problem areas are located and help decide how to change the land and landscape management patterns to rectify adverse effects. It is only when we know this, that we can properly target our limited financial and manpower resources.

Developing such environmental planning tools would allow a more effective local level system of achieving environmental sustainability to be developed and the economic consequences of introducing them to be better calculated. In addition, knowing which forms of urban development cause the least problems in relation to environmental sustainability will help the planners of future settlements decide the best form for particular urban areas.

### **6.9 A technique for handling environmental data for the local planning process**

A problem in relation to any environmental planning is that much of the environmental data available for city planning at present is generalised and not place specific. The local level environmental variations (abiotic, biotic, social, cultural and economic) which are such an important part of life in cities, therefore, go un-noticed in many planning studies. Yet they are critical to developing effective environmental management strategies towards sustainability at the local level. If cities are to be planned in a more environmentally sustainable manner, a methodology for achieving efficient data gathering is required, of the type that will allow the development of effective action to implement the city-wide and district environmental planning policies. It is this that we are attempting to develop and test at the Department of Landscape, University of Sheffield.

A major problem with gathering site specific environmental data on urban areas is that there is just so much of it. The underlying landform and the pre-existing landscape of each part of a city differs, the urban forms that have developed on the surface differ, the



way people manage the urban form differs. Therefore, each variation between the different urban forms is associated with a different combination of environmental attributes. These can be recorded and measured. However, the sheer quantity of environmental information, if each environmental attribute were individually recorded, makes the data difficult to handle. Even with the most powerful GIS and data management systems to handle it the human cost of gathering the survey data would be prohibitive. Therefore, mechanisms are needed which allow the gathering and recording of sufficient data to allow effective environmental planning, but without spending vast resources on labour.

The local environmental planning methodology being developed through the Sheffield University Study adapts that used for many years by ecologists when studying large ecosystems or large areas of land. For instance, ecologists use a well tried and tested technique based on stratified sampling to study complex habitats such as forests. This technique involves:

- i) identification through stratification of the zones exhibiting varying levels of homogeneity, followed by
- ii) studying in detail a sample area within each zone to acquire the scientific data which will allow analysis of the habitat or ecosystem involved.

In such a methodology, the levels of homogeneity identified influence the number of the sample areas required. Where homogeneity within an area is high, one sample area is often sufficient, but where it is low a much higher percentage of the land surface must be studied to gather data. Statistical techniques have been outlined by ecologists to establish the exact procedure it is appropriate to use locally. This is the concept that has been used for the case study, it involves the identification of variations in urban form and to collection of a sample set of data for each different area.

So far the Sheffield University Study has operated by breaking the study area down into its smallest units of homogeneity, in the expectation that the similarities between many of the zones will allow larger homogeneous units to be identified within the GIS at a later date. Within each of these small units a sample quadrat of 200x200 m has been surveyed and data recorded for a range of environmental attributes (see Diagram 4) in a relational data-base. These data were then applied as standard data for the whole homogeneous zone through the mapped interface of the GIS (MapGrafix, a user friendly GIS, compatible with ARCInfo has been used) which was prepared by digitising the boundaries of the homogeneous zones. This has already allowed a broad range of maps to be generated showing variations in the distribution of specific environmental attributes and has allowed interactions between the variable to be examined. Area calculations (for instance the total area of unsealed surface by zone, by district or by watershed can readily be derived from the data). Further manipulations of the data to examine the interactions are planned when new resources become available for the project.

#### Diagram 4

### UNIVERSITY OF SHEFFIELD

## NORTH SHEFFIELD SUSTAINABLE ENVIRONMENTS AND THE ROLE OF GREENSPACE PROJECT

### INITIAL DATA GATHERED FOR EACH LANDSCAPE STRUCTURE ZONE AT THE PILOT STUDY STAGE

#### Abiotic

Micro climate variations

Topographic variations

Local surface drainage and water quality

#### Biotic

% of surface cover by woodland trees, individual trees and large shrubs

% of surface cover by mown grass, rough grass, scrub

% of surface cover by water, wetlands

Variety of plant species

Relationship of site to Sheffield's green corridor plan

Sites of special ecological interest - location, size and shape

#### Social

Population distribution x age, sex, family type

Poverty indicators

% unemployed

% of single parent families

Housing tenure

Housing for sale

Level of vandalism

Subjective assessment of feeling of "safety"

#### Land use

Use of buildings x

Age of building

Condition of building

Block height, length and width

Size of front & rear gardens

Number for sale

Transport

Width of streets & verges

Width of other tracks & verges

Public transport accessibility

Woodlands x type, size and location

Agricultural land

Derelict land

% sealed surface (paved and built over areas of land)

### 6.10 Urban Landscape Structure Zones

It is important to understand that the term 'landscape' is used here to describe what we live in, not just what we see. The term 'townscape', used in some planning literature, would be inappropriate as it would exclude the less built up areas, the open spaces and the fringes of the city which all have an important role to play in developing environmentally sustainable approaches to cities.



The homogeneous units have been termed Urban Landscape Structure Zones (using a term first applied to the city of Munich by Dr. Fritz Duhme and his team at the Technical University of Munich, when they undertook detailed studies of the ecological variations found in different Landscape Structure Zones). Once the Landscape Structure Zones have been identified, data for the sample area is gathered mainly from air-photographs. In addition, site visits are undertaken to supplement the data and to allow verification of the remote sensed data. Unfortunately the best resolution available was at the scale of 1:10,000, more detailed air photographs would allow a higher proportion of sample data to be derived through visual and computerised inspection air photographs, as has been indicated in a privately sponsored study by Bud Young for Vodaphone (1993). Much of the data for the pilot stage in Sheffield was gathered by post-graduate students from the Landscape Department.

Any city can be sub-divided into a series of distinct Landscape Structure Zones; these can be thought of as the basic building blocks of the city. They are readily identifiable with the aid of the excellent colour photographs that are now available. Except for those areas of cities which have undergone several periods of development, the Landscape Structure Zones are in the main areas of land with a high level of homogeneity. For instance, as we walk through any city we are aware of sudden changes in the 'picture' we see - a densely built area with rows of terrace houses with small front gardens will suddenly give way to an area of larger terraces with no front gardens and that in turn to an area built over by semi-detached houses spaced at equal distances apart and with front and rear gardens full of trees. Because of these different characteristics the range of possible 'urban landscapes' is immense. This is so even within the residential areas and is not just a result of variations in the major land-use across the city. It is a characteristic of the way each area of land has been laid out and the styles and fashions of design when that occurred. As a result, different housing areas can have very different influences on a city's abiotic and biotic factors, as well as be capable of supporting very different human lifestyles.

The cause of the variations between residential Landscape Structure Zones across a city (Whitehand, 1992) are the same everywhere: whenever development takes place someone or some authority has decided how the land will be divided up, how the roads aligned. That alone starts to distinguish one part of a town from another. If the development is low density individual houses, the level of uniformity in the way the land is laid out might stop with the allocation of plots and roads. In such circumstances, a fairly high level of variation in layout and other environmental characteristics is likely to be found. But, in most cases of residential development, decisions are made for a substantial group of dwellings by developers or planners over a relatively short period of time. These decisions predetermine the density, form and height of each building, its materials, its garden size, its relationship to roads and footpaths, the distribution of local open spaces and often the plants which grow in the gardens and, therefore, the range of wildlife that can be supported. Such initial decisions on layout will also have an effect on whether pre-existing vegetation is retained and incorporated into the new development, whether streams are kept open or culverted or whether new planting is added or not.

The developer will also have had a clear idea of the potential buyers or tenants and have built according to their means, so determining to an extent the future social structure of an area of the city. All of which can be used to determine the present level of environmental sustainability of a particular residential development, provided we can define appropriate performance criteria for each environmental attribute.

Important for the Sheffield University Study is that each different Landscape Structure Zone also has a different 'greenspace' value. This can be measured in a variety of ways which includes: surface area (unsealed surface) and the present status and complexity of plants. The range of use the greenspaces can be put to by the inhabitants and visitors can only be assessed through on-site data collection. This will be done in future phases of this project. In some parts of the city the housing areas themselves are of critical importance to the city's greenstructure; in others they play little part in it, as there is no physical space within the development for the environmental attributes connected with greenspace to occur. In the development of long term greenstructure strategies, as a part of the move towards a greater level of sustainability in our planning of cities, information about these variations within housing areas is vital. It is as important as information about a city's 'official' open and green spaces and areas of nature conservation.

### **6.11 The Sheffield Pilot Study**

A district of Sheffield City is being used as a case study to gather data and to test ideas; the district was selected by the University team because it is an area within which there is a high level of social disadvantage and also an area with ample greenspace. The 1991 Census and more recent employment data consistently show very high levels of unemployment throughout this district which houses about 30,000 people. Maps have been prepared in the GIS of the 1991 Census Data available at Enumeration District level. The district which covers an area of land about 6 kilometres east to west and four north to south abuts the city centre on one side, the countryside on another, a huge area of decayed industrial development undergoing a regeneration scheme on another and the River Don the city's major watercourse on the fourth side.

Manpower restraints have meant that, at the pilot stage, the study has gathered data and developed ideas which in the main relate to the abiotic and biotic aspects and to the physical aspects of the built environment - the buildings and the roads etc.. It is, however, just these aspects about which we lack data - census and economic data is much more readily available to local planners in a much more detailed and accurate form than environmental data.

There are of course some areas of any city which cannot be described as homogeneous, these also have to be studied to provide environmental data although in this study they cover a small area. This normally involves recording detailed data for a higher proportion of the zone to compensate for the variations. These areas are characterised by their diversity rather than any level of homogeneity, and are an important part of any city adding to its visual diversity and, because they are often associated with mixed land uses, its social diversity. The remaining built-up Landscape Structure Zones of a city are

those which result from the location of social facilities such as schools, shopping and community centres and recreational facilities.

In addition, the data needs to be recorded for the un-built Landscape Structure Zones: public open spaces, nature conservation areas, woods, rivers, streams and ponds plus derelict and agricultural land. As with other Landscape Structure Zones, each needs identifying separately, not just as a Land Use. For instance, a Park may in fact contain several Landscape Structure Zones - a woodland, an area of playing fields, a formal garden, a riverside meadow. In developing effective local plans to achieve greater environmental sustainability through managing greenspace, data is needed on the environmental attributes of each part not just of the total district. Each Landscape Structure Zone performs a different environmental function within the city and is, therefore, associated with different environmental attributes which need managing in different ways if cities are to move towards a greater level of sustainability. Each Zone does interact with its surrounding zones. In developing strategies to enhance sustainability it is possible to envisage that a high level of environmental performance in one area may compensate for a lower level on an adjoining or nearby site.

Studying the city in this way, that is as a series of urban landscapes, is invaluable for effective environmental planning. We can begin to see exactly how one area differs from another and how some already achieve the levels of environmental sustainability implicit in the city's planning policies and others do not. For instance, the totality of green areas in the city can be studied properly for the first time - the "green" of the private gardens, as well as the "green" of the parks and open spaces. The green around the schools and of the countryside all of which interact to form a city's green structure. Viewed in this way, as Landscape Structure Zones, it can be seen that urban landscapes consist for the most part of spaces, with in some parts the buildings rather than nature dominating. For instance, with this data the potential to develop a higher level of biodiversity within these spaces can be evaluated.

The use of Landscape Structure Zones as the basic building blocks for implementing policy at the local level can be seen as a potentially important contribution to environmentally sustainable cities. They give us the effective elements for linking the 'top down' to the 'bottom up' approach to landuse and environmental planning.

## **6.12 The next step**

It is the resolution of the conflict, between the need to develop planning strategies to support the immediate needs of humans living in cities and the long term needs of survival, that is at the heart of ecologically sound development. A future stage of the Sheffield Pilot Study will be to develop performance criteria for a range of environmental attributes, this will be done in relation to the city-wide and district level policies developed by the city's officials. However, account will also be taken of issues that the city has not yet begun to consider in detail but many of which involve the possibility of community action.

For example:

- the possibilities of local water management using the house, its garden and the local open spaces to manage water a factor which will have implications for the future role of the city's open spaces,
- the possibilities of ameliorating heat loss in buildings by increasing tree cover in exposed locations which will have energy implications,
- the possibility of increasing tree cover to ameliorate the outdoor climate which has the potential to increase the use of outdoor space,
- the possibility of increasing the range of habitats throughout the area to enhance the level of biodiversity,
- the possibilities of growing biomass in the extensive open spaces of this particular part of Sheffield for use in small community CHP stations so as to be more sustainable in use of energy,
- the possibilities of developing effective local composting of biodegradable garden and household waste so as to improve local soil fertility.

The full involvement of the local communities in achieving the implementation of any of this work will be essential. A start would be to alert the local inhabitants to the environmental enhancement possibilities inherent in their area by providing them with data from the GIS. This would show how the various environmental attributes of their area rated against the same in other areas of their district. Introducing local inhabitants to the options available for local action would be an essential part of the process to make change happen, such environmental education will be crucial to what communities actually chose to do. Research is needed to establish what will stimulate local action? Is it effective to use local government money for pump priming local action? Can just providing materials get the local community started? Or, do the public believe 'it is all too complicated for us to become involved' and expect direct action by local authorities which they are willing to pay for through taxation?

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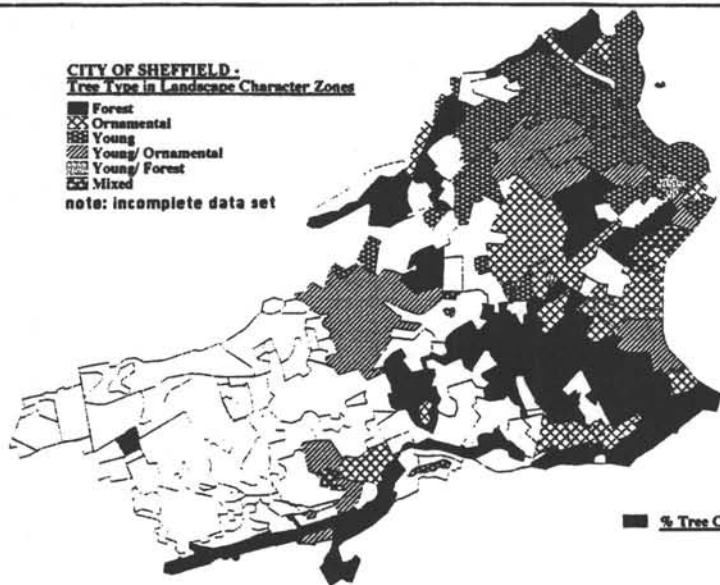




**CITY OF SHEFFIELD:**  
**Tree Type in Landscape Character Zones**

- Forest
- ▨ Ornamental
- ▧ Young
- ▩ Young/Ornamental
- ▦ Young/Forest
- ▤ Mixed

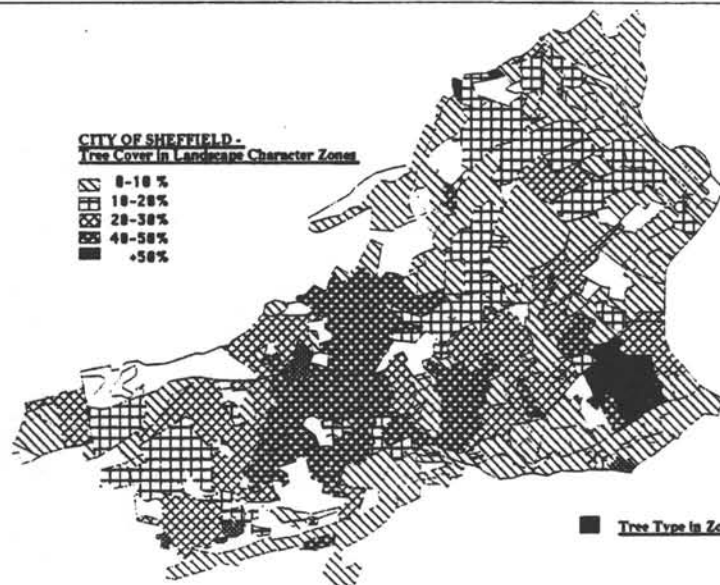
note: incomplete data set



■ % Tree Cover in Zone

**CITY OF SHEFFIELD:**  
**Tree Cover in Landscape Character Zones**

- ▨ 8-18%
- ▧ 18-28%
- ▩ 28-38%
- ▦ 48-58%
- >58%



■ Tree Type in Zone



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# Urban Ecology in the City of Dordrecht

*Hein W. Struben*

## 7.1 Introduction

As I see it, in an ecological city the flows of water and energy, waste and traffic are well controlled and the inhabitants can live together in harmony with their environment.

The environmental load is minimal and most people live, work, and enjoy their leisure within the city. Nature is a logical part of the urban fabric and has other functions besides biological ones, playing a role in the awareness of the seasons and the leisure activities of the inhabitants.

There is a new economic base, in which environmental technology plays an important part. At different levels efforts are made to achieve sustainable development.

This may be Utopia. Even so, I would like to demonstrate to you that Dordrecht is already well on the way to the realisation of this image of the future.

The city of Dordrecht has currently about 115,000 inhabitants and is uniquely situated on an island in the delta of the rivers Rhine and Meuse. In addition it borders on the Biesbosch National Park, which is part of the main national ecological structure. As a result of its location Dordrecht has become a centre of transport activity, by water, but also by rail and road. It has important industrial and service facilities.

The town was founded around the year 1008, and soon developed into the most important medieval port on the trade route from Cologne to England. In the 15th and 16th centuries the town developed rapidly, on the basis of city rights and the collection of tolls. This position was gradually taken over by the cities of Amsterdam and Rotterdam.

Today Dordrecht faces a number of environmental problems which have their origin in the past:

- shipbuilding has moved elsewhere and industrial processes have contaminated the land;
- the huge increase of traffic along the ancient routes causes air pollution and noise nuisance;

- transport of dangerous substances through densely populated parts of the city exposes people and the environment to serious hazards.

When I came to work here in *Dordrecht* in the department of City Planning, I found a number of very positive developments in the area of environmental awareness and action. These activities turned out to be an excellent starting point for a change in direction in the traditional approach to planning and management of the town towards more environmentally responsible urban development.

What has happened so far?

Within the Municipal Planning Department attention is focussed upon the environmental effects of building materials.

Several people within the municipality are studying the links between environmental problems in the 'Quality of the Daily Living Environment' working group.

They are also looking for links with the research done by the national government.

The authorities are guided by the demands of the environment as well, and are formulating their point of view with regard to renewal, developing a vision on the direction to take in the 21st century.

A number of environmental tasks are tackled at the regional level, resulting in regional discussions at the administrative, political and government levels.

You will notice that integrated concepts are central to the vision of the physical environment. Authorities and politicians choose quality rather than quantity.

As a result the time is ripe for an active role of ecology in planning. In 1992 the 'Urban Ecology' project was started.

Soon after, the concept of a hidden urban district was born. This 'City Fruitful' could be a symbiosis of living, working and leisure, of food production and food consumption.

## 7.2 BOMIL

I shall now go into some detail about these developments.

It all started in the 1980's, when attention for the environment was growing and a large number of studies about ecological building were published. As a result some individuals working for the municipality began to look critically at the environmental effects of building materials.

In 1990 an official project team, 'BUILDING AND THE ENVIRONMENT' (BOMIL) was formed with political support. The team members are from different municipal departments as well as from housing associations.

The first priority of this project team was to initiate and stimulate the use of environmentally friendly building practices. Attention is given to demolition and building waste as well as to building materials, energy, drinking water and domestic waste.

The team concentrates on finding methods and measures that have a broad application rather than on experimentation. They are particularly interested in simple, easily and quickly applicable methods, such as extra insulation or water based paints. They also, however, attempt to ban the use of certain materials such as tropical hardwoods.

Checklists are produced, in which the different steps for each building process that are least damaging to the environment are described. They use the so-called 'four versions method', based on an idea by Professor Cees Duijvestein.

In column A a number of possible measures, methods or materials are indicated that are the least harmful to the environment; in B and C there are intermediate variations and in column D you will find those activities or products that are in current use but that often are detrimental to the environment. An X marks those that should not be used under any circumstances.

The different options enable the municipality or other developers to establish the number of measures before building starts.

By now the checklists have been brought up to date a number of times and separate lists are available for new buildings and for maintenance and renovation. I would like to state that we have succeeded in establishing the checklist as standard procedure.

This project has had as a direct consequence that the environment is the starting point for outlining the form and character of the district called Oudelandshoek with about 2500 housing units.

### **7.3 KWADALO**

In early 1991 a further project team was formed, the 'Quality of the Daily Living Environment' (KWADALO). Its mandate is to improve the quality of the daily living environment and the external integration of environmental policy. Rather than calling it a team I should like to describe it as a platform for the exchange of ideas with a stimulating effect on current projects. The important components are development of knowledge, policy and decision making and collaboration.

It is mainly concerned with the maintenance of public space and green areas.

Firstly, the problems had to be analysed and next the theory of an integrated environmental vision had to be translated into practice from a variety of approaches, notably socio-cultural, economic, spatial planning and ecological.

In addition there is a desire to gain practical experience with various aspects of neighbourhood management of the living environment in the Oud Krispijn district. A project of the National Spatial Planning Agency offered the right framework: Dordrecht was able to provide an example at the neighbourhood level, Zwolle contributed at the city level and Breda at the urban regional level. The findings have been incorporated in a strategy policy document for ecologically sound urban development, compiled by Sybrand Tjallingii.

The integration of ecological aspects into spatial planning is still insufficiently developed, but a step forward has been made in the approach to ecologically sound urban development.

This is also apparent in the policy that was launched with the policy document 'Dordrecht renews'. This is the vision of the municipal authority of integrated quality management aimed at the next century. It is clear that the local authority is not only looking for renewal but that there is active involvement with environmental policy. This also includes environmentally aware industry and storage in controlled deposits of unprocessed building and demolition waste.

The various activities have had repercussions, not only at an official and managerial levels, but also among the citizens themselves. Discussions have been organised on social and economic developments, administrative renewal and the use of space on Dordrecht island.

#### **7.4 Regional cooperation**

The ideas about renewal have also led to a strengthening of the REGIONAL COOPERATION between the communities along the banks of the Drecht river. Everyone agrees that this is the only way to clean up the pollution left by the former activities of shipyards in the region. With the help of the province an analysis of environmental conditions has been made that is to lead to zoning and decontamination. In view of the enormous problems this can only be solved at a regional level; furthermore, financial support from the national government is indispensable.

The social consequences are a cleaner environment and new opportunities for living and working are created as a result of a joint vision on the physical and functional redevelopment of the banks of the Drecht river. At the heart of the project are the quality of the river junctions and cross-river connections.

Cooperation at a regional level is also needed for the different aspects of mobility, employment and housing.



## **7.5 Vision on the physical environment**

In the drawing up of a master plan, too, a clear choice is made for an integrated environmental approach as a part of spatial planning.

In my opinion the policy document clearly reflects the way in which spatial planning is conceived in the 1990's. The master plan is a continuation of the integrated municipal vision 'Dordrecht renews' with its emphatic choice for quality above quantity.

We suggest that new developments must be related to existing qualities and the identity of Dordrecht. We are also of the opinion that:

- the position of Dordrecht with respect to important traffic arteries must be maximised;
- the attractive nature of the city centre and the standard of services deserve to be improved;
- it is important to guarantee a city with a good quality of life;
- the forces in the region should be combined;
- ecological zones should be designated and strengthened.

Briefly, the city places emphasis on functional use, quality of life and a worthwhile future.

I am impressed by the political courage of opting for quality above quantity.

Dordrecht borders on the unique tidal nature reserve called the Biesbosch, which is a protected area, a national park. We are anxious to maintain the ecological qualities of the nature areas as much as possible. This implies that future spatial planning for the suburbs should place the emphasis on the development of nature areas and recreational functions.

This choice sets limits to the expansion of the city. It means that we must protect the living environment of the existing city. I would like to achieve a compact city by increased density and better use of existing space. This will of course have to be done in a careful manner. Such ideas are part of public policy but can only be realised with sufficient support from the national government, for instance for the decontamination of the land and the relocation of industry. The costs of restructuring the city are enormous.

## **7.6 The 'Urban Ecology' project**

As you will have noticed the emphasis in Dordrecht is on the integration of environmental policy in all its facets.

This is why to us integrating the ecological discipline and urban development is so very important. Sustainable development of the city is bound by ecological rules.

In 1992 we started the URBAN ECOLOGY PROJECT, an activity that is expected to produce a new municipal organisation in which ecological planning and operating will be the norm.

What are the aims of the Urban Ecology Project?

We want to utilise ecological knowledge for urban development.

As our starting point we are applying the ecosystem model developed by Van Leeuwen and Van Wirdum, which shows the effects of certain activities.

The city, but also a district, is considered to be an ecosystem. There are flows which enter, such as solar energy and water, but also traffic and raw materials. Furthermore there are flows which drain away, for instance heat, waste and dirty water. An ecosystem however also has the ability to stem flows or to retain them. Internally the ecosystem city is faced with negative influences, for instance to public health, with loss of function or damage to plants and animals.

The model is useful for registering problems of depletion of resources and environmental damage. The effects of measures are more quickly visible as well. We are making an effort to balance the city's activities in such a way that they are in harmony with the social basis for support of the biotic and abiotic environment at the local and regional levels.

In Dordrecht an analysis was made of urban ecological activities, knowledge and needs: what are people doing, where are the data, what is lacking and what are the main problems?

The study makes it clear that:

- among the municipal departments various activities are being carried out that qualify as urban ecology;
- at first people were hardly aware of each other's activities;
- often the necessary know-how is missing.

We would like to see ecologically sound urban development and ecological city management, which is the reason that the municipality has not only called in external expertise, but also appointed its own urban ecologist.

The urban ecologist will be mostly concerned with initiating and coordinating an integrated approach. In addition transfer of knowledge will have to be organised and new insights developed. The various departments are participating in these activities because urban ecology has full municipal support. Communication with the citizens is another important facet.

Workshops have been organised around the various themes in which practical possibilities for an urban ecological approach are discussed; not only my own department but Public Works and the department of Housing are involved too.

The workshops of the past few days and this very congress as part of the international week for the ecology belong to the urban ecology project. Besides I consider them to be a source of inspiration and exchange of knowledge.

I think it is important that the officials involved will eventually consider it a matter of course to use an ecological approach and that this approach will be given full support by the inhabitants of the different neighbourhoods.

After an initial phase of two years a further three year period will be used to shape and broaden ecological urban development and management.

The firm of consultants Habitat and Energy from Gouda expect that after a period of five years ecological urban development will be so well integrated into the entire municipal system that by then there will no longer be a need for a coordinating urban ecologist.

It is clear that it is necessary to think in cycles, and that joint discussion will have to bring about integrated ecological operational methods.

In the near future we intend to limit ourselves to a number of model projects at city, district and neighbourhood level. At the moment a renovation project is being carried out in Wielwijk, a district built in the 1950's, intended to serve as an urban ecology model project at the neighbourhood level.

Taking four different starting points, data are assembled and flows are recorded with respect to:

- building and the environment;
- city planning and traffic;
- public space and its management; and
- neighbourhood management.

Next, goals will be formulated and measures devised to effect them. These measures will then be incorporated as much as possible within further planning for each area.

It is clear to everyone what we intend to do, that is:

- reduce the nuisance caused by noise and odour;
- limit pollution and contamination of water, air and land;
- use materials that cause minimal environmental damage and that can be recycled;
- be as economical as possible with energy, water, and raw materials;
- improve the quality of the internal environment;
- involve the inhabitants in sustainable renovation and, later, in management of their own neighbourhood;
- reduce the total amount of waste;
- improve natural values in the living environment.

## 7.7 City Fruitful

Finally I want you to accompany me to an urban concept which combines housing and horticulture under glass. The core concepts are energy, ecology, economy and emotion, the four Es.

The project 'CITY FRUITFUL' is a symbiotic combination of living, working and leisure, of food production and food consumption.

The project will have to be in part self-contained and is aimed at saving energy. Attention has been given to the integration of natural elements and to the educational value of natural processes, such as biological pest control and water purification. The economic dimension concerns mainly the combined use of the land.

The designers have also included an emotive dimension, the form of space and shelter, the effects of a play of colours and the perfume of plants, and the changes of the seasons.

Is it a Utopia, or is it the Ecocity of the future? Whatever it is, I consider it a challenge.

I hope I have succeeded in showing you that the realisation of a policy of spatial planning aimed at sustainability is possible only when citizens, officials, authorities and politicians are willing to think in an environmentally conscious way.

We still have a long way to go, but I am convinced that the basis for urban development that is ecologically sound has been laid.

*Gunilla Molin Gustafsson*

### **8.1 Introduction**

Environmental work at the municipal level in Sweden has mainly consisted of efforts to keep pollution under control. For example, municipalities have measured emission levels and compared them with limit values. If the readings were in excess of the limit values, the municipalities intervened and demanded remedial action. In other words, to ensure that pollution was kept under control municipalities tried to keep pollution within the permitted limits (often in relation to centrally established norms).

Today, Örebro is striving to implement preventive measures to reduce the environmental burden, and, to go further than required by the centrally established minimum norms.

### **8.2 The Environmental Protection Programme**

The city of Örebro, with a population of approximately 120,000 and an economy dominated by service and commerce, activated its environmental work in the early 1980's. In 1981 the first draft of a municipal environmental protection programme was drawn up, the final form of which was adopted by the local council two years later.

In 1989, Örebro appointed an environmental delegation, a special organisation with representatives from all the central municipal boards, and directly responsible to the municipal council. Its purpose was to coordinate environmental work, find new ways to tackle it, and experiment with unconventional methods. In 1991, the environmental delegation was superseded by a standing committee on the environment.

The Örebro municipal environmental programme for 1990-94 states that society must be structured on basic ecological principles. In the foreword to the programme, the objectives of environmental work in the municipality are described as follows:

Our aim is to structure social developments around a basic ecological philosophy, including ensuring that resource consumption and pollution must not exceed what nature can withstand. However, successful environmental policy requires a more fundamental

reassessment of many aspects of society. The aim of development work and social planning must be a more economic use of resources. We can only achieve long-term acceptable development by reducing our consumption of natural resources.

We must adopt political decisions for limit values laid down by law, environmental surcharges, and specification of legal liability - to mention a few examples. We must make political decisions to obtain mass transport solutions for our traffic systems, and collective solutions to the problems associated with energy systems, water, effluent and waste management. Public agencies and boards of directors, associations and industries must all contribute to energy conservation, the procurement of environmentally friendly goods, and environmentally sound manufacturing processes and products.

It is a major political task to provide the prerequisites, through information campaigns and influencing public opinion, for adopting sufficiently effective laws and other ordinances. When conflicts arise between the interests of profit and the long-term, comprehensive interests of society in safeguarding the environment, the latter must be given precedence, via the organised, democratic forces in society. When conflicts arise between short-term employment factors and environmental considerations, precedence must be given to what nature can withstand. Otherwise, in the long run, employment will also be threatened.

This was the environmental protection programme adopted by the municipality. But what did they do then? Their work has progressed at several levels. Local government has not only played its part as a public authority, but has also been active in promoting, demanding and innovating.

The establishment of the environmental delegation was a clear signal from local government to all its agencies that environmental work was being given high priority. How is it possible to overcome the inertia often experienced when local government agencies are to tackle new problem areas? The solution used in Örebro was to initiate cooperation beyond the usual territorial boundaries. In the past, municipal work had been extremely linear. Each section dealt with its own issues, and did not interfere with those of others. Many obstacles have been abolished by experimenting with new working methods. One example is the "Give the Environment a Chance" campaign, carried out by



the City Management Board. The campaign promoted a new life style to reduce the environmental load.

The daily newspapers ran advertisements with headlines like: 'Keeping your home clean can be dirty work - for nature' (on domestic chemicals), 'If you take your car when you don't need it, you're taking yourself for a ride' and 'Bleached or unbleached? You won't feel the difference, but mother nature will' (on different kinds of toilet paper). The purpose of the campaign was to help raise awareness among people living in Örebro of how their own lifestyles impact on the environment, and it was concluded with a festival for the environment in the town square, including a waste source separation competition between school children and politicians. A study made by Statistics Sweden indicated that many people changed their purchasing habits after the campaign. Spatial planning usually means working on the basis of given guidelines. There must be one pipe system for drinking water, one for waste water and one for storm water. There must be pipelines for energy and district heating. Roads should have specified dimensions, and there are to be a certain number of parking spaces per square meter of dwelling space. There are even norms for the distance from buildings to bus stops.

When the newest area in Örebro, known as Ladugårdsängen, was being planned, traditional thinking was reversed, and new questions were asked, including: 'Do we really have to follow all the specified planning guidelines?', 'Do we have to plan for cars?', 'Do we have to have waste collection vehicles?', etc.

Planning work for Ladugårdsängen began on the basis of such perspectives, and although many of the ideas generated were not ultimately used there, a whole new way of thinking about spatial planning came into being. What happened can be described as the meeting of old and new ways of thinking: planning in the 1970's could be described as predominantly waste water planning. The capacity of the water and waste water network and population size in relation to services required determined the results of planning. A new area had to have enough people in it to justify the construction of primary schools and bus stops. Today, methodical planning on the basis of ecological factors has begun to dominate. One example of what this means in practice is that all detailed planning in the future is to include environmental impact assessments.

But Ladugårdsängen is only one small, new part of Örebro. The rest of the environmental work done there must be based on existing environments, including a densely populated part of the city with mostly stone buildings, and other areas which have been built up throughout this century. The municipality emphasises words like resource minimisation, re-use, energy economisation, energy production with renewable sources of energy (solar power, wind power, and hydropower), in stating its main objectives for environmental work. Cautious use of chemicals and consideration of what nature and living organisms can withstand are other ways in which this basic ecological view is expressed. When it comes to actual goals, the municipality has set a zero-emission limit for some toxic substances and others which biodegrade only very slowly (that is no emissions at all). For other substances, the goal is to keep pollution increases low in relation to natural background levels. For polluting substances which

occur in nature, the goal is to bring every pollutant down to a level safely below the lowest level at which tangible negative effects are known to occur.

Another fundamental approach has been to tackle environmental problems at source. This means:

- reducing emissions of acidifying substances rather than treating water courses with powdered limestone;
- limiting noise disturbance rather than muffling it;
- economising with raw materials and promoting recycling.

As an aid in this work, and to raise awareness of the significance of environmental issues, a decision was adopted to introduce environmental impact assessments in municipal work beginning in 1991. In some problematic situations, for example in relation to pesticide residues in water, various local agencies have collaborated to find solutions. In that project, the environmental delegation worked with the environment and occupational health administration, the town planning office, the labour market office, and the County Administrative Board.

In 1990, the environmental delegation initiated a project in collaboration with disadvantaged farmers and the municipality, for the establishment of non-cultivated buffer zones with natural vegetation along water courses. Buffer zones prevent water pollution from soil particulates and precipitation. The municipality has drawn up detailed measures to be implemented for every section of its environmental protection programme, specified which local government bodies are responsible for implementing them and ranked the projects in order of priority by determining the date by which each measure is to be implemented.

Follow-up is another important aspect of municipal environmental work. The municipal council has highlighted the significance of environmental issues for the welfare of the population and the future of the municipality by closely monitoring the environmental work carried out by the local administration. In consultation with all the bodies involved, the environmental delegation has performed evaluations, and prepared written assessments of the work of each administration. The evaluations were made public in the local press, and were also published in the municipality's personnel newsletter. The environmental delegation stated that this was very important in keeping up the interest of all parties involved.

Örebro has proved to be a pioneer municipality in environmental protection work in other ways besides these organisational changes and new working methods. They have found new technologies and methods for solving old problems. The district heating system built up by the municipality - including a CHP plant based on solid fuel (wood chips, lumber from demolished buildings, etc.) is considered very environmentally sound. Its combustion processes are effective and controlled, and its sophisticated technology makes it possible to substantially reduce the levels of most types of emissions.

As an example of the ambitions of the municipality, the energy plan and environmental protection programme propose measures to:

- reduce environmental impact;
- reduce energy consumption;
- increase the use of renewable sources of energy;
- increase the proportion of wood fuels used at the CHP plant.

Extremely high (goals have been stated for the CHP plant, including the use of at least 50 per cent wood fuel in the new solid fuel boiler until 1994. This will mean lower than combustion of peat an emissions of sulphur and mercury coal, and no increase of the carbon dioxide level in the atmosphere.

A new energy plan will be drawn up in 1992. One of the goals will be to take concrete measures to encourage the use of renewable types of energy. The goal of the municipality with regard to domestic and industrial waste is to plan with a view to reducing waste quantities, its disruptive effects on human health and the environment, and an optimum utilisation of management resources. In order to achieve this, waste is to be regarded as a resource, and the municipality has been instructed to aim for maximum recycling through source separation. One objective is to reduce the total waste fraction deposited by 50 per cent between 1990 and 1994. Many measures will be implemented with regard to waste. The environmental protection programme details 17 measures, 12 of which are ranked as high priority. These include measures to reduce or phase out entirely municipal organisations' use of disposable materials, repeated neighbourhood campaigns for special disposal of hazardous waste, and a study of the possibility of differentiating waste collection tariffs to stimulate households and industries to separate their waste. A comprehensive waste management plan has been adopted, and the local sanitation department has run a successful campaign to stimulate waste separation.

Örebro municipality and the local tradesmen are running a joint campaign called "The Black List" to stimulate environmentally sound shopping, focussing on household use of chemicals and their environmental load. The campaign is part of an agreement with the retail trade in an effort to limit the proportion of environmentally hazardous products in the product range of groceries, automotive products, coatings and building products. The campaign has received a great deal of attention, and was copied by other Swedish municipalities. This campaign, in conjunction with the 'Environment Friendly Shopping' campaign run by the Swedish Nature Conservation Society have made the people of Örebro municipality more aware of their environmental impact, and of how a consumer's product choice can affect the environment. Relatively large environmental benefits have accrued from this collaboration with the retail trade. In one year, the total number of environmentally harmful products sold was reduced by 75 per cent because manufacturers changed the chemical contents of their products. Some suppliers have also stopped importing products containing hazardous substances.

Other examples of ongoing practical environmental work in Örebro include efforts to improve water quality in the Svarta River, the water supply source of Örebro. Those efforts include the introduction of 'buffer zones', areas adjacent to water courses where

land use is limited. This is achieved in negotiation with farmers and land owners in which they are encouraged to safeguard the water from nutrient leaching (primarily of nitrogen and phosphorous) and pesticide leaching.

The establishment of the Örebro Environmental Protection Centre in 1985 was another initiative. This centre works with organic gardening and experiments with alternative forms of cultivation and composting. The centre runs tours for school and pre-school children, teaching them about ecological relationships and the laws of nature. And a private initiative known as 'the ecology bus' makes it possible for the school children of Örebro to learn about the cycles of nature on site. Since 1985, the municipality has also consulted regularly with all the environmental and nature conservation associations via the nature conservation council, on which members from the various interest groups serve. The council discusses various plans and proposals for improving the conditions for the flora and fauna of the region, and its biological diversity.

### **8.3 Ladugårdsängen, a new area in Örebro**

Ladugårdsängen, an area planned on the basis of ecological principles, was completed in the summer of 1992 when Örebro hosted a trade fair known as Housing '92. The neighbourhood consists of some 850 apartments in large and small apartment buildings built for over 20 housing associations - private, public, and condominium. The philosophy of the cycles of nature is expressed at various levels, from the municipal master plan through technical design and exterior on site, to the lifestyles of the people living in the different buildings.

The following principles have guided the work of the municipality:

- the area was chosen because it is in easy reach of the town centre, about 1 km by bicycle;
- the area has both residential neighbourhoods and employment locations. Probably about 500 people will eventually work there;
- rainwater will be collected. Ladugårdsängen uses soil infiltration and conduction to ponds for local storm water (rainwater) management. This will make the storm water an asset to the area, instead of a load on the receiving waters. The soil will be the catchment site for phosphorous, metals and other substances normally transported to rivers and the sea with a detrimental impact on their quality;
- reducing the number of parking spaces in residential neighbourhoods makes them somewhat more people-oriented. Creating new parking areas along the edges of the main roads and utilising existing parking spaces more rationally has made it possible to reduce parking to 70 per cent of the normal parking standard. Where there used to be cars there are now garden allotments, which makes the environment more pleasant and increases the real estate value of the property;
- waste separation. Refuse trucks will come to Ladugårdsängen less and less frequently over time. The inhabitants will reduce the quantities of waste they produce and manage their own waste as far as possible. The waste management plans for the area provides for a variety of solutions, extensive source separation and composting. There are plans to provide the people living in the publicly owned collective

apartments a worm composting system. The condominium buildings have been built with thermal composting facilities, and special compost rooms alongside every street entrance. The privately owned buildings will have a suction system for waste separation;

- differentiated streets with traffic separation will increase safety and improve the environment. The proximity of recreational facilities (golf course, sports hall, swimming centre) and excellent parks (the Sörby woods) will make it possible for the inhabitants of the area to participate in sports and be outdoors without needing a car.

There was also a proposal during the early planning stages for waste water management. A system of separate waste systems was initially discussed, to make it possible to conduct toilet waste water to a biogas plant and extract energy to obtain rich, usable sludge. However, these plans were abandoned owing to the high cost and some scepticism about the untested technology. A small number of the apartments in Ladugårdsängen will now be testing a new kind of water-economising toilet with considerably lower water consumption than a normal toilet - 0.8 litres as against the normal figure of 6 litres per flush.

agrees to a more complete system. The environmental benefits have been seen with almost complete success and the impact upon the environment is minimal. The private utility industry has a strong interest in waste

management. The private utility industry has a strong interest in waste management. The private utility industry has a strong interest in waste management. The private utility industry has a strong interest in waste management.

There was also a program being run early on for waste water management. A system of waste water systems was developed to make it possible to collect waste water to a central plant and export it to other areas. However, these plants were abandoned owing to the high cost and some confusion about the method of collection. A small number of the systems in the country will now be using a new kind of waste-water treatment plant with considerable lower water consumption than a conventional plant. It is estimated that about 100 plants of this type are in use.



## Ecological Planning in an Urban Region

*Leo van der Wal*

### 9.1 Introduction

The discussion about the meaning of ecological planning in urban areas points to the necessity of a sustainable society and the wish to take that into account in drafts of urban plans (2). In practice, however, integration of the environment and spatial planning meets with problems in terms of both organisation and content (42). At the regional level, the ecological planning dilemma becomes clear when assessing claims on space, such as large scale housing construction and new industrial estates, on the one hand, and the preservation and improvement of the living environment, on the other. How can these - often conflicting - interests be better related to each other?

The regional goals formulated for the urban region of Breda, for example, are directed at spatial-economic development according to preconditions aimed at sustainable spatial development (20). The spatial programme up to the year 2005 concerns issues such as extra claims on 420 hectares for housing construction, 60-200 hectares for industry and business and 1,500 hectares for greenhouse cultivation. The preconditions concern factors such as reduction of car use, preservation of valuable landscapes and improvement of the green living environment. The issue at hand is which of the region's locations qualify for future urban developments.

In this context, this policy is also referred to as the dual-network strategy (1). The traffic and transport network is believed to strongly influence the location of highly dynamic uses, such as businesses, offices, mass recreation and agriculture. The water network is felt to have an influence on less dynamic uses, such as water collection, nature and extensive recreation. Within the context of a long term research programme at the National Spatial Planning Agency, aimed at ecologically based planning and cooperation in urban areas, INRO-TNO<sup>1</sup> has developed this flows-oriented approach for the urban region of Breda. This has resulted in a method for ecological planning in urban areas.

The following issues were involved:

1. What are the regional bottlenecks? What objectives are pursued and what policy measures are taken to ensure sustainable development?

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<sup>1</sup>

Institute for Spatial Organization of the Dutch Organization for Applied Scientific Research.

2. What preconditions does a transport network aimed at 'effectively controlling car use' set with respect to the required sustainable spatial development and what form can such a network be given?
3. What preconditions does a water network aimed at integrated water management set for sustainable spatial development and what form can it assume in a spatial plan?
4. What are the possibilities and limitations of different drafts of urban plans in relation to the two networks?
5. Will the dual network strategy lead to a specific location-specific district concept?

To answer the questions, a policy analysis was conducted, which can be schematically represented as follows:

#### *Identification stage*

- \* The present situation: bottlenecks
- \* Future situation: policy framework

#### *Development stage*

- \* Elaboration of area objectives
- \* Exploration of solutions and alternatives

#### *Selection stage*

- \* Ecological development principles
- \* Target situations
- \* Spatial structure

## **9.2 Traffic and transport flows**

### **9.2.1 Bottlenecks**

The traffic network in the urban region of Breda is dominated by the diamond shaped structure of motorways in the area. There is the A16, which forms the link between Rotterdam and Antwerp, and the A27, which connects Breda to Utrecht. Intersecting both roads are the A58 and A59, which link the region with urban nodes in the east. The secondary road pattern is characterised by radial roads, which link the dispersed small nuclei and regional subcentres to the heart of Breda. Two railway lines run through the region: the Breda-Rotterdam line and railway line through the chain of Brabant cities.

The major problems regarding traffic and transport in the region are the considerable acceleration of growth in traffic volume (with serious consequences in terms of acidification, eutrophication, disturbance and distribution of hazardous materials), traffic congestion on major roads, excessive through and external (haulage) traffic in the city of Breda, problems concerning quality of life and safety in various small nuclei caused by through traffic, unfavourable travel time ratios between regional bus and car, the limited frequency of regional bus transport, the lack of high quality public transport between Breda, Oosterhout and Utrecht, a deficient waterway connection for goods transport,

the limited possibilities of passenger and goods transport by rail, and the underdeveloped bicycle network (20).

### 9.2.2 Policy

To tackle the problems, plans have been developed in a regional context (transport region) and, following the lead of national policy, a mobility and location policy is being pursued (20, 21, 25). This policy aims to effectively control car use and to promote the use of public transport and the bicycle. The aim is to develop agglomerations where people live and work and which highlight urban facilities; to develop railway station locations for businesses and institutions with large numbers of staff and/or visitors (A-locations), railway station locations which are also directly accessible by motorway (B-locations) and motorway locations for firms with few staff and/or visitors, but which are highly dependent on road transport (C-locations).

### 9.2.3 Ecological development principles

It follows naturally from this policy that priority be given to an extension of the railway network and the construction of railway stations in new housing estates. However, the location policy should also allow for adequate accessibility by bicycle: A, B and C-plus locations. Various plans demonstrate the importance of an adequately developed bicycle network at the urban level, of high quality public transport at the regional level, and a reduction of the road network at both levels (1, 4, 37).

Taking the chosen policy into account, it is possible to formulate a number of ecological development principles on the basis of these studies, which could serve as guidelines for optimal and sustainable traffic management at various levels.

At the urban level:

1. A separate, star shaped bicycle network with main radial routes to the railway station and sub-routes linking the districts.
2. An intensive, radial bus network as an alternative to the bicycle.
3. Residential districts, separated from each other by car free zones, linked to the road network with the centre free of non-business car traffic.
4. Cycling paths and motorways intersecting each other as little as possible.
5. Housing at cycling distances from the railway station.

At the regional level:

6. High quality public transport, by express bus and train, aimed at a maximum accessibility of A and B-plus locations.
7. A coarse road network, aimed at ensuring that the accessibility of C-locations does not fall below a minimum standard.
8. Housing and employment locations close to the high quality public transport network.
9. A railway and waterway network for goods transport, aimed at maximum accessibility of industrial estates and business parks.

10. Location of facilities, such as bicycle sheds, near railway stations and public transport intersections, transfer points on the urban fringes and goods transshipment stations on industrial estates and business parks.

#### 9.2.4 Target situation for traffic

The application of these principles to the urban region of Breda would result in the following target situation. The existing radial roads to the centre of Breda constitute the major routes for a separate cycling network (see map 10). The star shaped structure is ideal; space is created for cycle paths, cars are excluded. The main urban green structure provides nodes for green bicycle routes. Alternative green bicycle routes are possible at the locations where rivers flow into the city. Fringe areas, country estates and park areas between the districts may serve as a basis for minor routes. The major routes extend to the surrounding small nuclei and to Etten-Leur and Oosterhout. Oosterhout and Etten-Leur also have a star shaped cycle network oriented on the centre. The nuclei, in turn, are linked to each other by cycle paths, many of which run through wooded areas or open grassland. This regional cycling network offers an alternative especially to non-business traffic. The daily (commuter) traffic mainly uses the urban cycling networks.

The radial roads at the regional and urban levels also serve as routes for an intensive network of city buses. The buses run on clear bus lanes running parallel to the cycle paths.

High quality public transport in the form of express buses operates between the stations of Oosterhout, Breda and Etten-Leur (see map 11). The high quality public transport links are important for regional passenger transport. The buses run on clear bus lanes via the motorways. There is a route via the northern ring road and the southern ring road of Breda. Both routes run via the main railway station.

The railway network (see map 11) has been extended with the Breda-Oosterhout-Utrecht railway line and the high speed railway line from Antwerp. Both railways are crucial for the role of Breda as nodal point, as they provide optimal access for the regional economic market to the European market, towards the Randstad conurbation and Belgium and France. Furthermore, the high speed railway link is of significance as an adequate alternative route for the "Zoomse" axis and for external through car traffic. A requirement for the region is that it must be provided with a station, for example at Prinsenbeek. In addition, a ring railway line has been constructed along the old goods line from Oosterhout to the Zevenbergschen Hoek. This is important for both regional passenger transport and goods transport between the industrial and business parks and the markets of Breda, Oosterhout and Etten-Leur. Goods transport to and from supraregional production and consumption areas may also benefit from this situation. The railway lines will be doubled to allow both express and slow traffic.

In this target situation, car traffic (see map 12) has been limited to the A16, A27, A59 and A58 motorways. This regional diamond shaped structure has branches to all small nuclei. In view of their size, only Breda, Oosterhout and Etten-Leur still have through routes: Breda via the northern and southern ring road; Etten-Leur via the old A58 (the

new one has been re-routed); and Oosterhout via the Weststad industrial estate to the A59. All parts of the city and residential neighbourhoods are either directly linked to the diamond or to a through route. Each neighbourhood is a residential area with speed limits. Roads and through cycle paths have been separated as much as possible. The neighbourhoods are separated from each other by car free zones. The ring roads around the city centres can be reached by car from every direction. The city centres themselves are closed to non-business car traffic. The industrial and business parks all have short links to the diamond.

An essential condition for the proper functioning of this system is the construction of sufficient and efficient utilities: transfer opportunities at the exits of the diamond to the through routes; public transport intersections at the main railway stations and at the intersections of motorways and public transport links; cycling facilities in the neighbourhoods, centres and near railway stations; and, finally, goods transshipment stations in the industrial and business parks.

### **9.3 Water flows**

#### **9.3.1 Bottlenecks**

The urban region of Breda is situated where higher sandy soils in the south meet lower clay soils in the north. Rivers flow from the south in the direction of Breda and join the Mark river, which flows in a north-westerly direction through the clay polders and discharges into the Zoommeer lake. Infiltration areas in the south (chiefly consisting of the Belgian Kempen) feed deep seepage water flows, which come to the surface in the polders to the north.

The bottlenecks related to water flows can be summarised as follows (4). The infiltration areas in the south are considerably polluted by intensive livestock farming. Nutrients constitute a threat to the quality of the both shallow and deep ground water. Too much ground water has been extracted by water companies, the food industry and agriculture, and especially (greenhouse) cultivation. The consequences of this include an accelerated suction of polluted, shallow ground water to the deeper, clean ground water, the drying out of the landscape, and disruption of natural seepage water flows. In the northern seepage areas, agriculture relies on the supply of polluted water from outside the area in the summer. The drainage of agricultural areas and increase in construction in urban areas cause an increase in the peak surface drainage of rainwater. Heavy rainfall causes a flood of polluted water from the sewer system to flow into the surface water. By means of a rapid discharge of the surface water into canalised streams and wide canals in the urban area, an attempt is made to prevent flooding in the transitional area from sand to clay. These technical measures have a detrimental effect on nature and have resulted in a deterioration of the landscape. These problems also affect the supraregional system: the Zoommeer lake reserved for conservation and recreational purposes is facing problems caused by the supply of polluted water and silt via the Mark river (eutrophication, heavy metals).



### 9.3.2 Policy

The aim of the policy is to restore the natural basic system, linked to nature development (20, 21, 25). Plans have been made for integrated water management and area-specific restoration and conservation policy, as in the Chaamse Beken area, for example. Water management, environmental management, agriculture, conservation and spatial planning must be coordinated. The aim is to develop a collective approach to quantity and quality, of both the surface water and the ground water. Following national spatial policy, implementation is sought in a water management approach: rural and urban water units which are to be considered independent units for which targets must be set (39).

### 9.3.3 Ecological development principles

An analysis of the various plans has revealed that it may be useful to make a distinction at the regional level between clean water and polluted water systems (4, 40). At the urban level, the distinction between potable water and rainwater is particularly important. In addition, a number of ecological development principles can be formulated.

At the regional level:

1. Taking hydrological and biological processes into account: restoration of the natural basic system, including infiltration areas, natural surface water, ground water and seepage areas. Hydrological isolation of a clean water system.
2. Regulation of these processes in an ecological framework of wet (the clean water system) and dry nature areas.
3. Allocation of land uses to match the ecological framework, in such a way that clean land uses involving the risk of drying out are situated at the beginning of the cycle, while the major water consumers and uses constituting a load on the environment are situated at the end of the flow. Zoning of uses must be linked to the various water flow qualities.
4. Integration of city and infrastructure, the urban framework, into the landscape. Damage to the ecological qualities inside and outside the city must be minimized. The same applies to industrial estates and areas of intensive agriculture.
5. Improvement of the water quality in urban areas in conjunction with measures in the rural areas upstream of them.
6. Hydrological isolation of polluted water systems as independent units: agricultural areas, cities, industrial estates. Utilisation of natural and/or artificial purification facilities per unit.
7. Restriction of use of surface water outside of the area.
8. Switch from ground water collection to surface water as a source of potable water.

At the urban level:

9. Making of space for ecological structures in the city (dry and wet nature areas), both with a view to an independent use as nature reserve or recreational area and with a view to creating links between nature reserves at the regional level (corridor function).
10. Situation of environmental facilities.



11. Separation of the supply and discharge of potable water ('tap water') and rainwater.
12. Discharge of purified waste water preferably into a supraregional, water management system.
13. Retention of clean rainwater.

#### 9.3.4 Target situation for water

If these principles are applied to the urban region of Breda, the target situation for sustainable water management can be described as follows: the clean water system consists of infiltration areas, river basins, the Mark river and polders with seepage. These are what are called the "green course" areas, where nature is the determining factor with respect to spatial development. Within the urban region, they are the local infiltration areas such as the Mastbos woods and the wooded and moorland areas between Breda and Oosterhout; the natural rivers of the Bijloop, the Mark river and the Chaamse Beken; polders with shallow seepage which are designated as nature reserves, such as the Lage Vught, Haagse Beemden and the West and East Polders north of Etten-Leur. Together these areas form one separate hydrological unit (see map 13).

The infiltration areas are turned into ground water reserve areas. Ground water collection ceases but ground water forms a strategic supply. A reservoir is created, north of the region in the Oudlandse Polder of Zevenbergen, which is fed by deep seepage and clean surface water from the clean water system. This reservoir supplies the entire urban area with potable water. Another objective in this deep seepage zone is to create an ecological link between the Mark river and the Biesbosch reserve.

The original, meandering course of the natural streams and the river is restored, with reservoirs, marshland and woodlands in the valleys, which allow substantial water storage. Wild vegetation is allowed to grow alongside the water courses in the city in order to preserve flora and fauna as well as the water quality. Here, too, the aim is to restore the original direction of the water flow as much as possible, and to create space for a continuous green structure. An area with park woodlands is created in the polders.

The polluted water systems consist of rivers and polders which have been designated as following a "brown course", that is areas where agriculture prevails (Aa or Weerij, Molenley, Weteringloop, Krekelpolderloop, Brandsche Vaart and Lökkervaart and the northern clay polders). Each area is considered an independent hydrological area, in which users share responsibility for the quality of the water (see map 14). In the rivers, clean water is led upstream into a system of ditches, parallel to the watershed, crossing the valley and parallel to the river. The marshland is downstream, where the water, which is no longer clean when it reaches this point, is naturally purified before it flows back into the clean river water. The rivers themselves may meander within set limits, their banks featuring wild vegetation. Intensive agriculture (greenhouse cultivation and intensive livestock farming) is relocated to the polders in the north, if they are not situated in the seepage zones. The productive polders have special purification plants, made to fit the specific use of each polder.

In the urban areas, clean rainwater is disconnected from the sewer system (see map 15). This relieves the burden on the sewage purification plants, which enables them to boost the efficiency of their purification process. Considering the scant infiltration capacity of the soil (aggraded and alluvial land), the water is chiefly stored in surface water reservoirs. For this purpose, Breda is building a water circulation system per district, fed by flowing river water and clean rainwater. The water is discharged to the canal or river. The main green structure has been taken into account in the construction of the systems. City ponds with helophyte filters are present in parks across the city and are incorporated into district circulation systems. Development measures, such as grass covered roofs, rain butts and a reduction of paved surfaces, contribute to the reduction of the volumes that must be discharged during heavy rainfall. Clean rainwater is also collected in the urban fringes, in reservoirs of the purification areas. The water that leaves the city in a northerly direction is subjected to further treatment. Here is space for the creation of marshy woodlands.

Polluted rain coming from intensively used roads, parking areas, transfer points and industrial estates is collected through the (mixed) sewer system in large sedimentation basins under the ground. This water can be discharged into the Mark river via the further treatment area north of the city.

The potable water for the urban region comes from the Zevenbergen reservoir (see map 16). After use, it is transferred to the sewage purification plants via the sewer system. The effluent is not discharged into the Mark river, but via a pressure pipe into the Hollands Diep channel.

The water from outside the area in the Wilhelminakanaal and Markkanaal channels is separated from the clean water system by a sluice. As a result of the expected recovery of seepage water flows, the channel water no longer needs to be used in the productive polders. It is, however, used as cooling and process water for industrial activities. It is transferred to industrial estates in the urban region through pressure pipes. Each industrial estate has its own purification plant. The purified wastewater is discharged into the channels through the same system. The food and beverage industry, which depends on clean water, uses water from the reservoir as a basic resource for its products. Companies with a high environmental impact and/or large water consumers have been relocated to the end of the water chain as much as possible, for example from the north of Breda to the industrial estates along the Markkanaal and Wilhelminakanaal channels (Oosterhout) or to the supraregional water system (Geertruidenberg or the Moerdijk area).

## **9.4 Spatial structure**

### **9.4.1 Dual network strategy**

Now that the target situations for a sustainable traffic and water management have been established, we could implement the dual network strategy to determine the spatial structure of the urban region of Breda. Superimposition of these plans over each other in

the form of transparent maps, as it were, will show the options for spatial development of the region and will result in an ecologically sound spatial structure, an ecoregion.

Traffic management is determined by the respective networks for cycle, bus and train (see maps 10 to 12). The contours indicating accessibility by cycle prescribe new building locations. In theory, the three cities can still expand in all directions. The sphere of influence of the existing stations and the future station in Oosterhout fall within the cycle contours (A-plus locations). The express bus network is, via the diamond and ring roads, also located within the cycle contours, and opens up new areas; motorway locations can be reached by public transport (B-plus locations).

Water management is largely determined by the clean water system (wet nature areas), the natural purification areas of the polluted water systems, water circulation systems for clean rainwater in the cities, and the reservoir for potable water (see maps 13 to 16). They limit the possibilities of urbanisation to a considerable extent. This is particularly so in the city of Breda. Reserving space for the clean water system and water circulation system, combined with green structures, will have an adverse effect on intensification.

In order to still provide sufficient options for urbanisation, a ring railway line is used, which allows the construction of stations in new residential districts, on the outskirts of the large cities, but also in more remotely located new centres. Three new railway stations are likely: Leur, Dorst and Made. According to the ecoregion concept, the first two offer opportunities for substantial expansion of Etten-Leur and Breda. The area around Made is situated exactly midway between two seepage zones, offering good conditions for the integration of urban areas and intensive agriculture. Apart from the three large cities, it is the only northern area in the target situation for water management that qualifies for urbanisation. It is located outside the clean water system, on less vulnerable clay soil and it is accessible by the ring railway line and the motorway. The polders to the north east of Made offer sufficient space for the desired relocation and expansion of greenhouse cultivation. Made itself has prospects as a future greenhouse cultivation centre, around a new greenhouse products auction market. The present auction market at Breda sells the field vegetable products grown in the south west.

#### **9.4.2 Urban areas**

Approximately 40 per cent of the target for new urbanization is to be completed in Breda. The city will predominantly grow in westerly and easterly directions. A number of small nuclei will be annexed in the process. A compact city, however, is not a feasible option. Natural purification areas, urban water circulation systems and an ecological framework crossing the city from south to north leads to a considerably fragmented form, a city consisting of suburbs.

The two regional sub-centres each account for 20 per cent of the urbanisation. Etten-Leur is capable of assuming a more compact form, because the water management has a smaller influence here. Oosterhout is confronted with a deep seepage zone in the north and an infiltration area in the south, and can therefore only expand in a westerly and

easterly direction. The best option of the final 20 per cent of urbanisation is Made. A new urban centre will emerge here in the long term.

The region as a whole could be characterised as having a polynuclear structure, an urban area with several growth centres around which various forms of land use develop. The region can even more appropriately be described as an ecological structure or ecoregion, because the spatial structure is the result of applying ecological development principles.

In total, 500 hectares will be used for residential purposes and 240 hectares for industry and business. This scenario conforms with both the economic-spatial task and the ecological preconditions. The limits to growth are, however, being approached. It will become increasingly difficult to continue expansion well into 2000 without adversely affecting the living environment.

#### **9.4.3 Rural areas**

Rural areas can be developed in the following manner. The wet nature reserves of the clean water system can be extended to include dry nature areas, such as the area of woodlands between Breda and Etten-Leur. Together they form the ecological framework that crosses the region from the south to the north.

There is space for the desired greenhouse cultivation, approximately 1,500 hectares, north east of Made in the polders between the seepage zones. The green heart of the urban area is formed by the polders between Made and Breda. Here are opportunities for a combination of agriculture (livestock farming), recreation and conservation. The traditional location for arable farming is north west of the region. In the long term, the availability of new arable land will also offer opportunities here for the creation of an ecological link with the Biesbosch, linked to the Mark and the reservoir.

The more extensive forms of agriculture can be maintained in the southern sandy area; the areas for field vegetable cultivation south west of Breda; tree cultivation in the south of the basin of the Aa or Weerij; and cattle farming in the south east of the basin of the Molenley. The basin of the Donge east of Oosterhout could become a nature reserve again and as such form a natural buffer between Oosterhout and Geertruidenberg. Intensive agriculture would not be an obvious option here, because of the seepage zone. This means that there will be little space left for further expansion of greenhouse cultivation in the region in the period after 2005.

#### **9.5 Conclusion**

The methodology for ecological planning in an urban region is based on the flow approach. In the dual network strategy, traffic and water flows are the decisive factors in determining spatial structure. It is not inconceivable, however, that there are other flows which influence spatial structure, such as waste, raw materials and energy flows, or information networks. Further research would have to establish this.

The creation of an ecologically sound structure requires completing a number of stages: the identification stage, in which an inventory is made of bottlenecks and policy per flow; the development stage, in which area objectives are elaborated in more detail and potential solutions and alternatives are explored; and the selection stage, in which ecological development principles and target situations are established. A superimposition of these target situations over each other in the form of transparent maps will, as it were, reveal the options for a spatial development of the region and produce an ecologically sound spatial structure, an ecoregion. By going through the research stages several times, the options will become increasingly clear and better founded. This is the way in which a new development scenario has been developed for the urban region of Breda.





## *Part III*

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### *Strategies and Models*

Strategies and Models

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## Guideposts to the Ecological City<sup>1</sup>

*Henk ter Heide and Jenneken Berends*

### 10.1 The question

#### 10.1.1 First and second generation environmental problems

In his paper for the Seventh Conference on Urban and Regional Research (Ankara, 1992), Pitkaranta referred to the shift from first to second generation environmental problems which we have experienced in our lifetime (Urban Ecology 1992 pp. 129/130; cf. also Holmberg & Karlsson 1992). The first generation problems were characterized by

- sporadic, recognizable sources of emissions (e.g., factories);
- local effects;
- tangible and manifest, short term effects;
- a relatively low level of perceived complexity.

It can be said that urban planning in Europe in the nineteenth and early twentieth century was to a large extent concerned with solving these first generation problems. Descriptions of nineteenth century Dutch planning, for instance, show that mainly on the basis of German studies and examples planners were preoccupied with 'hygienic' considerations (De Ruijter 1987, Van der Valk 1989). Residential development should allow for adequate supply of daylight and clean air; faeces, rain water, and residential as well as industrial waste water should be removed; and main sources of smoke should as much as possible be downwind from dwellings. In the twentieth century, in line with CIAM principles, urban planning became highly concerned with segregation of functions, with a view to keeping nuisance caused by industry and traffic, e.g. noise, away from residential areas.

In retrospect we might say that the efforts of nineteenth and early twentieth century urban planners to combat environmental problems were aimed at alleviating the effects rather than counteracting the causes of these problems. Ironically, they thus contributed to our present-day second generation problems. These are characterized by

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This paper is a revised and expanded version of a Dutch text which appeared as a chapter in *Ruimtelijke Verkenningen 1993*. *Ruimtelijke Verkenningen* (Spatial Reconnaissance) is a Yearbook published by the Netherlands National Physical Planning Agency for the benefit of all those within the Netherlands who are interested in spatial planning.

- diffuse sources of emissions, often relating to consumption rather than production (e.g., motor cars);
- supralocal, even global effects;
- future, predicted problems;
- great socio-technical complexity.

### 10.1.2 From shifting to solving problems

The above shows how environmental problems and initial attempts to solve them take the shape of shifting these problems: from one actor onto his neighbours, from rich countries onto poor, from the present generation onto future ones. The transition from first to second generation environmental problems is characterized, on the one hand, by an increase in the number of sources of pollution, and on the other hand by an increase in distance and in time over which the problems are shifted.

Spatially, two types of problem shifting may be recognized:

- from one location to another (from cities to rural waste tips, from European cities to tropical rain forests which supply hardwood);
- from low to high levels of scale (from local and regional traffic to global warming, from energy-intensive domestic appliances to exhaustion of global energy supplies).

The first generation environmental problems came about (inter alia) as a result of the industrial revolution and took the form of short-distance shifting of immissions, both spatially (within the cities) and temporally (epidemics caused by poor hygiene were common). They were resolved by extending the distance in space and time, and thus also increasing the level of scale of the problems. Hence the advent of the second generation problems. Obviously, we cannot go on like this, because the problems are now of a global nature and we ourselves are beginning to become the generation which is burdened by the problems.

On the other hand, we cannot undo the industrial revolution, nor reduce emissions to zero. Also, it cannot be denied that segregation of functions did resolve problems which were felt by urbanites and which we do not want back. We cannot retrace our steps, so we shall have to find new ways for going forward.

The question we face is in what direction such new ways for addressing urban environmental problems may be found. Preferably, they should be directions which do not, like the old policies, bring us up against new obstacles in the future: they should promise true sustainability.

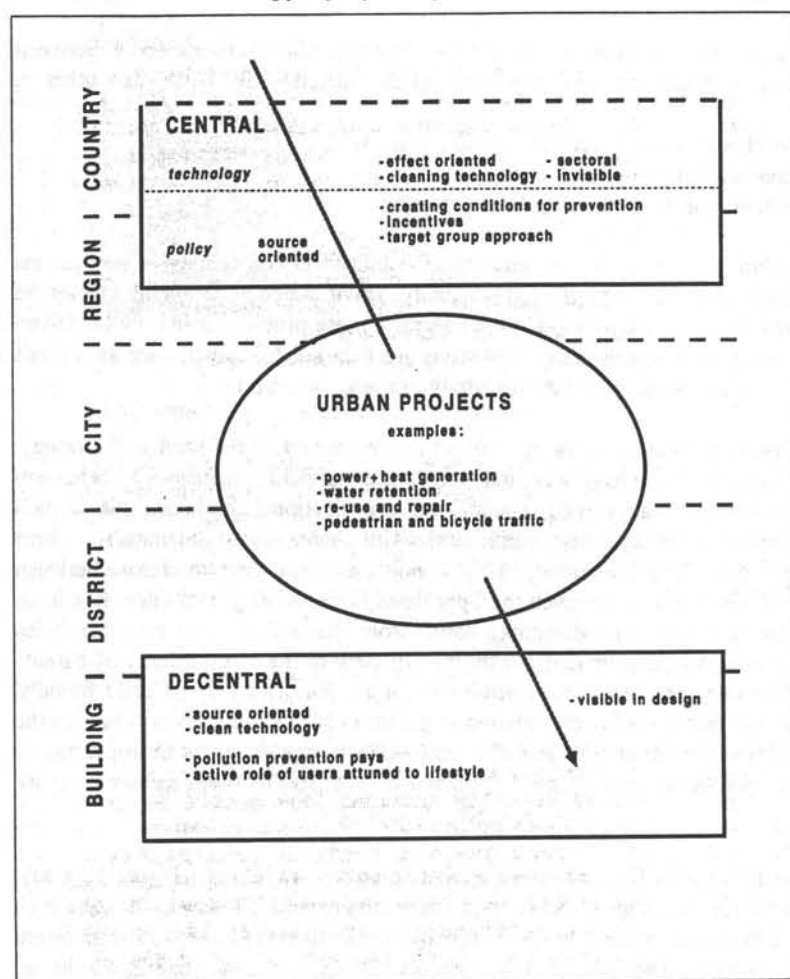
## 10.2 Toward answers

### 10.2.1 The sandwich strategy

Counteracting spatial shifting of environmental problems would seem to imply resolving all such problems at the source, thus at the level of scale whence they originate. We have seen, however, that the second generation problems are characterized by diffuse sources,

so this would mean that all or most solutions would have to be sought at the lowest level: the individual dwelling, the individual car. This remedy is indeed tried in many ecological experiments at the micro level: ecological dwellings, villages, small neighbourhoods. Unfortunately such solutions often do not lend themselves to wider application: they do not fit present-day urban space and urban culture.

**The sandwich strategy by Tjallingii**



This problem is overcome in Tjallingii's sandwich strategy (reproduced once more on this page), which is based on the principle of selecting solutions not on the lowest level of scale as such, but of finding, for each particular solution, the lowest level of scale at which this solution is still effective and efficient. As is expounded in Tjallingii's basic paper for the present Workshop (pp. 14-16), the various societal layers corresponding to levels of scale take on diverging responsibilities in the sandwich system. The task of the top layer (municipal and higher authorities) is to create conditions for sustainability.

Under the influence of this policy, the bottom layer (individual citizens, neighbourhood groups, private enterprise) develops sustainable behaviour. The intermediate layer (neighbourhood, city, region) provides optimum niches for ecological projects such as rainwater retention, district heating using the total energy principle, waste recycling facilities, second hand shops, attractive and safe cycle paths.

### 10.2.2 Diversity

The lower, however, the level of scale one observes, the more diversity between localities and their inhabitants one will find. Urban districts differ from each other in three ways:

- abiotically: soil, elevation, water systems;
- biotically: characteristic flora and fauna;
- socially and economically: lifestyles, business styles.

Generally speaking, this diversity enhances the flexibility and adaptability of ecosystems (including cities) and thus supports sustainability. Environmental problems cannot be remedied if this diversity is ignored. On the contrary, these problems can only be solved by accepting and promoting diversity. Solutions are thus needed which vary as regards level of scale, spatial design, management conditions, etc.

Social diversity, in particular, is highly relevant in the context of the sandwich strategy. This strategy expects, as we have seen, individuals and individual businesses to behave in an environment-friendly way, provided spatial and organizational conditions enable such behaviour. People are regularly confronted with behavioural dilemmas, where constraints of various kinds, including spatial conditions, force them to choose between feasible actions. They should be given the opportunity of resolving such dilemmas in an environment-friendly way. The dilemmas result from the multitude of responsibilities which life imposes. An example may clarify this. In view of the responsibility of parents for their children they may feel, if their neighbourhood is not designed in a 'child-friendly' way, that it is too dangerous for the children to go to school by themselves; while on the other hand walking the children to school would make it impossible for both parents to reach their own places of work in time by public transport; so that they feel forced to use the car.

Obviously, in the case of this example a spatial condition which must be met is a safe route to school for as many children as possible. In general, however, it should be realized that differences in lifestyle result in behavioural dilemmas being quite different for different people. The spatial requirements for solving the dilemmas in an environment-friendly way thus also vary. Hence the need for differential sustainable neighbourhoods.

The example also illustrates the importance of the time factor. At different times people confront different behavioural choices. Working, learning, participating in social life all call for different spatial surroundings. It is inefficient, and thus at variance with the quest for sustainability, to try and cram room for all of a person's various activities in one and



the same locality. Consequently, people must be allowed to move about: mobility must be accepted in spite of its environmental disadvantages.

### 10.2.3 Coherence between levels of scale

The sandwich strategy implies that measures at different levels of scale should be closely attuned to each other. This is symbolized by the 'stick' connecting the three layers of the sandwich. In particular, top level policies should enable environment-friendly behaviour of individuals, and intermediate level projects should further encourage and supplement such behaviour.

The interrelationships between the levels of scale take shape in the flows of water, materials, energy and traffic which move through the system. Attunement between the levels can be attained by partially closing the flows at different levels, so as to achieve a closed system by combined efforts at the various levels. The 'guiding models' for the four flows which Tjallingii has constructed (see his basic paper section 4) can be used to this purpose.

Possibly even more complicated than finding the most efficient ways of closing flows, however, is organizational attunement through the levels of scale. There are many links between laws and regulations at different levels and in different fields, so that desirable changes in individual behaviour, and desirable projects at city or neighbourhood levels, often involve complicated adaptations in administrative instruments. Attempts are made in current Dutch studies to identify such links and gauge their consequences for desired changes. We refer to other Dutch contributions to the Workshop for further information.

Both in closing flows and in administrative attunement the necessity of providing diversity at local levels should be born in mind. All measures taken at the top level should be highly flexible so as to allow for this diversity. This of course further complicates matters. It implies, *inter alia*, a willingness to accept that sustainability can be reached by means of different combinations of norms.

### 10.2.4 A recipe

We have now found three components of what might be called a recipe for sustainable urban development:

- Close flows of water, materials, energy and traffic at those levels of scale where optimum efficiency can be attained.
- Provide optimum diversity of neighbourhoods, taking into account abiotic and biotic aspects as well as lifestyles and business styles.
- Attune, both technically and administratively, measures aiming at sustainability which are taken at various levels of scale.

Before the recipe can be applied we must, obviously, determine the optima to which it refers. This calls for technical, biological, social, and especially interdisciplinary research. Optimal values will, of course, be location- and culture-specific. This by no means implies that generalized knowledge is useless, or that experts, policy-makers, and

citizens in different countries cannot learn from each other. Abiotic and biotic conditions all over earth do resemble one another, and even more pertinent: cultural change - which is required for attaining sustainability - most often results from cultural interchange.

### **10.3 Toward planning guidelines**

#### **10.3.1 Reflection**

In the search for optimum values of the components of the recipe, or to speak less figuratively, for concrete planning guidelines toward sustainability, insight can be gained from analysis and reflection, as well as from experiments and practice. In this section we will give examples of both sources of knowledge.

One method of further developing planning guidelines for sustainable urban development is by linking the elements of the recipe to (existing or new) spatial concepts. A spatial concept expresses through words and images in a summarized way the views of a planning subject in respect of desired spatial developments and of the nature of interventions considered necessary. Spatial concepts fulfill important roles in the communicative action which is a necessary part of effective planning. They have cognitive, intentional, institutional, communicative and action functions (Zonneveld 1991).

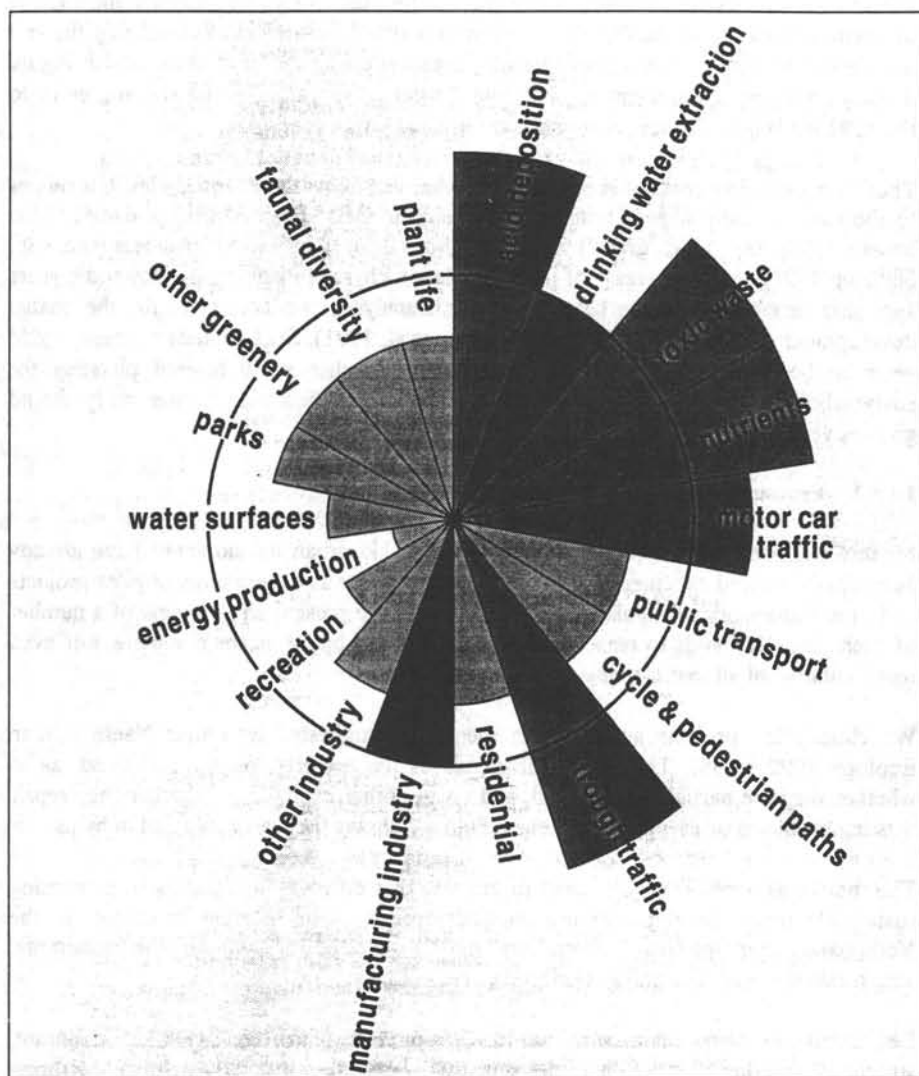
Over the years, a great number of spatial concepts have been developed by Dutch planners. Three such concepts have been analysed as to their relevance for sustainable urban development. These concepts represent the three layers in the sandwich model. They are:

- urban environments differentiation;
- city region, urban node, (eco)region: three concepts which, in the spatial sense, considerably overlap;
- urban networks.

Urban environments differentiation is a strong concept which dates back to the Second Report on Physical Planning (1966). It is obviously suited to being used for underpinning ecologically optimal neighbourhood diversity. To this end it should be further developed with respect to possibilities of combining abiotic, biotic, and social factors in the choice of locations for various types of neighbourhood, and the lifestyle aspect should take account of the need to enable and encourage behaviour which enhances sustainability. Moreover, the present circumstances necessitate intensive cooperation between government authorities (which are responsible for the design of public space) and private developers (who are mainly responsible for providing new dwellings) for application of the concept to be successful.

At the level of the city region sustainable management of both flows and areas (cf. Urban ecology 1992 p. 35) is possible. Tjallingii's 'strategy of the two networks' (see his basic paper for the Workshop) can be applied at this level. We do not want to imply that all flows can be closed at this level: this is obviously impossible. It may, however, be

*The amoeba concept: an example for an urban area*



- *desired value*
- *decrease to desired value*
- *increase to desired value*
- *already on desired value*

Figure 2. An amoeba for an urban area

possible to audit flows at the city region level. One could imagine toll bars (not real but virtual ones) at city region borders which could be used to try and minimize the shifting of environmental problems from one region to another. A method of visualizing the real and desired values of such regional balance sheets is the so-called amoeba model. Figure 2 shows a suggested amoeba for an urban district as appearing in the winning entry to the 1992 Eo Wijers Contest, which asked for plans for an ecoregion.

The urban networks concept is, as yet, somewhat vague. At the European level, it relates to the various interurban or interregional design models with imaginative names ('blue banana', 'blue star', 'green grape') which have been devised by various planners (see, e.g., Nijkamp 1993). A project team of the Netherlands Physical Planning Agency some years ago also developed, on the basis of in-depth analysis, two scenario's for the spatial development of North-West Europe (Verbaan et al. 1991). Such models as these would seem to be suitable as points of departure for further study toward planning for sustainability at higher levels of scale, but in which direction such further study should go is as yet unclear.

### 10.3.2 Practice

Meanwhile, many spatial plans aiming at sustainable urban development have already been drawn up and executed in various countries, either as experiments or pilot projects or in the framework of regular planning activities. We present an overview of a number of such plans. It stands to reason that this overview is by no means complete, nor even representative of all that is going on.

We classify the projects according to the matrix suggested by Petter Naess (Urban Ecology 1992 p. 68). This matrix distinguishes the projects, on the one hand, as to whether they are partial or structural, and on the other hand, as to whether they repair existing problems or prevent future ones. Figure 3 shows the matrix as filled in by us.

The matrix as a whole would seem to indicate that different approaches to promoting sustainable urban development are unequally practiced in different countries. In the Netherlands, for instance, efforts are mostly directed at two of the quadrants: structural/repairing, and partial/preventive.

Let us look at each quadrant in turn. We start with the top right quadrant, structural/repairing, because it is the simplest to describe: it mostly involves restoring accessibility within existing urban areas. In the top left quadrant, partial/repairing, we can distinguish, illustrated by examples from Germany and Sweden, two types of projects. The one type can be characterized as ecological urban renewal. This is found, inter alia, in the Kreuzberg/Moritzberg/Schoonberg Viertel in Berlin. The other type may be styled 'metropolitan key projects' in the sense that they can be imagined to boost developments in their localities as well as act as ecological prototypes. The example given in the matrix, the Potsdammer Platz Contest Plan, was produced jointly by the well-known architect Richard Rogers and the 'eco-architect' Eckhart Hahn.

*Positioning of projects according to Naess matrix*

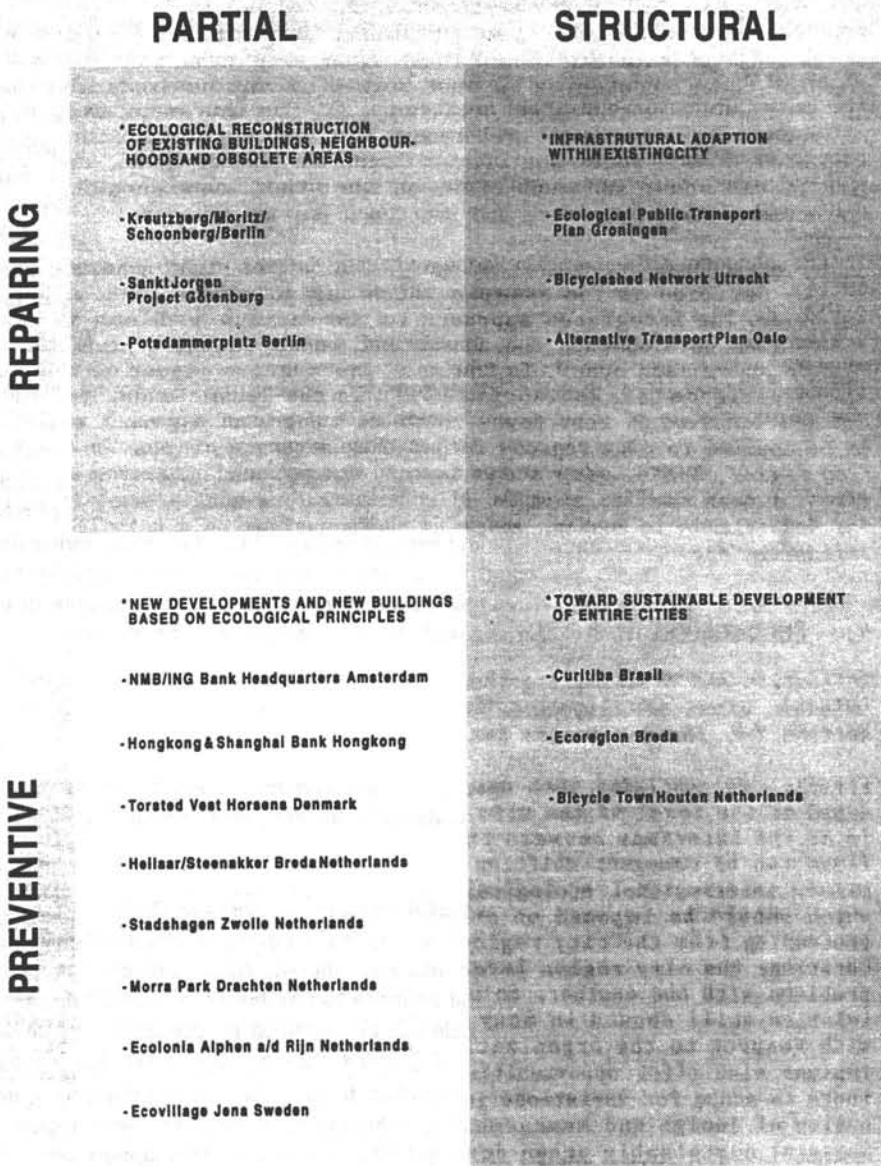


Figure 3. Classification of ecological projects



Such key projects may be seen as a manifestation of a new 'eco' trend which, at the level of individual (office) buildings, is also encountered in the bottom left quadrant of the matrix, the partial/preventive quadrant. By employing the high-tech idiom this trend opens up new pathways to ecological design. Making use of it we can, analogously to the concepts high-tech and high-touch, distinguish between 'eco-tech' and 'eco-touch', thus enhancing our possibilities for providing diversity within urban areas. Eco-tech is capital-intensive and operates on the basis of (much) sustainable energy in carefully designed closed networks; eco-touch is space-extensive and relies for its operation on people having sufficient time available. In formulating sustainable settlements policies one should thus, among many other things, consider which of these strategies is most suited to various locations; e.g., the city centre or the urban periphery. If, for instance, in studying lifestyles and locational preferences one finds a distinction between people with much money and little time, on the one hand, and people with little money and much time, on the other, consideration of the distinction between eco-tech and eco-touch may be relevant.

In the structural/preventive category, the bottom right quadrant of the matrix, Curitiba is the example which has attracted most attention worldwide. The integrated approach to the various problems of large-scale urban development, the consistent manner in which problems were used to solve each other, is the most instructive aspect of the Curitiba experience (cf. Rabinovitz 1992). In the Netherlands, in view of the smaller size of most towns, such an integrated approach would have to be applied to city regions rather than separate cities. In one Dutch city region, Breda, some steps toward ecoregional planning have been taken. A much smaller example of structural/preventive eco-planning in the Netherlands is Houten, which is characterized by a bicycle-friendly infrastructure.

#### 10.4 Perspectives

Reflection and practice together suggest promising avenues toward sustainable urban development. In line with the recipe formulated in section 2.4, three messages can be deduced.

Firstly, we concluded that many environmental measures can be coordinated at the level of the city region. In Tjallingii's sandwich, this is at the interface between the top and middle layers. On this level flows can be managed: shifting of environmental problems can be minimized, interregional ecological relations can be balanced. Conditions which should be imposed on other levels of scale can be identified proceeding from the city region level. As is shown by the example of Curitiba, the city region level also provides enough scope to relate problems with one another, to use problems to solve each other. Uncertainties still abound in many countries, including the Netherlands, with respect to the organization of regional governments, but city regions also offer opportunities for creative institutional solutions: there is scope for variations in forms of participation and for coordination of design and management. The first message thus is: *aim for integral sustainable urban development at the level of scale of the city region.*



Secondly, a large (but not yet sufficient) number of design ideas is available which can be used to provide for sustainable diversity of areas within city regions. The experiments, prototypes and pilot plans accruing to the partial/preventive category of ecological projects (the bottom left quadrant of Figure 3) offer a rapidly growing catalogue of such ideas. The distinction of eco-tech and eco-touch can be used as an aid to enhance diversity. Diversity is needed not only for buildings and areas, but also for the infrastructure making up the networks. Since, as was argued in section 2.2., mobility of people has to be accepted, policy has to aim at promoting sustainable forms of modal split. To this end many more means exist than have so far been tried, even apart from new technological advances. Curitiba, for instance, teaches us that other public transport solutions than expensive rail networks may suffice. In general the examples in the right-hand column of the matrix show that, as suggested by Tjallingii, traffic policy can and should take the form of integrated flow management, aimed at flows of traffic in their entirety, making flexible use of a diversity of means of transport, and attuned to the areal diversity. In sum, the second message is: *make optimum use of all possibilities to enhance diversity within city regions.*

Thirdly, at least as important as sustainable development of new neighbourhoods is ecological restructuring of existing urban areas. In this respect, important questions need to be studied more thoroughly and systematically. What measures should be taken concerning the passing of flows, including traffic, through existing neighbourhoods so as to prevent 'leakage'? What role do existing neighbourhoods play in areal diversity within city regions? What mix of eco-touch urban renewal and eco-tech key projects will create optimum sustainability under various conditions? Our third and final message has to be: *ecological restructuring of existing urban areas calls for more thought and care than has hitherto been devoted to it.*



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# 11

## EMICUS

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### Model for estimating energy and emission consequences of urban structure

*Kari Rauhalala (presented by Mr. Lujanen)*

#### 11.1 Main principles of the model

EMICUS estimates the total energy consumption and emissions caused by an urban structure. The model takes into account the energy demand and emissions of construction, starting from the production of materials, as well as the annual energy demand and emissions of heating, electricity consumption and transportation. The demand of primary energy and emissions of complete production chains of different energy forms are also included in the estimations.

One important objective in developing the model has been to make it as easy to use as possible. Thus, in the minimum case only the total floor area as well as the average trip lengths of work, school, daily shopping, other person trips and goods transportation are required. As regards the trips, the only significant ones are work and other person trips as well as goods transportation. However, the estimations can be considerably improved with more detailed input data. For example, it is possible to determine the distribution of the floor area in different building types. Also the building forms and sizes can be determined more closely by the mean building size and the mean storey number of the buildings. It is even possible to adjust the heat consumption of the buildings by giving, among other things, detailed climate data. In addition, it is also possible to divide the considered area into smaller sub-areas and determine the network lengths separately for each network type. At the most accurate level it is even possible to change the default parameters of the calculations, concerning among other things some essential properties of different building types, trip generation and modal splits in transportation as well as specify energy demands (contents) and emissions of building components and materials. Thus, it is possible to use the model in different planning levels from the roughest sketching phases to the final plans or, for example, from general plan level to even the building design level. The model also suits to comparative calculations with different input values or different calculation parameters.

#### 11.2 Structure of the model

The model operates in principle on three different phases: input of data, calculation of energies and emissions as well as output browsing. Each phase is independent and can be

carried out separately. However, naturally there has to be some input data before calculations and calculations have to be done before viewing outcomes.

### **11.2.1 Input**

Input data is given for building groups. The scope of the group can be from one single building to the whole area under consideration. The model asks for each building group four types of data: building data, climate data, network data and trips data. Building data consist of building category, floor area, average building size, average storey number and percentage of floor area heated by district heating. Climate data concern degree-days, wind velocities and solar radiation. Network data consist of lengths and areas of different network types as well as green areas. Trips data concern trip lengths in five trip categories. All input data gathered can be printed out at any time.

### **11.2.2 Calculations**

Calculations are carried out in four different calculation models: construction, operation, transportation as well as total energy and emissions (see Appendix 1). Calculations too can be executed separately. However, the calculation of total energies and emissions implies that the calculations of construction, operation and transportation have been done before.

#### **Construction**

Construction model estimates the materials and energy required to build the building group with its proper network and green areas. For doing that the model first divides the building group into five different building types. Using quantity data it then calculates the amounts of different building components defined as plinth, base, floor, external, wall, windows and roof. For each building component there are parameter values concerning demands of energy and different materials. The materials considered are glass, steel, concrete, asphalt, plastic, aluminium, copper and wood. By means of the parameter values the model finally obtains the energy and material demands of buildings. The energy demand and materials required to build networks and green areas are calculated in the same way according to typical network sections and area units.

#### **Operation**

Operation model estimates the annual heat and electricity consumption of buildings as well as the corresponding heat losses in district heating pipes and the energy used for lighting the outdoor areas. For that purpose the model first divides the building group into nine different building types. For each building type the model estimates the amounts of base, external walls, windows, roof and indoor air space. Heat consumption of buildings is estimated by first calculating conductive as well as ventilation losses and energy consumption of hot water supply. From the sum of these values the model still subtracts the amount of exploited free energies for getting the net heat consumption. The total energy consumption of buildings consists besides the heat consumption also the normal electricity consumption, which is calculated very roughly according to the floor area and the number of dwellings.



Conductive losses are calculated using the areas of base, external walls, windows and roof and their proper U-values, which are stored as parameters, as well as degree-days from climate data. Ventilation losses, in turn, are calculated using the specific air-change values of each building type (stored as parameters) as well as wind velocities and degree-days from climate data. Energy consumption of hot water supply depends in the model on the supply system, on the floor area as well as on the number of inhabitants. Free energies are gathered from the endogenous heat sources (people, electricity and warm water) as well as from the solar radiation gained in. However, only a certain part of these can be utilised to reduce the heat consumption. This matter has been taken into account by using a coefficient dependent on building type. Free energies are calculated by means of the number of inhabitants, the calculated amounts of warm water consumption and electricity consumption as well as the gain of solar radiation as estimated in climate data.

Energy consumption of networks and green areas consist of the heat losses of district heating pipes as well as of the lighting of outdoor spaces. Heat losses of district heating pipes are calculated in the model by means of the pipe lengths and the specific loss-values of different pipe sections associated with the different building types. The lighting of outdoor areas is composed of lightings of streets, paths, parking areas and green areas. Each has its own specific unit value of lighting energy stored as a parameter value.

### **Transportation**

Transportation model estimates the annual number of trips generated by the building group as well as the corresponding mileage, fuel consumption of vehicles and transportation costs. The model is an ordinary four-step model.

Firstly, the trip generation in five trip classes is estimated. The trip classes used are work trips, school trips, daily shopping trips, other home based person trips and goods transportation trips. Secondly, the modal split in each trip class is estimated according to the trip lengths. The transportation modes in person trips are walking/bicycle, private car and bus. In goods transportation the possible modes are van or truck. Thirdly, the person mileage in different transportation modes is calculated according to the trips generation and trip lengths in each trip category. Fourthly, the vehicle mileage is determined according to the person mileage and mean vehicle loads in each transportation mode.

Energy consumption of transportation is finally calculated according to the vehicle mileage and specific fuel consumption of different vehicle types. As a by-product the model also calculates the transportation costs and the time consumption of transportation by means of the vehicle mileage, unit costs and average modal speeds.

Transportation model has a lot of changeable default parameters. These concern, among other things, trip generation, modal split and mean vehicle loads in different trip classes, share of diesel motors and unit costs of transportation in different vehicle classes as well as mean velocities of different transportation modes.

### **Total energy and emissions**

Total energy and emissions model estimates the total energy demand of the area as well as the total emissions it will cause, both at the site and along the whole production chain. Emissions involve sulphur dioxide (SO<sub>2</sub>), methane (CH<sub>4</sub>), carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), particulates and carbon dioxides (CO<sub>2</sub>). Energy demands and emissions are calculated separately to building materials, heat and electricity consumption and transportation. Finally these are summed up to a total energy consumption and total emissions from 40 years of operation time.

Energy demand and emissions of building materials are estimated according to the quantities of building materials and their specific energy and emission values stored as parameters. Energy demand and emissions of heating and electricity are estimated according to their quantities and specific parameter values concerning total energy demand and emissions. Heating is divided into district heating and site heating, which have different parameter values. In transportation the total energy demand as well as emissions are estimated by means of the energy consumption as well as of specific energy and emission values of different vehicle types. The considered vehicle types are diesel cars, petroleum cars with or without catalyst, diesel buses and diesel trucks. The specific values of each vehicle type are stored as changeable parameters.

### **Transparency**

The calculation model is designed to be as transparent as possible. Consequently, all its calculation parameters are freely changeable. Only calculation routines themselves, data bases and macros (scripts) handling and controlling the operation of the model are opaque for the user.

### **11.2.3 Output**

Each calculation model has its own output files. These can be browsed independently. They are usually presented in a form format one building group at a time, but the representation can also be toggled to a tabular format to see all building groups at the same time. As regards the output of total energies and emissions, these can also be viewed as graphical bars. Finally it is also possible to print the output files out in a form format.

### **11.3 Accomplishment and use of the model**

The model is programmed with PARADOX<sup>1</sup> - data base program for PC computers. This program uses relational data bases and is powerful in handling them. However, in calculations the program is slightly less efficient. The interface with menus is easy to accomplish, but these are somewhat monotonous. However, the program is rapidly developing and also its Windows 3-version is launched, which considerably improves its usability.

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<sup>1</sup>

Paradox is a registered trade mark of Borland International.

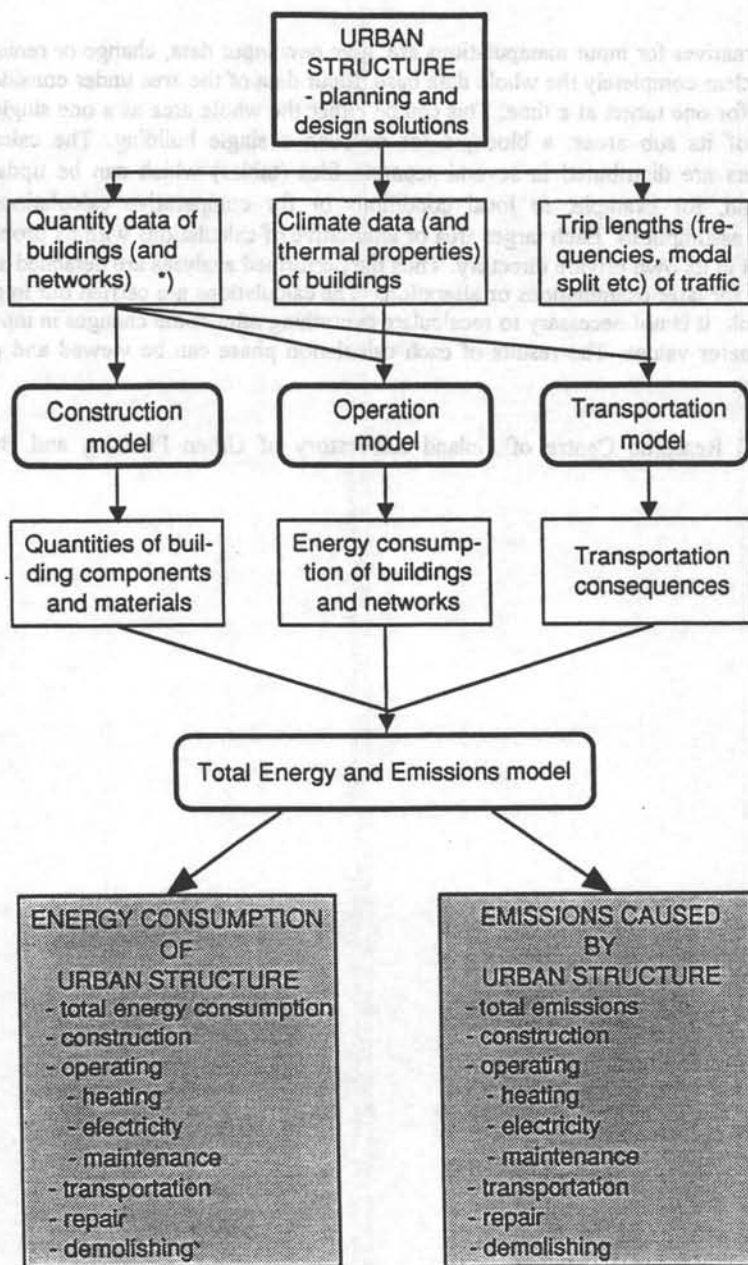
To be simple and easy to use, the model is completely menu-driven: all necessary instructions for the user are always present on the screen. After setting up the directory with proper files for the target area and giving identification data for the area, main menu appears on the screen. Its alternatives are: manipulate input values, update parameters, make the actual calculations and view or print the calculation results, or exit the program.

The alternatives for input manipulations are: give new input data, change or remove old ones or clear completely the whole data base. Input data of the area under consideration is given for one target at a time. This can be either the whole area as a one single piece or one of its sub areas: a block, a lot or even a single building. The calculation parameters are distributed in several separate files (tables) which can be updated to correspond, for example, to local conditions or for comparative calculations with different assumptions. Each target area or alternative of calculations with its proper files is located in its own private directory. Thus the performed analyses are detached and can be saved for later examinations or alterations. The calculations are carried out in phases. As a result, it is not necessary to recalculate everything after some changes in input data or parameter values. The results of each calculation phase can be viewed and printed separately.

Technical Research Centre of Finland Laboratory of Urban Planning and Building Design.

# EMICUS

## STRUCTURAL SCHEME OF THE MODEL



\* Data in parentheses have default values.

**EMICUS**

**EXAMPLES OF INPUT SCREENS**

Give the proper quantity data for buildings:  
OK = F2

# 3

## QUANTITY DATA FOR BUILDINGS

Block nr: 3  
Building Category: Det. & semid. houses  
Floor Area (sq.m): 4000  
Average Building Size (floor sq.m): 217  
Average Number of Storeys: 1,00  
District Heating percentage (%): 30



Give the proper quantity data for networks etc.:  
OK = F2

# 3

## QUANTITY DATA FOR NETWORKS ETC

Block nr:	3	Building Category:	Det. & semid. houses
Vehicular streets (m):	399	Distr. heating pipes (m):	615
Parking areas (sq.m):	1000	Electric cables (m):	1459
Pedestrian streets (m):	455	Green areas (sq.m):	5200
Water pipes (m):	628		
Drainage pipes (m):	615		

## APPENDIX 3

EXAMPLES OF OUTPUT REPORTS

### EXAMPLES OF OUTPUT REPORTS

EXAMPLES OF OUTPUT REPORTS

EXAMPLES OF OUTPUT REPORTS

## EMICUS

### EXAMPLES OF OUTPUT REPORTS

AREA:

TOWN:

-----  
 ENERGY AND MATERIAL DEMAND OF CONSTRUCTION  
 -----

BLOCK NR: 1 CATEGORY: Residential buildings  
 -----

FLOOR AREA: 10000 sq.m

ENERGY DEMAND (kWh/floor sq.m):	BUILDINGS	OTHER STRUCT.	TOTAL
	1767,44	121,86	1889,30

MATERIALS USED (kg/floor sq.m):	BUILDINGS	OTHER STRUCT.	TOTAL
Glas.....	11,93	0,00	11,93
Steel.....	29,58	2,94	32,52
Concrete.....	1157,71	10,44	1168,15
Asphalt.....	4,29	3,29	7,58
Plastic.....	8,81	1,27	10,08
Aluminium....	0,40	0,08	0,48
Copper.....	1,13	0,25	1,38
Wood.....	61,14	0,13	61,27

BLOCK NR: 2 CATEGORY: Multistorey dwellings  
 -----

FLOOR AREA: 8000 sq.m

ENERGY DEMAND (kWh/floor sq.m):	BUILDINGS	OTHER STRUCT.	TOTAL
	1858,45	86,96	1945,41

MATERIALS USED (kg/floor sq.m):	BUILDINGS	OTHER STRUCT.	TOTAL
Glas.....	11,28	0,00	11,28
Steel.....	32,88	2,05	34,93
Concrete.....	1305,52	6,55	1312,07
Asphalt.....	5,54	2,33	7,87
Plastic.....	9,63	0,87	10,50
Aluminium....	0,20	0,05	0,25
Copper.....	1,31	0,31	1,62
Wood.....	30,49	0,13	30,62

AREA:

TOWN:

-----  
 ENERGY CONSUMPTION OF BUILDINGS AND OTHER STRUCTURE  
 -----

kWh/floor sq.m, year

BLOCK NR: 1 CATEGORY: Residential buildings

FLOOR AREA: 10000 sq.m

## BUILDINGS:

Conductive losses....	91,80		
Ventilation losses...	76,19		
Warm water supply....	26,36		
Free energies.....	45,99		
HEAT CONSUMPTION.....	148,36	ELECTRICITY	
		CONSUMPTION.....	40,28

## NETWORK AND GREEN AREAS:

HEAT LOSSES.....	12,06	LIGHTING.....	3,49
(District heating pipes)		(Streets, yards, parks etc.)	

BLOCK NR: 2 CATEGORY: Blocks of flats

FLOOR AREA: 8000 sq.m

## BUILDINGS:

Conductive losses....	82,28		
Ventilation losses...	85,80		
Warm water supply....	28,56		
Free energies.....	49,67		
HEAT CONSUMPTION.....	146,97	ELECTRICITY	
		CONSUMPTION.....	42,94

## NETWORK AND GREEN AREAS:

HEAT LOSSES.....	8,91	LIGHTING.....	2,66
(District heating pipes)		(Streets, yards, parks etc.)	

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# Achieving more Sustainable Neighbourhoods: Preliminary Results from Research in Nottingham, UK

Jacquelin Burgess, Carolyn Harrison and Petra Filius<sup>1</sup>

## Abstract

In this paper, we present the preliminary findings of the first stage of our research under a two year programme, funded by the Economic and Social Research Council UK, and supported by the Research Institute for Forestry and Nature, Wageningen. The research is entitled: *Making the abstract real: a comparative study of public understanding of global environmental change in the UK and Nederland*. Through its innovative methodological approach, the work provides insights into the opportunities and constraints in the creation of *The Participating City* as outlined in the *Ecopolis* strategy.

## 12.1 Introduction

It is widely recognised that more environmentally sustainable practices will not be achieved without the mobilisation of the general public. Our research explores how lay publics in two highly developed, western European countries make sense of the complex relationships which link natural and physical environmental changes with the way modern society works. Each has a distinctive reputation in terms of environmentalism: the UK is often described as 'the dirty man of Europe', characterised as a country led by a government eager to drag its feet in terms of new environmental regulation, and a political culture of deregulation, leaving environmental as other areas of public life, to the Market. In contrast, Nederland is often hailed as 'the green man of Europe' with a very enlightened system of environmental legislation, a history of enlightened ecological planning, especially in urban areas, and an environmentally committed public. To what extent these epithets and judgements are a fair reflection of the social, cultural and political circumstances in the two countries, and the extent to which differences in public understanding of environmental change might be attributed to such contextual social and cultural values, is a major concern of the project.

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In terms of achieving more public commitment to policies and practices that will contribute to more sustainable urban development, we hypothesise that it is only when the 'abstract' quality of global environmental changes such as global warming and the hole in the ozone layer is experienced and understood as part of a local 'reality' through growing environmental and political consciousness that individuals, households and social groups feel able to take action - individually, within the household, and the wider community. Both from a theoretical standpoint (Giddens, 1991; Beck 1992) and from evidence of empirical studies (see Wynne 1989; Burgess et al 1991; Burgess 1993; Harrison and Burgess 1993), it is clear that environmental consciousness (and associated judgements about the risk of ecological catastrophe) depends on the extent to which people are able to assimilate the collapse of the global into the local that is inherent in contemporary systems of mass communication. For these reasons, the research is exploring the production and consumption of different discourses about global (and local) environmental change, linking these with two issues of direct concern to urban dwellers - pollution from traffic, and trees as agents of atmospheric renewal. The end product will be a contribution to understanding more of the psychological, social, cultural and political constraints which impede movement towards more sustainable practices.

### **12.1.1 Study Design**

The project is comparing public understanding of global environmental change in two cities - Nottingham, UK and Eindhoven in the Netherlands. The research strategy combines quantitative and qualitative methodologies. The first stage of the field research in the U.K. is complete. A survey of 252 households was conducted in April 1993 in selected neighbourhoods in Nottingham to ascertain current levels of awareness of environmental problems, the extent to which different households engage in 'environmentally-friendly practises', preferred political solutions for reducing the risks associated with three key environmental problems, and levels of participation in community life.

From the sample, nine men and nine women were selected for two in-depth discussion groups (see Burgess et al 1988). The single gender groups met for five weeks for meeting of an hour and a half in June-July 1993. The aim of the group discussions was to deepen our understanding of the social and cultural processes which lead to an acceptance or rejection of more environmentally-sustainable practices.

This field programme is to be replicated in Eindhoven, the Netherlands during the autumn and winter of 1993-4. The questionnaire has been translated into Dutch and a social survey was completed in November 1993. From this, group members will be recruited for a series of in-depth discussions to be carried out in January 1994. The results of the field research in the Netherlands will then be compared with those from the UK.

An analysis of media coverage of environmental issues over the research period will be carried out in the two countries, and comparisons will be drawn with a previous study completed by the researchers in the UK in 1989-1990 (Burgess. et al. 1993). The final



stage of the research will entail one day workshops with individuals close to the political, policy-making and communicative centres of the two cities to evaluate current policies in the light of the results of the full research programme. It is hoped that these workshops will assist in determining new strategies at the local level for encouraging and supporting the development of more sustainable urban environments and practices.

## **12.2 Interim results**

The Nottingham work was completed in 3 neighbourhoods on the northern edges of the city (see fig.1). Bestwood Park is a well-established area of public authority housing for people relocated from the centre of the city during the early 1960s. The housing is a mixture of semi-detached and terraced two storey family houses, flats and maisonettes in purpose-built blocks. There are some low rise, higher density dwellings towards the north of the neighbourhood. There are no high rise blocks. All the properties have access either to a private garden, or communal greenspace. The second neighbourhood - Top Valley and Rise Park consists of predominantly semi-detached private housing completed in the 1970s and 1980s all with private gardens. A third area was selected on the basis of census data, to ensure a mixture of social classes. This small neighbourhood consists of more substantial semi-detached housing built between the two wars. The neighbourhoods are well served by public transport in the form of buses. A total of 252 interviews were completed. Here we summarize some of the main issues from the Nottingham survey and the two discussion groups, highlighting the difficulties people experience in moving towards a greater commitment to urban sustainability.

### **12.2.1 Sample characteristics of the Nottingham household survey**

Summarizing the general characteristics of the sample of 252 respondents:

- The sample has slightly more men than women (54%, 46%) and as a whole is older than UK average, with slightly more old men than old women.
- Reinforcing the traditional employment structure of the Nottingham area, the sample has a high percentage of households in which the main wage earner has a skilled (19%) or semi-skilled (27%) manual job. The percentage of respondents in professional and managerial social classes is similar to that of the national average (4%; 23%); the percentage of respondents in skilled non-manual class (23%) is below the national average.
- Within the sample, the percentage of those people who are unemployed (11.1%) is twice the national average (5%) (1990 figures) and slightly higher than the Nottingham 1991 figure of 9.4%
- In terms of educational attainment, the sample population is slightly less well educated than the nation as a whole: 23.4% in the sample population have 'A' level qualifications and above compared with 27% nationally.

- There is a high percentage of car ownership recorded in the sample population - 78% of the households have access to one or more cars. This compares with a national figure of 73% according to Social Trends 1990. Regionally, the East Midlands has the highest average weekly household expenditure on motoring - £36.41 compared with the national average of £32.08. These high regional figures for expenditure on private motoring are reflected in a lower than average expenditure on fares and other travel costs £4.81 compared with a national average of £5.76.

Taken together these variables suggest a predominantly working-class population. The only variable which is less consistent with conventional views of what it means to be 'working-class' in Britain is the high percentage of home-owners in the sample population - 75.8% versus 52% in the Nottingham area as a whole. In other words, these figures suggest a sample population composed of a number of people who have benefited from central government policies designed to raise home ownership across the social spectrum. Many will have purchased their council house under the 1981 'Right to Buy' legislation. Assuming that most of these homes will be mortgaged and recognising that mortgage interest payments doubled between 1986 and 1992 - increasing by more than the rate of inflation - disposable household income is likely to be a critical variable for our analyses of consumer behaviour and environmental attitudes.

The Family Expenditure Survey (HMSO 1990) allows some comparison to be made between household incomes in the sample and those available nationally. The average gross monthly household income for all households according to this national survey is £1340. Nearly 40% of those who responded to the question about income in our survey have incomes at or above this figure, but 60% of households in our sample record incomes below this average figure. These latter figures accord well with those recorded in the national survey for households where the head of household is unskilled, retired or unemployed. For home owners, gross normal monthly income at £1660 is above the national average and disposable income is £1352. Again with 60% of the sample population having incomes below this national average, disposable income of the sample population is also likely to be below these national figures.

Coupled with the high regional expenditure per household on weekly motoring expenditure, we might anticipate that some home-owning households may seek to balance their budgets by adjusting their mobility behaviour. In cases where there is a move away from private motoring to other transport modes such as public transport, bicycles and walking this modal shift could be regarded as an indication of environmentally responsible behaviour. Nationally, the picture suggests that use of public transport has declined.

In cultural terms, the patterns of media consumption also support this view of a predominantly working class sample. The majority of the sample watch commercial television (83%), read the tabloid press (62%) and listen to radio stations at the popular end of the market (40% radios 1, 2 and 5; 49% listening to local commercial radio stations). They read a range of popular magazines (women's magazines 35%; radio and tv times 17%; gardening, home and DIY 16%). Respondent's estimated daily television viewing times, shown in table 1 also highlight the social characteristics of the sample

discussed above. These figures correspond with national audience survey figures indicating an average viewing time of approximately 25 hours a week.

TABLE 1

Hours viewing a day	Total weekly viewing	percentage of sample (252)
0-1 hours	0 - 7 hours	9%
1.1 -2 hours	7.1 - 14 hours	14%
2.1 -3 hours	14.1 -21 hours	20%
3.1 - 4 hours	21.1 - 28 hours	22%
more than 4 hours	more than 28 hours	35%

We propose to consider responses to the survey which indicate the extent to which there is awareness and understanding of the nature of global /local environmental problems, and the extent to which a predominantly working class population is likely to be active in moving towards more sustainable environmental practices. We begin by considering the relative priorities given to a range of environmental and social problems that had received sustained coverage in the UK national media in the year or so preceding the survey.

### 12.2.2 The relative importance of social and environmental problems

In the questionnaire we asked people to rank 8 problems in order of importance - crime, the greenhouse effect, unemployment, famine, homelessness, the hole in the ozone layer, traffic pollution and rainforest destruction. People were also asked to indicate whether they regarded these problems as short-term ones affecting people now, as long-term problems likely to affect future generations or as problems affecting both existing and future generations.

Table 2 shows the percentage of respondents ranking each problem as one of their top three priorities. As can be seen from table 2, crime was ranked as the most important problem. Forty-nine per cent placed crime at the top of their list, while another 24% included it as their second or third most important problem. Crime was followed by other immediate, local, social concerns - unemployment and homelessness. Global and /or environmental problems were not regarded to be as important as these social issues. Traffic pollution was ranked first by more people than was the greenhouse effect, the hole in the ozone layer and rain forest destruction. In terms of the top three priorities, there is a very marked drop of just over 20% before the 28% of the sample who included famine as one of their most important concerns, followed by approximately one quarter of the sample expressing most anxiety about global environmental issues. In general, it is worth noting the relatively low levels of concern expressed about traffic pollution - given

the widespread recognition among experts about the extent to which traffic contributes to urban unsustainability.

TABLE 2

PROBLEM	% RANKED 1-3
Crime	73%
Unemployment	62%
Homelessness	49%
Famine	28%
Hole in the ozone layer	24%
Greenhouse effect	23%
Rainforest destruction	22%
Traffic pollution	19%

These relative rankings bear close similarity to the findings of other national surveys of public opinion. Unlike the late 1980s when environmental problems were regarded by many people to be as much, or even more important as a number of social problems, our survey reveals that in 1993 environmental problems take second place to other more immediate problems that have a direct impact on people's lives. The results are indicative of the length and depth of the recession which has been affecting the UK economy since 1988. The local context is one in which the mining communities adjacent to Nottingham City were facing the dramatic and unexpected closure of their collieries as a result of central government plans to privatise British coal. These losses were coupled with a more general loss of manufacturing jobs in the UK over the period 1988-1993. These social concerns, affecting the lives of our respondents in very direct ways, were reinforced in the group discussions: the spectre of unemployment and poverty was particularly strong. So too was the collapse of community and social responsibility experienced in the neighbourhood, especially in terms of burglary - thefts from cars, taking vehicles away, house burglaries, and vandalism. One of the major concerns expressed in the groups therefore, was how to find new ways of making the communities *more socially sustainable*.

### 12.2.3 Evaluations of the immediacy of environmental and social problems

In the survey, respondents were asked to make a series of judgements about whether they regarded each problem as more of a short-term problem affecting people now, or as a long term problem more likely to affect future generations. They were able to select both options if they wished. Table 3 provides the results of these evaluations.

TABLE 3

PROBLEM	AFFECTS PEOPLE NOW	WILL AFFECT FUTURE GENERATIONS	A PROBLEM NOW AND IN THE FUTURE
Homelessness	46%	5%	50%
Unemployment	38%	4%	58%
Crime	37%	4%	59%
Famine	34%	14%	52%
Traffic pollution	31%	14%	55%
Rainforest destruction	20%	33%	48%
Hole in the ozone layer	10%	48%	42%
Greenhouse effect	9%	53%	38%

The majority thought that all the social and environmental problems we asked about were likely to continue into the future. So, although some people believed that problems like crime, homelessness and unemployment were more of a present day problem than problems like the greenhouse effect or the hole in the ozone layer, most people did not expect much progress to be made in solving any of them. Rather, people seemed to believe that any society is likely to experience this range of social and environmental problems.

Even so, the three clearly global environmental problems were thought to be more of a problem for future generations than others. For example, most people thought that the hole in the ozone layer and the greenhouse effect, would be a problem for future generations (48% and 53%) while less than 10% thought they were a problem for us today. Approximately double that number thought that rainforest destruction was already a problem.

The questionnaire cannot reveal why or how people came to make these judgements, but members of the discussion groups explained that part of the environmental 'problem' was knowing who to trust and what to believe when it came to determining whether something was really an environmental problem or not. The groups bear witness to a profound suspicion and mistrust of the range of *expert systems* - scientists, media, politicians and planners- who repeatedly make claims about the severity and widespread consequences of damage to global and local environmental systems, only to revise (apparently) or to refute previous claims in the light of newer or conflicting scientific evidence/theories. The growing mistrust of experts is also evident from recent interviews with media personnel carried out under a complementary programme to our own (see Anderson 1991).



The questionnaire survey suggests that people are much less certain about whether or not problems associated with traffic pollution and famine were of real concern to present generations. A majority of people believed these to be problems for both present and future generations but approximately one third of respondents believed they were already a problem. Talking about traffic and famine in the discussion groups suggested that these two problems differ in respect of people's direct experience of them. Famine becomes real only through the distressing pictures most households receive on television: it is also clear that the 'distress factor' is such that many people now switch off, both literally and emotionally.

Traffic pollution is also 'unseen' but is made real through people's daily lives and personal experiences - especially through its impact on the lives of children. There is deep and growing anxiety about the impacts of traffic pollution on health and its probable links to asthma. At the same time, it is clear that the car is widely regarded as essential for people to maintain their daily time-space budgets: women, in particular, would find it extremely difficult to balance their dual roles as workers and mothers without the flexibility of private transport. Over 70% of the survey population have at least one car in the household and approximately 60% use it more than five times a week.

The environmental problems addressed in the survey have only been in the public domain for the last five years or so, and thus, it is unlikely that most people would have encountered them through formal education programmes. Approximately 80% of the sample were over 25 years old and had left school several years ago. So the majority of people had come to know about these environmental problems from informal communications - stories they had seen or heard in the mass media and by talking about them with their families and friends. The discussion group members confirmed that most of their knowledge of these problems came from *mediated experience*. It became clear that the absolute decline in UK media coverage of environmental issues over the last two years has both reduced people's *discursive confidence* when talking about environmental issues, and reduced the sense of crisis and urgency among members of the public that was so clearly evident in our previous work carried out between 1989-1991.

#### 12.2.4 Environmentally responsible behaviour

Although the questionnaire survey suggested people did not regard environmental problems to be as important as social problems, when we asked about the kind of actions people took that can be regarded as 'looking after the environment', the survey shows a very high level of activity across all types of household. For example, a high proportion of households in the questionnaire survey have bought green products (94%) and recycled waste materials (78%). These levels of participation are, if anything, higher than those reported nationally. But like the national picture, ozone-friendly aerosols are the products bought most frequently (88%) followed by recycled paper (72.6%). An impressive 87% of households try to conserve energy by insulating the loft or putting in double-glazing, mostly because it saves money. A further 13% of respondents also tried to save energy because it was wasteful of resources and better for the environment.



The questionnaire did not explore issues of *motivation* - why people behaved in such a responsible way towards the environment - these were a focus of the in-depth discussion groups. It is evident that gender plays a highly significant role in motivations towards more environmentally-friendly practices. Discussion in the women's group highlighted the importance of relative affluence or poverty in the extent to which women felt free to purchase 'green products' - and a number expressed a sense of 'guilt' at buying the cheaper product which was not 'environmentally friendly'. This was especially true for organically-produced meat and vegetables. Most group members thought buying green products was something of a 'con'; buying them did not really help the environment - only the profits of the businesses who manufactured and marketed them. At the same time, several people went to a great deal of trouble to seek out green products when they went shopping. Being sure that food and other household goods like washing powder and vinegar did not have unnecessary additives in them, was important because people wanted to be in charge of their own health and that of their family.

When it came to contemplating life without the car, things seemed to be much more complex than recycling. 78% of the households in the questionnaire survey had access to a car and the majority of people used the car almost every day for a variety of very practical reasons. Even though about 16% of people in the household survey had reduced their use of the car, the majority of these people were elderly and became eligible for subsidized travel on public transport. A few people in other age groups seldom had reduced their use of the car but none of these respondents had done so for environmental reasons. Members of our discussion groups confirmed how difficult it was to organize their lives without a car - children needed taking to school, relatives and friends needed visiting and looking after, people needed to get to work and the shopping needed taking home. The city was simply not planned in such a way that it was easy to travel across its suburbs by public transport. Group members clearly felt that individuals on their own could do little to reduce the number of cars on the road and in Britain at least, the government did not seem to be tackling the problem either. In the meantime, more adults and children are suffering from 'hay fever' which many people believed were attributable to traffic pollution.

### 12.2.5 Environmental Scenarios

We asked people how they would tackle three environmental problems, all of which have a direct bearing on questions of environmental sustainability. The three were:

- a. the best way of reducing the number of cars in Nottingham;
- b. the best way of reducing the amount of carbon dioxide produced by the energy industry;
- c. the best approach to stopping rainforest destruction.

These were introduced as a means of exploring the validity of the cultural theory thesis developed by Douglas (1978, Douglas 1982), and extended to the environmental domain by Schwarz and Thompson (1990). These authors suggest that four differing rationalities of how nature will respond to the impacts of human activity are the product of four different structures of social organisation, depending on the extent to which individuals are locked into strong or weak group dynamics; strong or weak structures of social

codes and rules. The 'ways of life' are described as egalitarian, hierarchical, individualist and fatalist (see Harrison and Burgess 1994). A pilot survey of the questionnaire completed in March 1993 revealed that the results of attitudinal scales designed to measure these dimensions were unreliable. We wished to discover the extent to which the typology would be helpful for categorizing people's understanding of nature's ways and the kind of social action thought appropriate for sustaining them. We explored these relationships through questions about world scenarios concerned with rainforest destruction and climate change. Both are scenarios underpinned by a strong assumption that a natural balance needs to be maintained.

Respondents could choose amongst four possible options for reducing the number of cars and five possible options for addressing carbon dioxide emissions and rainforest destruction. Each of these options was designed to explore the extent to which changes in individual behaviour and different forms of collective action either voluntary or compulsory, were regarded as the best way forward. One option also allowed people to express the opinion that none of the proposed approaches would work. The scenarios are presented below in Table 4, and the results are given in table 5.

TABLE 4

Copies of the scenarios used in the questionnaire

**a. Car dependency**

**21 In the next twenty years the number of cars in Nottingham is expected to grow by 50%. Do you think people should be encouraged to use the car less often than they do at the moment?**

- 1 Yes, ASK 23
- 2 No, ASK 22
- 3 Don't know, GO TO 25

**24 How would you reduce the number of cars in Nottingham?**

**Would you please look at this card (GIVE SHOWCARD 2) and say which of these approaches best fits with your ideas about how the number of cars in the city can be reduced.**

- 1 The cost of motoring should be increased significantly so that people don't use their cars so often - for example by increasing the price of petrol, car tax/insurance, and by charging for the use of roads.
- 2 The government should introduce new laws to ban cars altogether from city centres; only bicycles, buses, trains and trams should be allowed into the centre.
- 3 People should be encouraged to cooperate more with one another - for example by sharing cars, employers running minibuses/ buses and the council designating special lanes for cars with more than one person in them.
- 4 I don't think any of these approaches will work, we'll have to live with the traffic problem.

**b. Rainforest destruction**

**37 According to some estimates, an area of tropical rainforest the size of Wales is destroyed each year. If this rate of destruction continues there won't be any rain forest left by the start of the next century. What do you think is the best approach to stopping rainforest destruction?**

**Could you look at this card (GIVE SHOWCARD 5) and say which approach best fits with your ideas?**

- 1 Individual countries should be allowed to decide the future of their own rainforests.
- 2 Third World governments should pass laws to control how forests are used - for example by only allowing people and companies who plant new trees to use the forests.

There should be financial cooperation between Western Countries and Third World Countries to protect the rainforests.

- 4 We, as individuals, should boycott rainforest products.

**c. Global warming**

**39 As a means of preventing the greenhouse effect, Governments have agreed to cut the amount of carbon dioxide gases released into the air by half, by the beginning of the next century.**

**What do you think is the best way of reducing the amount of carbon dioxide produced by the energy industry?**

**Can you look at the card (GIVE SHOWCARD 6) and say which approach best fits with your ideas about how this kind of industrial pollution can be reduced?**

- 1 Energy industries should get together and agree amongst themselves what they should do, without any government interference.
- 2 The government should set limits to the amount of carbon dioxide gases which energy industries can produce and should fine those who pollute the air by more than this amount.
- 3 Energy industries and the government should cooperate more closely to reach agreements on how best to reduce the carbon dioxide pollution.
- 4 We, as consumers, should try to reduce the amount of energy we use.
- 5 I don't think any of these approaches will make much difference.

TABLE 5

WAY OF LIFE	CARS SCENARIO	RAINFOREST SCENARIO	GLOBAL WARMING SCENARIO
Individualist (free market)	10%	3%	2%
Hierarchist (regulatory)	49%	37%	50%
Egalitarian (co-operation)	32%	50%	35%
Individual action		3%	6%
Fatalist	10%	6%	7%

Although asked to choose only one preferred option for each of the scenarios concerned with rainforest destruction and the green-house effect, several respondents found difficulty in expressing a clear choice. There are 14 missing cases for the rainforest scenario and 23 for the green house scenario. These missing values reflect badly on the quality control exercised by the interviewers, but they may also suggest that a reluctance to choose only one option is a real consequence of the uncertainties people feel about trying to solve environmental problems.

When analyzed using the four 'ways of life' suggested by Schwarz and Thompson our survey suggests that the overwhelming majority of respondents took a positive approach to solving environmental problems. Only 6% of respondents chose the Fatalistic option - 'None of the proposed actions will help'. Equally, only a minority of respondents (2%-7%) supported the Individualist position whereby businesses and industries should be allowed to decide how best to solve environmental problems.

More surprisingly given a growing commitment in political and environmental circles to encouraging individuals to take responsible action, only a minority of respondents believed the Egalitarian option to be important. For example, 3.2% respondents believed that responsible consumer purchasing by the individual would assist in reducing rainforest destruction, and 5.6% believed a similar approach would assist in reducing CO<sub>2</sub> pollution. On the other hand support for co-operation between institutions such as between businesses and governments was substantial as was support for the option involving greater intervention by national governments. Such support suggests that respondents believe solutions to environmental issues involve institutional solutions but whether these responses are regarded as support for an Egalitarian way of life or for a Hierarchical one, is not yet clear from our preliminary analyses.

Like the results of several major public opinion surveys completed in North America and reported on by Dunlap (1992) these responses suggest that most people regard solutions to environmental problems reside with institutions - governments and industry, business - and not with individuals and their behaviour. In our survey, a partnership approach in which national governments and financial institutions work together to reduce rainforest destruction received greatest support (47%) and 32% believed a partnership approach between the energy industries and the government would assist in reducing CO<sub>2</sub> emissions. The position of each scenario was reversed for responses supporting a more regulatory role for national governments, with 34% preferring this option for the rain forest scenario and 45% for the green-house scenario (If we look at responses to reducing dependence on the car, the regulatory role for central government is supported by 40% of respondents and the partnership approach by 27%).

We might hypothesise that the dominant political option pursued during successive Conservative governments has been a market-driven one favouring free enterprise and the Individualist option. However, a partnership option coupled with exhortation to the individual to be an active citizen best typifies Conservative environmental policies in practice. Conversely, the Labour opposition has consistently favoured a more regulatory approach. But while there is considerable support for both a partnership/co-operative approach and interventionist approach amongst respondents, this support is not consistently correlated with voting intention. For example 60% of Labour voters chose the regulatory option for reducing dependence on cars compared with a sample average of 48%, but 46% of Conservative voters picked this option for the rain forest scenario compared to a sample average of 36%. There was no difference between voting intention and option choice for the green house scenario. Overall, only a very small number of respondents showed a consistent relationship between choice of option for the environmental scenarios and voting intention.



The analysis does provide some guide to identifying groups of people who are more or less willing to be active citizens. A significant number (46%) of those respondents who consistently chose the regulation option for all three environmental scenarios had also taken action in the local community. This compares with an overall percentage of people who took action in the sample of 29%. By contrast the small number of people who took a fatalistic view of solving environmental problems rated themselves as largely in-active in the local community (see also below).

We learn from this analysis that when asked to choose options for addressing environmental problems, the overwhelming majority of people take an optimistic view about solving environmental problems - there are few fatalists amongst the surveyed population. Equally there are few Egalitarians and Individualists. The latter finding is perhaps the more surprising because dominant Conservative party ideology has consistently advocated this approach in all its dealings with commerce and industry even if in practice it has pursued the partnership options. Not surprisingly therefore the option involving partnership between government and industry finds as much acceptance as the option requiring intervention by the government. But, in a survey of this kind, a compromise option such as the partnership one is the easiest option to choose and it is the high level of support for government intervention that is the more remarkable.

Overall however, we are left with a confused and uncertain picture about what kind of actions the public believe to be appropriate for addressing environmental problems. We are forced to conclude that the environment is neither a party political issue nor a matter to be resolved by the actions of individuals and businesses working on their own. Furthermore these results confirm that amongst the sample as a whole there is no common 'green' view of global problems and of their solutions - individual scenarios provoke different solutions by the same respondent.

A substantial number of people regarded some form of co-operation between industry and government as a good approach. This option was most strongly supported as a way of reducing the rate of rainforest destruction (50%), but a substantial number of people also regarded co-operative approaches as a way of reducing both the number of cars (32%) and carbon-dioxide emissions (35%). In the case of the rainforest, the high level of support given to financial co-operation between western countries and third world countries might be interpreted as people's recognition of the inter-dependent nature of the development processes contributing to forest destruction and of the moral responsibility people feel for contributing to the destruction of these distant forests.

But when local people talked about these issues in the discussion groups, none of these approaches seemed to be quite as straight forward as the survey results implied. There was a much greater sense of pessimism expressed about the complexity of environmental problems and the impossibility of persuading politicians to shift their policies towards more sustainable practices. The level of alienation and loss of any sense of citizens having power or influence over political and institutional practices was profoundly disturbing.



### 12.3 What the results contribute to understanding of lay public awareness, understanding and commitment to sustainable environmental practices

National public opinion surveys in the UK and elsewhere suggest that it is difficult to establish causal connections between measurable variables and people's environmental attitudes and behaviour. However several hypotheses have been suggested (see Cotgrove 1982; Lowe and Rudig 1986; Dobson 1992).

a. a *socio-economic* argument links active environmental behaviour such as green consumerism and membership of environmental organizations to high income and educational levels. Such a hypothesis emphasizes that positive environmental attitudes and actions are contingent upon other conditions having been met, that is positive attitudes to the environment are acquired through learning; participation in environmental activities is an affordable luxury rather than an expression of commitment. This overall hypothesis is linked to Maslow's hierarchy of needs which suggests that environmentalism is an expression of a prosperous post-war society in which post-material needs such as the desire to belong and for self-esteem assume an importance because experience of affluence allows other material needs to be satisfied.

b. heightened environmental awareness is linked to *widespread shifts in social values* in which the mass media and advertising in general are implicated. As a result both high environmental awareness and participation in environmentally responsible behaviour can be expected amongst all social groups - moderated in some instances by the availability of facilities eg: access to recycling facilities or availability of consumer goods.

c. environmental actions are undertaken by people who have a *propensity to behave altruistically* - that is they are prepared to make sacrifices for the greater good of society as a whole and for future generations. This propensity to behave altruistically is poorly accounted for by measurable variables such as income or education. Altruism is regarded an expression of 'goal seeking' behaviour rather than of the 'needs satisfying' behaviour favoured by the first hypothesis.

The persistence of green consumer purchasing and participation in other environmentally responsible behaviour such as recycling during a period of national economic recession in the 1980s and early 1990s, together with a rapid growth in membership of environmental organizations, favours an explanation rooted in changing social values rather than one solely concerned with income levels or altruistic leanings. For example, over 60% of the people surveyed in the Social Trends Survey 1991-2 use ozone-friendly aerosols and 50% buy recycled paper and take empty bottles to a bottle bank. However, it would be unrealistic to dismiss economic considerations as having no bearing on environmental attitudes and behaviour. For example, adopting energy saving measures in the home involves high initial capital outlays which are recovered only over a period of years rather than months. Equally, most green products are known to be more expensive than alternative products. Participating in some environmentally responsible activities therefore does incur new or additional costs. However, undertaking recycling activities does not necessarily involve any capital outlay and in organizational terms is one of the easiest actions to undertake. On a scale of least cost and least personal sacrifice,

recycling scores highly because it involves little or no costs and little or no organizational effort, but reducing dependence on a car has a low score because it is both complex and the costs and savings involved are far from clear. Arguably, loft insulation would fall in an intermediate position on this scale.

The high levels of participation in energy consumption, recycling and the purchase of 'environmentally friendly' products across all household types are consistent with the view that there has been a shift in social values rather than a temporary change in consumer behaviour fuelled perhaps by households with high incomes or by specific groups of people predisposed to engage in altruistic behaviour. The more detailed analyses lends support for this theory. For example, there is no correlation between green consumer purchasing behaviour and income or age. In addition, given that there is a positive correlation between the number of products bought and purchasing frequency, these results suggest a committed public rather than one experimenting with novel or fashionable products. A similar relationship is revealed for recycling behaviour - as the range of materials recycled increases so the commitment to these actions increases. Presumably direct experience of environmentally responsible activities is a pleasurable one and the fact that people who are committed green consumers are also committed recyclers indicates a measure of habituation acquired through undertaking complimentary behaviours.

Energy conservation measures have been taken by the overwhelming majority of the sample population and consistent with its widespread adoption there are no strong correlations with other socio-economic variables. The high proportion of home owners in the sample may partly explain this high incidence of energy saving. But at the same time there is no straightforward correlation with other environmentally responsible behaviour. For example, there is no significant correlation with green consumer behaviour although there is a significant correlation between the number of things people do to save energy and the number of things they recycle. In other words those people who are committed energy savers are often also committed recyclers.

It is useful to examine whether the degree of commitment to environmentally responsible behaviour is correlated with other socio-economic variables. By identifying committed environmentalists as those respondents who always buy several green products, always recycle a range of materials and do several things to conserve energy, we find that in comparison to other less committed groupings, these committed environmentalists are well educated, have occupations classified as professional and managerial/technical, pursue their chosen religion actively, have higher incomes than average, consume more 'quality' media products and are more likely to vote Conservative than Labour. The identification and characteristics of these committed environmentalists provides some support for both altruistic and socio-economic theses.

Households which do not engage in any of these activities, are located in the Bestwood Park neighbourhood - a neighbourhood with some of the oldest local authority housing in the sample area. Respondents in this group also appear to be politically disaffected either because they 'do not vote', or are unsure about which party to vote for. They also spend most time watching television.

Overall the analysis suggests that the sample population exhibits a range of environmental behaviours consistent with participation levels exhibited nationally. The widespread adoption of activities amongst the population as a whole lends support to theories of social change whilst providing few indicators of causal processes or motivations for these changing environmental attitudes. In this sense the survey suggests a willingness on behalf of most people in all kinds of households and social groups to undertake some kind of environmentally responsible behaviour. It is perhaps worth noting that loft insulation is the most commonly engaged in activity amongst all the activities included in the survey, and is the only one to have been promoted historically by the government. However, the lack of government promotion and absence of financial incentives attached to other environmentally responsible activities does not appear to serve as a deterrent to participation. This finding suggests that factors other than cost and government promotion are involved in people's decision to recycle or purchase green products. Even so, it is noticeable that amongst households who take several actions to conserve energy, there is a greater propensity to recycle than to buy green products. This finding suggests that for some households recycling materials is a more acceptable means of engaging with environmentally responsible behaviour than buying green products.

As with other arenas of environmental activity, the most committed participants live in professional and managerial households conforming with the socio-economic hypothesis advanced to explain active environmental support and with the altruistic thesis. But some members of all social groups participate in some environmentally responsible behaviour suggesting support for a general shift in attitudes towards the environment. At the same time our subsequent analysis of community involvement and action suggests that these same people are also amongst the most active citizens. This congruence between a commitment to engage in environmentally responsible behaviour and to being active citizens suggests that a propensity to behave altruistically may best explain this group's behaviour.

### **12.3.1 Community involvement and active citizenship**

Nationally, the picture of how people participate in society and their local community is similar to that exhibited by respondents to the survey. Women are more likely to be involved in voluntary work than men (25% and 21% respectively) and people from professional backgrounds are two to three times more likely to be involved than other social groups. As far as our survey is concerned just under one third regarded themselves to be active members of the community and slightly more women than men define themselves as active in the neighbourhood. Overall 28% of these active respondents were involved in voluntary neighbourhood work and a similar percentage helped out at a school. 35% of respondents mentioned sports or hobbies undertaken locally.

People who regarded themselves as active in their local community also took action to change things they were unhappy about. 36% of those people who wanted to see things changed in their local neighbourhood acted upon their dissatisfaction. Writing a letter to the local council or businesses (24%) and contacting a local councillor (20%) were the

actions taken more commonly. Other forms of action included signing or organizing a petition (16%), joining or organizing a protest or interest group (15%) and contacting a Member of Parliament or the police (9%). In comparison to those people who were dissatisfied with the conditions in their neighbourhood but who did nothing about their concerns, these more active members were likely to be older members of the community, and retired and professional people.

Many of the actions taken by this group of active people involve individuals working on their own rather than co-operating with others. Such actions are consistent with a rights or entitlement approach to securing change - namely to ensuring local services are improved, litter is cleared and problems involving law and order are pursued. In terms of using local action as an indication of an empowerment process, such individual action tends to be a response to deficiencies in standards operating for a particular set of social and economic circumstances - the status quo. Collective political action may either challenge or support the standards set by the status quo. Within the sample only 10% of respondents mentioned political activities within the range of actions they took. However, in terms of voting behaviour, our survey suggests that people who are most active in their local community intend to vote Labour - an intention which would contest the status-quo. By contrast, there is a measure of political disaffection amongst those who did not participate locally.

#### 12.4 Summary

The level of participation in community activity is on a par with that recorded nationally, but in comparison with levels of participation in environmentally responsible behaviour, these participation levels are much lower. For both arenas of activity the most active group of people tend to be professional people, and established members of the community rather than young people. The voting intentions of the most active group however differ - community actors are more likely to vote Labour; committed environmentalists are more likely to vote Conservative. In this sense environmentalists appear to be happy with the status quo whereas community actors are not. Both analyses confirm a group of inactive disaffected people who are disengaged from community and environmental activity. However, for the majority of the respondents in the sample, that is those people who are neither committed environmentalists/actors nor inactive environmentalists and community participants, the quantitative analysis provides few pointers to what factors and hypotheses best account for existing attitudes and behaviour or propensity to change.

Neither does the survey deal effectively with questions of gender. Looking at the comparative rankings and the saliency/immediacy of problems for men and women, for example, there are few differences for the social or environmental problems. More women (33%) than men (29%) regard traffic pollution to be a problem now, although the majority of men (58%) and women (52%) believe it to be a problem for both existing and future generations. There are no differences in the ranking or immediacy of the famine problem by gender. For rain forest destruction, more men (22%) than women (17%) regard this to be a contemporary problem, but again the majority believe it to be

either a problem for the future or for both existing and future generations. Overall there is a homogeneity and consistency of responses by men and women - a universalizing response which belies the highly-gendered discourses in the group discussions.

Whilst these interim results offer some clues about current levels of public understanding of environmental problems, and indicate that perceptions of the risk of immediate environmental catastrophe (which drove public concerns during the late 1980s) have been reduced, or rather mortgaged into the future partly because there has been a dramatic decline in media coverage of environmental matters in the UK, they cannot provide any clear indication of the processes underpinning these judgements. We need the insights that will come from the in-depth qualitative study, and the discussions with members of the political, commercial and professional elites of the city, before being able to understand better the kinds of socio-economic and cultural constraints which are inhibiting moves towards more sustainable environmental and social practices.

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## Challenges of Sustainable Flow Management to Local Authorities in the State of Brandenburg

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### 13.1 Aims of the paper

The concept of sustainable development, coined by the Brundtland Report for the developing world in 1987 and subsequently taken up as a model for the rich, industrialised nations, poses a particular challenge to those regions of central and eastern Europe currently undergoing transformation from a centrally planned to a market economy, from a centralised party-state to a multi-tier democracy. The speed of change, the collapse of old structures and the close proximity to west European states place a special strain on the regions of the former eastern bloc. How far can the notion of sustainable development provide a useful orientation point for the reconstruction of structurally weak regions within a more prosperous national or European context? Conversely, what lessons for the concept can be drawn from the central and east European experience?

In the following paper I want to explore these questions tentatively with a preliminary analysis of the flow management situation in the state of Brandenburg, one of Germany's new federal states. Although many of the difficulties facing Brandenburg are peculiar to post-unification Germany - involving the restructuring of political administration and the regional economy - the case of Brandenburg is of wider interest to a European audience. Situated close to the fault-line between the former blocs of western and eastern Europe and encircling the vibrant city-state of Berlin like a doughnut, Brandenburg illustrates in concentrated form the particular problem of structurally weak, often rural-based regions sustaining their own existence and identity without shutting themselves off from their natural and stronger neighbours.

To illustrate this disparity in development levels, Brandenburg's population of 2.56 million - sparsely distributed at only 88 inhabitants per square kilometre - is overshadowed by the 3.5 million inhabitants of Berlin. The few large industries in the state - mainly in the steel and mining sector - have either collapsed or declined sharply, hitting the handful of large towns particularly hard. Unemployment, officially at 15.4%,

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lies realistically at between 40 and 50%. The communes, two thirds of which number less than 500 inhabitants, are desperate to maintain their local communities, willing to accept almost any offer of investment if it brings jobs and local revenue. Closer to Berlin the picture is rather different; there the development potential is greater, though municipal expectations still often exceed real demand. The current imbalance of opportunity between the region surrounding Berlin and the periphery of Brandenburg is, indeed, one of the state's most pressing problems.

What impact does this have on the provision of energy, water, sewage and refuse disposal services? Is the concept of 'sustainable flow management' a luxury of purely academic interest to the beleaguered communes? Or could it hold the key to a development strategy oriented to their particular problems? Let us take a look at the current challenges in the fields of energy, water, sewage and refuse management and how local authorities in Brandenburg are coping with them.

### 13.2 The dimensions of the task ahead

Firstly, it is important to appreciate the scale and nature of the challenge to flow management in Brandenburg. The poor condition of supply networks and plants, the low rate of connection to mains supplies, the environmentally damaging production of energy and high levels of consumption comprise the principal weaknesses of technical services in the former GDR.

To take the case of water supply and sewage disposal, 92% of Brandenburg's population is connected to a water mains, a figure falling, though, to under 80% in 7 rural districts.

1 The situation of sewage disposal is far worse. Across the whole state just over half the population (54%) is connected to a public sewage treatment plant, again with a sharp drop - down to below 15% in 3 districts - in rural areas.

2 The figures for sewage connections compare unfavourably with the average for the new federal states as a whole of 60%, let alone with the figure of around 90% for the western federal states.

3 Moreover, most of the existing plants and drains are in a chronic condition and fall far short of modern technical requirements. Nearly a third of Brandenburg's sewers date from the 1920's and 30's and later construction techniques have proved sub-standard.

4 Of the 1,400 million m<sup>3</sup> of sewage produced in the former GDR, only 52% received biological treatment, 36% mechanical treatment and 12% simply entered the water system untreated.

5 Little wonder, then, that 42% of the new federal states' rivers and 24% of their lakes and reservoirs are so polluted that they cannot be used for drinking water purification. High levels of nitrates and phosphates pose a particular problem. The only consolation has been the dramatic decline in water consumption since unification. Total water

consumption in Brandenburg fell by almost a third - or 410 m<sup>3</sup> - between 1990 and 1991, a shift due less to a change in household practices than to the collapse in industrial and agricultural production.

6 The trend in material refuse, however, is going in the opposite direction. In the GDR the average household refuse produced per capita stood at around 175 kg p.a., less than half that of the former FRG.

7 Such a low figure was due partly to the limited supply of consumer goods and partly to an effective system of collecting and recycling so-called secondary raw materials, ranging from paper, metals, textiles and oil to glass and plastic containers. It is worth recalling that the 'SERO' system recycled in 1988 36.4 million tonnes in total, representing a raw materials equivalent of some 13%.

8 Designed to offset a national shortage of raw materials and hard currency rather than for ecological reasons, the system was no longer financially viable after unification and was discarded. Since then, refuse levels in the new federal states have nearly doubled, rapidly approaching the west German per capita average of 365 kg p.a.. Reliable data for Brandenburg is still not available, but estimates put the figure for 1991 at around 300 kg, compared with 337 kg for Berlin.

9 Disposing of this refuse and, by contractual obligation, of a large part of Berlin's refuse highlights the low capacity and critical state of refuse disposal sites in Brandenburg. There exist some 4,200 refuse sites across the state, of which only 68 are still in use. Apart from the problem of ensuring the environmental safety of disused sites, around a half of those in operation will reach full capacity by 1997 and all but a dozen by the year 2000.

10 Alongside efforts to reduce refuse levels, therefore, there is urgent need for new waste disposal sites and treatment plants if a refuse crisis is to be averted. The field of energy requires more restructuring than additional capacity. Notoriously, energy consumption in the GDR was one of the highest per capita in the world, standing at 125 gigajoules p.a. compared with 116 gigajoules in the FRG, owing to inefficient electricity production and heating systems.

11 Within the space of a year, however, energy consumption fell sharply to just 97 gigajoules p.a., owing to the collapse in industrial production and, to a lesser degree, higher prices. The even greater extent of this fall is hidden somewhat by the rise in energy consumption for transport - a reflection of the increasing number and use of private cars in the new states. Figures for Brandenburg reveal total end energy consumption down by 28.3% between 1990 and 1991, composed of a 47.2% drop for industrial production, a 27.8% drop for households and a rise of 26.8% for transport.

12 The welcome trend in energy consumption is, therefore, merely an expression of economic decline and is likely to reverse as the economy recovers. The quest for a lasting reduction in energy consumption and in energy pollution raises the question as to how far lignite (brown coal) should remain the principal energy source. Owing to the

cost of imported energy, local lignite resources made up 68.5% of primary energy consumption and 43.5% of end energy consumption in the GDR in 1990, compared with figures for the FRG of 8.2% and 1.3% respectively.

13 In Brandenburg, with its large, open-cast lignite mines in the Lausitz region producing 62% of the state's primary energy in 1991, there are strong socio-economic arguments for retaining lignite as a prime energy source. Against these, however, range criticisms of the damaging impact of mining on the environment and the cost of the technology required to keep emissions to acceptable levels. Whilst there is universal agreement on the need to replace old, lignite-fired heating stoves, therefore, the future contribution of lignite to heating and electricity production is highly controversial.

To summarise, each of the three fields poses problems of a rather different nature. Water and sewage services require substantial physical improvements, the refuse system needs additional capacity and spatial concepts, whilst the field of energy demands a restructuring of energy production and heating systems. All three have one requirement in common though: the need to reduce consumption. But apart from the sheer scale of the problem, what other obstacles complicate the task for the communes of Brandenburg?

### **13.3 The obstacles to conventional flow management**

Whilst west German authorities have had over 40 years to perfect their flow management systems with the help of steady economic growth, the new federal states are expected to cover the same ground as rapidly as possible during a severe regional recession with a workforce still learning the legal and political groundrules. Is this expectation realistic? If so, what consequences might the conventional response of hi-tech, end-of-pipe solutions under market conditions hold for living standards, regional development and local self-government in the new states? Let us explore these questions by examining the principal barriers to effective flow management in Brandenburg today.

#### **13.3.1 Financial limitations**

Firstly, what are the implications in terms of financial cost? It has been estimated that cleaning up the environment of the new states will cost some 236 billion DM.

14 The lion's share of 125 billion DM is required for sewage plants and sewers alone, with a further 17 billion DM for drinking water and 34 billion DM for refuse disposal.

15 Within the state of Brandenburg some 7.1 billion DM are needed to fulfil EC regulations on drinking water by 1997 - the extended deadline for the new states - and around 20 billion DM in order to serve 90% of all households with a public sewage network by the year 2005.

16 Notwithstanding the considerable funds provided by the federal and state authorities for environmental projects, the bulk of the financial burden of building up the technical

infrastructure falls on the local authorities, or communes, who are responsible by law for supplying local energy, water, sewage and refuse disposal services.

17 They, however, lack the resources to meet their regular administrative costs, let alone finance costly, long-term investments. Caught in the trap between high social and personnel costs on the one hand and low local tax revenue on the other, local authorities in Brandenburg concluded the financial year 1992 with a combined deficit of nearly 220 million DM, estimated to rise in 1993 to at least 520 million DM.

18 Under these circumstances local authorities are poorly equipped to take on fresh credits for long-term investments. To a large extent their share of investment costs must be recouped through municipal charges. Raising municipal charges is, however, a socially and politically divisive issue. Local services for energy, water, sewage and refuse disposal, heavily subsidised in the GDR, rose two-and-a-half fold between July 1990 and July 1992, faster than any other item of living costs except rents, as subsidies were removed.

19 Those communes in Brandenburg which have invested in new sewage treatment plants and sewers are in several cases charging over 10.00 DM per m<sup>3</sup> for sewage disposal, with peak rates reaching 16.00 DM, which constitutes an average of 240.00 DM a month for a family of four.

20 By comparison, Berliners will pay just 3.30 DM per m<sup>3</sup> from January 1994.

21 Levying charges of this astronomical level in a depressed area is likely not only to discourage local investment and accelerate the population shift to large cities but constitutes a recipe for social conflict with serious consequences for the self-governing communes. In addition to which, under these circumstances there is clearly little scope for the use of economic instruments, in the form of higher charges or punitive fees, to promote greater environmental protection.

### **13.3.2 Administrative limitations**

If the financial framework of local authorities is severely limited, what administrative scope is available to them? In theory, the communes of the new federal states have considerable powers to determine local flow management. The provision of energy, drinking water, the removal and treatment of sewage and the disposal of refuse is a legal obligation of local authorities, specified in par. 2 of the Municipal Constitution of the GDR of May 1990, still in force.

22 The Brandenburg state government lays great store on local self-government but has felt forced to consider larger local units to deal with the costly fields of flow management. Under the State Interim Law on Refuse (*Landesabfallvorschriftgesetz*) of 20.1.1992, responsibility for refuse disposal was passed to the district authorities (*Landkreise* and *kreisfreie Städte*), with subsequent recommendations to operate in even larger refuse administration unions (*Abfallzweckverbände*).



23 Currently, the state is considering obligatory associations for local water and sewage services for reasons of efficiency, here against the will of the communes.

24 These steps are an expression of the urgent need in Brandenburg, with its large number of small communes, for inter-municipal cooperation and regional coordination over flow management, both of which are at an early stage at present. More serious in terms of eroding the room for manoeuvre of all local authorities is the growing trend for federal government legislation on the environment. To take the example of refuse policy, a series of laws and regulations have been introduced recently with the objective of protecting the environment without undermining market conditions. The Packaging Decree (Verpackungsverordnung) of June 1991 set up from January 1993 a system of package recycling parallel to existing municipal refuse collection - hence the so-called 'dual system' - without prior consultation with the communes. The Sludge Decree (Klärschlammverordnung) of 1992 established strict criteria for the treatment of sludge. Under the Technical Directive for Household Waste (TA Siedlungsabfall) of May 1993 a high proportion of organic refuse must in future be reduced chemically prior to dumping. Passed the same month, the Law to Ease Investment (Investitionserleichterungs- und Wohnbaulandgesetz) exempts all new refuse treatment plants from local planning procedures. Further federal legislation on resource recycling and the disposal of dangerous refuse is in the pipeline. Leaving aside the question of whether these initiatives, with their emphasis on end-of-pipe solutions, are capable of treating the root cause of high consumption, the overall impact is very demanding on local authorities. The uncertainty created by the quick succession of new legislation and the ongoing debate on technical specifications makes planning decisions for long-term investments extremely difficult. Moreover, the high technical standards required, notwithstanding a transitional phase of implementation, will place a considerable financial burden on the communes and, ultimately, the local population.

### 13.3.3 Organisational limitations

A third obstacle to effective local flow management in the new federal states is the thorny question of who owns and controls the services. This applies in the first instance to energy services but, as communes seek financial and technical support from private sources, is fast becoming a key factor in water, sewage and refuse disposal services too. The case of energy illustrates well the particular disadvantages facing the new states. Whereas west German towns have long regarded the provision of energy as a pillar of municipal services, their east German counterparts are fighting for the return of their electricity and gas works, expropriated under the GDR.

25 This is not so simple, for the energy services were subsequently restructured under district combines (Kombinate), which in 1990 agreed to west German electricity companies gaining a financial share in return for investments. The unification treaty later that year attempted a compromise, granting the communes a 49% share in the new regional energy companies (with 51% going to the west German companies), but 165 communes were not satisfied and appealed to the Federal Constitutional Court.



26 The current agreement - accepted by all but a handful of the claimants - envisages communes being allowed to take over electricity plants and power lines on their territory and manage local electricity supply in return for giving up their share in the regional energy companies, from which they are obliged to draw 70% of their electricity. This last stipulation will pose a serious obstacle to the communes' ability to influence local energy policies, for it limits the scope for environmentally-oriented pricing, energy-saving concepts and a more rational, decentralised production of electricity. The case of gas is less contentious, concerning merely the supply rather than the production of energy, but less well advanced. The 49% municipal share in the regional gas companies, as specified in the unification treaty, has still not been allocated amongst the communes by the Treuhand, the privatisation trust.

27 Meanwhile, private gas companies have established networks for natural gas in those communes not previously served by gas. The fundamental problem of the part-private, part-public regional gas companies, though, is the inability of the communes to raise their share of the capital to the level required for building investments. If they cannot, the difference will be covered by the private sector, leaving the communes with only a minor share of the capital and, thus, little influence over company policy. The scale of investment and the shortage of municipal funds together are obliging local authorities, therefore, to draw on private support, whether to run individual services or, more seriously, to take over or share ownership of the municipal infrastructure. This applies to all branches of flow management, not just energy. It is estimated that currently half of the refuse disposal services in the new federal states is in private hands, with an even higher proportion in rural areas. The first privately run water and sewage plants have been opened in Brandenburg, following the lead of the Rostock region. In some cases the communes, individually or collectively, have a financial stake in the company. In others, the municipal authority or union ascribes the management of services to a private company, whilst retaining ownership. In either case the question remains as to how much control the communes retain. On the basis of current experience in the new federal states it appears that the short-term gains of so-called public-private partnership are made at a risk to services and policy priorities in the longer term. That is to say, communes are benefiting from the know-how, rapid decision-making and adaptability to market forces of their private partners, resulting in the construction of new, high-technology sewage treatment plants or gas pipelines without delay. However, in their enthusiasm to begin investment and through their susceptibility to hard western marketing, several communes are today bound to their partner companies with 20-30 year contracts leaving little scope for municipal policy guidance. Apart from the danger of the company running into financial difficulties or even - as has happened on occasion - going bankrupt, the communes find they have little leverage over crucial factors such as pricing, siting new plant and setting environmental priorities. Charges for refuse disposal or sewage, planning a thermal power station and choosing between different energy sources - to name just a few examples - are determined primarily according to the profit motive of the private company involved. Thus, high investment demands and pressure on public budgets are forcing communes to take steps which are undermining their potential to set a new, environmentally-oriented agenda to their technical infrastructure in the long term.

### 13.3.4 Diverging interests

The fact that local authorities possess this potential does not, of course, mean they invariably pursue environmental interests against the economic motives of the private sector. Communes are themselves torn between environmental and economic considerations, especially in the new federal states where the need for economic development is so great. The will to attract investors and create jobs tends to overwhelm all other factors, as is testified by the large number of new but under-used commercial sites in the green belt surrounding Berlin. Brandenburg faces the additional problem of highly diverse development potential between those communes close to the metropolis and those on the state's periphery.

To give some examples of how conflicting economic and ecological interests affect flow management in Brandenburg, the desire of communes to form their own public utilities, or Stadtwerke, for energy, water and sewage services is motivated in no small measure by the expectation of additional local revenue. Higher municipal charges would in this case be used to cover budget deficits rather than to fund resource-saving investments or environmental awareness campaigns. Given the low level of local incomes and the high cost of new plant, however, financial surpluses from water and sewage utilities, at least, seem highly unlikely for the foreseeable future.

A second example concerns district heating in towns. Here, the desire to reduce energy consumption confronts the wish to maximise the use of municipally-controlled district heating networks. For, given the restrictions on supplying electricity and gas under the unification treaty, district heating stands as a key element amongst municipal utilities. In the case of pre-1990 district heating systems, inefficient in both production and transmission of energy, the main argument is simply financial: to raise municipal revenue. Modern systems, however, offer the dual benefits, thanks to combined heat and power generation, of ecological efficiency and financial reward through the sale of electricity locally or to the regional distributor. Thus the interaction of a combination of factors - fiscal, environmental, economic and even political - make district heating a prime example of the different forces at play in local flow management.

Energy policy in Brandenburg as a whole offers a further illustration of the diverging pull of environmental and economic forces. On the one hand the state is trying to reduce the proportion of lignite in energy consumption, operating a programme to assist the conversion of heating systems from lignite to other fuels.

28 On the other hand the economy of the southern region of Brandenburg depends on lignite mining, which still employs 30,000 people, and the government is committed to maintaining production at a third of GDR levels, or 60 million tonnes p.a. by the year 2000. Policy guidelines on energy reflect the state's desire to strike a balance of interests and take a broad view incorporating social and economic, as well as environmental, considerations.

29 The case of the city of Potsdam, which in October 1993 decided to build a gas- rather than lignite-fired power station for financial and ecological reasons, suggests, though,

that the issue of energy sources is likely to prove highly divisive in the future, with decisions ultimately determined by somewhat volatile political factors.

30 To summarise the obstacles facing flow management in Brandenburg, these relate less to technical limitations than to issues of funding, running and structuring the utilities. On top of the environmental damage and investment backlog left by the GDR, new pressures after unification of a financial and organisational nature are threatening the local authorities' say over their infrastructure and, thus, their environment. If current trends continue it is clear that the process of catching up to west German standards will take at least a generation, with the costs being passed on even further. Moreover, it seems likely that, on the way to achieving this objective, environmental concerns may well fall victim to overriding economic interests.

#### **13.4 Reflections on 'sustainable development'**

What can we learn from these experiences? In particular, how can they affect our understanding of the concept of sustainable development?

Firstly, it is clear from the problems outlined above that we need to reappraise the conventional goal of creating living conditions of an equal value in all regions, as set down in Germany's Basic Law. What in theory sounds like a yardstick for fair resource distribution has in practice been a target for economic development pursued in frequent disregard for endogenous qualities. For the new federal states to match west German living standards it was calculated in 1991 that they would require an annual growth in GNP of 15% for 10 years.

31 Today, with the German economy in decline, nobody dares offer predictions of when parity might be achieved. As the goal disappears over the horizon, the question is not just how realistic is this path, but how desirable? The price to pay, in terms of financial strain and environmental damage, seems very high.

If catching up with west German standards is not the yardstick of development, then what level of development is feasible and by what criteria should it be judged? One factor we can deduce from the Brandenburg experience is the importance of measuring the quality of development according to local standards rather than those of other regions. It makes more sense for Brandenburg to base its future development on its own individual potential than on the example of Berlin, difficult though this may be on the city's periphery. Sustainable development, I would argue therefore, should be essentially locally-oriented.

Secondly, the concept of sustainability cannot focus exclusively on ecological factors but must take adequate account of the social and economic context. The case of the flow management in the new federal states illustrates clearly the futility of pursuing environmental objectives without considering the economic and social cost. There is no point in preserving a natural habitat if, in the process, the local population are forced to leave. Sustainability, in other words, cannot refer purely to maintaining an ecological

balance in the future but should include all factors helping society to sustain itself. Nowhere is this more relevant and more essential than in the towns and villages of Brandenburg.

Although these comments are based on the new federal states, this is not to say, of course, that they cannot also apply to other regions of Europe, including west Germany. Indeed, intractable problems currently being experienced in the west, such as how to reduce energy consumption or cope with the growing mountains of refuse, require a similar rethinking of development principles and planning priorities. It may seem a rather far-fetched suggestion today, but the lessons born out of hardship in central and eastern Europe might well offer solutions to regions of the west in the future. With this in mind, we should view the transfer of knowledge as a two-way process.

### **13.5 The consequences for sustainable flow management**

The task of creating effective and ecologically sound flow systems in the new federal states stands, therefore, as a challenge to set new standards - and not just technical ones - in flow management. What form could these standards take? Let us, to complete the circle, return to the communes of Brandenburg to see what steps are already being taken to meet this challenge. For, despite the limitations outlined above, local authorities there have been making a determined effort to develop locally-oriented solutions which are both realistic and affordable.

Firstly, there is growing recognition that economic instruments of a purely punitive nature are of limited value. Raising municipal charges may reduce consumption, but at the cost of considerable personal hardship and political unpopularity. Moreover, it may well spark off a backlash, such as the illegal dumping of refuse. So far this year the district of Fürstenwalde to the east of Berlin has had to remove some 11,000 tonnes of illegally dumped refuse and 587 abandoned cars.<sup>32</sup> Instead, a 'carrot and stick' approach is increasingly preferred, whereby economic incentives are accompanied by attractive opportunities to save resources. These might take the form of grants to modernise heating systems, recycling specific materials to reduce the regular refuse disposal bill or participating in pilot projects to test resource-saving techniques. The appeal of such a combined policy is two-fold. Firstly, it offers people the chance to save money and thereby offset any higher municipal charges.

Secondly, it eases acceptance of higher charges by linking them clearly to environmental improvements, rather than using them to shore up municipal budgets. This illustrates a gradual shift in the function of local authorities from operating as 'controllers' to being 'enablers' in the field of environment policy; the second recent trend. Rather than simply monitor the implementation of the law, concerned largely with end-of-pipe measures, communes see the chance to play a role in problem prevention, or 'beginning-of-pipe' solutions. Being close to the public, they are in an ideal position to influence people's attitudes and habits on resource consumption. The particular attraction of problem prevention is, of course, the financial saving to both commune and consumer. Not only



can current bills be reduced, but the lower demand means less capacity and therefore less investment needed.

For this reason communes in Brandenburg are giving high priority to local advisory centres, publicity and educational measures to encourage energy saving and refuse reduction in local households, businesses and the public sector. They are taking advantage of free or low-cost advisory services provided by state bodies and quangos. The Brandenburgische Energie-Sparagentur (BEA) operates a team of energy advisors in 12 towns, advising communes on ways of saving energy and setting up energy concepts, passing on experiences from other regions. The Deutsches Institut für Urbanistik offers a package of introductory advice on the environment for communes, for which the Bundesstiftung Umwelt bears 85% of the cost. Whilst the potential for changing attitudes and practices in private households is widely acknowledged, there seems to be less appreciation of the advantages to be gained by persuading businesses to take greater account of environmental considerations. Local authorities could use their power to set environmental standards, say on new buildings, to much greater effect.

A third feature, especially characteristic of the new federal states, is the trend towards more flexible flow management strategies designed to raise standards at a pace more in tune with local capabilities. After an initial phase of investment in often large-scale, state-of-the-art technology, when communes followed the example of their west German cousins and the advice of many parties holding a vested interest, local authorities now appreciate that there has been misinvestment and are looking to ways - if the option still remains - of raising ecological standards and meeting legal obligations in a manner more commensurate with local resources. For example, instead of sparsely populated communes being served by a central sewage treatment plant, involving considerable cost for the plant and the connecting drains, they could each have one or several 3-chamber sewage pits, which at a fraction of the price could offer adequate treatment, if without any nitrate or phosphate elimination. In other words, decentralised units of a lower technological standard could provide a viable short- and medium-term solution until higher quality units are affordable. More than that, they could prove the wider value of decentralised services in achieving high quality where it is needed. What is required, then, are models of a flexible structure which can fulfil minimum requirements today and yet can be extended at a later date to satisfy the most exacting environmental standards.

Fourthly, the difficulties in implementing high quality flow management are making it all the more important for communes in the new federal states to coordinate their local resources - both material and human. So long as ecology is viewed and practised as a separate field of the administration, much of the current initiative will fall on stony ground. As an integral element of a local development strategy, however, its chances of acceptance will be far higher. In appreciation of this fact, local authorities are coordinating their approach to energy and refuse, in particular, with integrated concepts which offer an analysis of the existing situation, a plan for flow management and steps of implementation. One of the best examples in Brandenburg is the town of Rheinsberg, known as 'Brundtland-town' by virtue of its model role in reducing energy consumption. The Rheinsberg project, developed in cooperation with 2 towns in Denmark and Schleswig-Holstein, comprises an ecologically-oriented local energy system, a

programme of energy savings in buildings and a new district heating network capable of using heat from local bio mass sources and a power plant fuelled by wood chippings from the nearby forestry.<sup>33</sup> A key feature of all these flow management concepts is the involvement of all local protagonists, private and public, in what is essentially not a municipal but a common cause.

Extending the principle of coordination to a regional level is the next necessary step. Given the financial and technical limitations of such small communes, inter-municipal cooperation is vital for efficient flow management. After an initial phase of going-it-alone after the first democratic elections of 1990, which - though understandable - led to some misplanning and wasted investment, communes are increasingly coming round to recognise the need to work together. On their own initiative, neighbouring communes have formed joint organisations to supply electricity or run water and sewage services, in addition to the refuse administration unions mentioned earlier. The Brandenburg state government, meanwhile, is encouraging inter-communal cooperation as part of its concept for regional planning. In order to diversify pressure for development from the inner belt around Berlin onto peripheral areas, the state is implementing a model of 'decentral concentration' based on the strengthening of 6 cities in an outer ring some 60-80 km from Berlin. A key element of this policy is the recent creation of five regional planning bodies, each covering a wedge-shaped region from the Berlin boundary to the periphery.<sup>34</sup> How far these bodies, made up of district and municipal representatives, will be able to promote a much-needed regional dimension to flow management in Brandenburg, covering all aspects from coordinated funding to organisational structures, will have a determining influence on future development.

### 13.6 Concluding Remarks

Flow management in the state of Brandenburg is being determined in the immediate term by factors peculiar to post-unification Germany. The required quantum leap to meet federal and EC standards, the sudden superimposition of 'western' consumption levels on inadequate structures and strong competition from the private sector are forces which to this degree are unique to the new federal states. Nevertheless, the speed of transition from a socialist planned economy to a market system and the intensity of the problems facing flow management might offer a useful example for other countries in Europe, particularly those undergoing a similar process of sudden transformation. In the other direction, the gravity of the situation facing the new federal states makes it all the more necessary for them to draw on the experience of other European states and participate in a common learning process. In this vein I welcome such an opportunity here to exchange ideas and cooperate in what, after all, is our common cause: the sustainable development of all our communities.



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## Spatially Effective Strategies for Traffic Avoidance and Reduction

*Stefan Schmitz*<sup>1</sup>

### 14.1 Introduction

The enormous energy demands of modern affluent societies are among the main threats to the biosphere. Germany for example represents only about 1,5% of global population but is responsible for about 5% of global CO<sub>2</sub> emissions.

In three cabinet decisions taken on 13 July 1990, 7 November 1990 and 11 December 1991 the German Federal Government approved a comprehensive CO<sub>2</sub> reduction program with the objective of reducing CO<sub>2</sub> emissions by 25 to 30 % by the year 2005 in relation to the emission levels of 1987. Both the national climate protection strategy and existing international commitments consider also the reducing and limiting of other climate-relevant emissions.

Meanwhile the feasibility of the CO<sub>2</sub> objective is questioned by many scientists and politicians. At least it has to be assumed that the already taken steps together with prepared measures - e.g. an amendment of the Ordinance on heat protection (thermal insulation), an amendment of the Ordinance on heating facilities or the draft of an ordinance on heat use - are far from complying with the CO<sub>2</sub> reduction goal.

There are still numerous suggestions to save energy and to reduce CO<sub>2</sub> by technical means. In order to achieve substantial effects, conventional energy-related instruments as well as market-economic instruments have to be applied. But technical measures to save energy are nothing new. For decades, there has been considerable progress in thermal insulation, in efficiency of heating systems and in car engine technology. However, nearly all improvements have steadily been balanced out by growing energy demands.

Although car engines today are far more energy efficient than years ago, energy consumption in the transport sector is increasing corresponding to the fact that more people use heavier and more powerful cars and drive more frequent, faster and longer distances.

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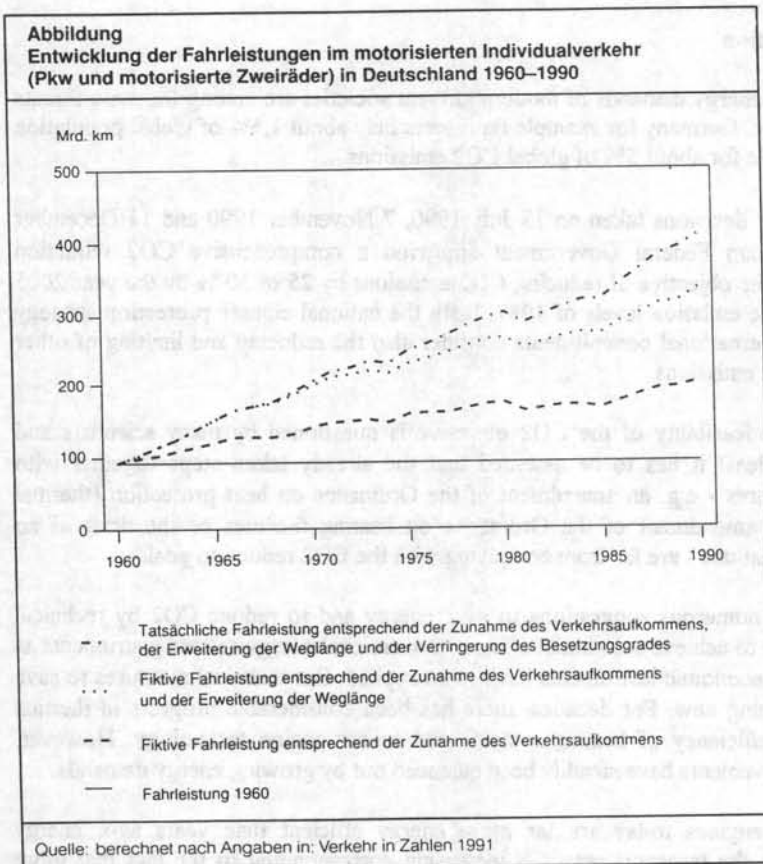
<sup>1</sup>

Federal Research Institute for Regional Geography and Regional Planning Bonn, Germany.

In spite of better thermal insulation there is a rising energy demand for heating purposes because living spaces are growing and households are becoming smaller.

## 14.2 Land-use and transport

For these reasons sustainable development means avoiding the ongoing increase of the demand for energy, mobility and comfort. This obviously makes it necessary to reflect upon our lifestyles and economic systems. Many aspects of our lifestyles and economic structures are closely related to our settlement structures and land-use systems. This is most obvious when focusing on transportation.



Spatial organisation of activities and spatial interaction are characterised by an enormous decrease in locational ties. Today, goods and services can be produced and consumed nearly everywhere. This is mainly due to a better accessibility of locations because of the decline of transport costs in terms of time and money.

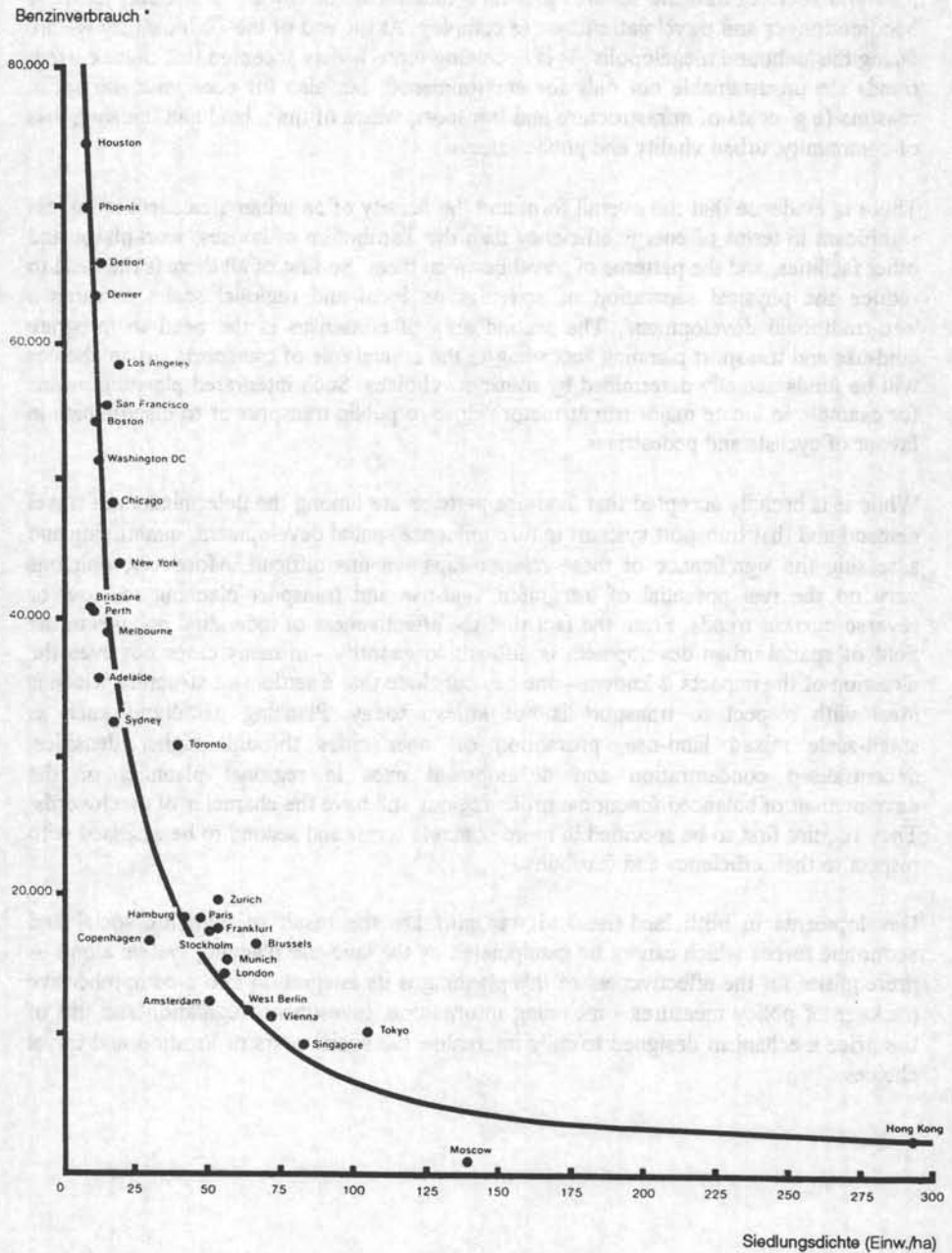
On this background land-use and transport trends interact to produce an increasingly mobile society. Dispersed location of facilities induce high car mobility, which in turn stimulates further physical separation of activities and further relocation of households, jobs and services into the suburbs and rural hinterlands of cities. As a result, journeys become longer and travel patterns more complex. At the end of the 20th century we are facing the 'unbound megalopolis'. It is becoming more widely accepted that these current trends are unsustainable not only for environmental, but also for economic and social reasons (e.g. costs of infrastructure and transport; waste of time, land and housing; loss of community, urban vitality and public safety).

There is evidence that the overall form and the density of an urban area seem to be less significant in terms of energy efficiency than the distribution of houses, workplaces and other facilities, and the patterns of travel between them. So first of all there is the need to reduce the physical separation of activities on local and regional scales towards a 'neo-traditional development'. The second area of consensus is the need to integrate land-use and transport planning according to the crucial role of transport: Urban choices will be fundamentally determined by transport choices. Such integrated planning means for example to locate major trip attractors close to public transport or to discriminate in favour of cyclists and pedestrians.

While it is broadly accepted that land-use patterns are among the determinants of travel demand and that transport systems in turn influence spatial development, quantifying and assessing the significance of these relationships remains difficult. Moreover, opinions vary on the real potential of integrated land-use and transport planning to slow or reverse current trends. From the fact that the effectiveness of individual policies in the field of spatial urban development is difficult to quantify - in many cases not even the direction of the impacts is known - one can conclude that a settlement structure which is ideal with respect to transport is not known today. Planning paradigms such as small-scale mixed land-use, promotion of inner cities through higher densities, decentralised concentration and development axes in regional planning or the development of balanced functional urban regions still have the character of catchwords. They require first to be specified in more concrete terms and second to be assessed with respect to their efficiency and feasibility.

Developments in both land-use and transport are the result of complex social and economic forces which cannot be manipulated by the land-use planning system alone. A prerequisite for the effectiveness of this planning is its integration into a comprehensive package of policy measures - including information, investment, regulation and use of the price mechanism designed to fully internalise the social costs of location and travel choices.

**Abbildung**  
**Siedlungsdichte und Kraftstoffverbrauch**



Quelle: Newman, P.; Kenworthy, J.: Cities and Automobile Dependence

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# Management of the Flow of Traffic: A Review of the Problem

*Henk M.M. van den Heuvel<sup>1</sup>*

## 15.1 Introduction

1. In Ankara, at the ECE conference last year, I gave a presentation about the 'Quality of the daily environment' project we are undertaking in the city of Dordrecht, in particular about some experiences and findings of the first phase of the project. Since then we have started with the second phase.

The first phase discussed the nature of the problem, with a particular emphasis on an integrated approach. The second phase will be used to develop the findings of the first phase into experimental projects and to define the actual problems against the background of the newly acquired knowledge. This final process again includes a review of aspects.

2. The research of Sybrand Tjallingii into 'Ecologically Sound Urban Development' presents two elements which are important for the steps we have identified. The first is the concept of the ecosystem. This means trying to find solutions within the smallest spatial entity - a house - before exploring a larger one such as a neighbourhood. The second element is the management of flows. He mentions four main flows: waste (matter), water, energy and traffic. What people do in their own homes is an important issue when we are concerned with the management of the separate flows.
3. It is always interesting to note that many professionals try to find solutions in the field in which they are operating, and experiments within the city of Dordrecht show us that the newly acquired knowledge makes the professionals enthusiastic. They try to find solutions in the production technology of end products, which are consumed by the public, and sometimes very successfully. I am aware that a great deal can be done without conflicting with the interests of ordinary people. Nevertheless the burning question remains of what will happen when the public becomes involved? Are we going to make the right investment decisions in the city? Should they be different when people become ecologically active?

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Director of the Centre for Social Geography (SGB), City of Dordrecht, The Netherlands.

4. Based on research of the Centre of Social Geography we concluded that a lot of people should be active but do not know how to begin in a way that they consider valuable. Because of this we began to contemplate experiments which would interest the public and concluded - based on the findings of the first phase - that an important condition for a successful experiment is that it creates a win-win situation, favourable for people and for nature.

At this time we discovered an experiment which had already been tested, called 'the Ecoteam Programme', promoted by Global Action Plan for the Earth (GAP), a worldwide organisation, that has recently been supported by the United Nations. The aim of this organisation is to solve the environmental problems within one generation!! The aim is then translated into targets per country. In the Netherlands 20% of households have to become a member of an Ecoteam during the next three years!

5. In the GAP programme ordinary people can start an Ecoteam which comprises six to twelve households. They receive a handbook which has to be worked through within seven months. The findings are reported each month to a central point, so that every participant can follow the results of the operation. Municipalities may support this action on a contractual basis with the GAP. Several municipalities all over the world have already entered into such a contract. I expect that the municipality of Dordrecht will also do so before the end of the year. It means that the city of Dordrecht will create both internal and external networks that encourage people to participate in the Ecoteam Programme.
6. This experiment would become more interesting in combination with another handbook, which has been developed by William E. Rees et al. of the University of British Columbia, Vancouver, Canada. In an article in 'Environment and Urbanization' Rees discusses some theoretical notions. It is remarkable that he tries to find a solution to environmental problems by integrating ecological knowledge with economic theory. We already know that environmental problems are first and foremost economic problems. His conclusion that 'ecology and economics share not only the same semantic roots, but also much the same substantive focus. In fact, it could logically be argued that economics is really human ecology', gives us something to think about.
7. Rees introduces the concept of the ecological footprint. The essence of this is that the consumption of goods requires a certain production of natural goods. From the economic point of view nature is the capital, which produces the goods. This production requires a certain amount of land. The conversion of consumption into square metres of land produces the ecological footprint of a household, a city or a country. Recently Mathis Wackernagel, William E. Rees et al. have produced a handbook on their work. So it is now possible to calculate the footprint of your own consumption. They have already calculated the footprint of the Netherlands as an example in the handbook, and as might be expected the footprint is much bigger than the area of the country, at least 17.6 times bigger!



8. Working with the Ecoteam Handbook it will be possible within a couple of months - as Mathis Wackernagel of the University of British Columbia has informed me - to calculate whether and at what rate the footprint will become smaller and more in equilibrium with the production of matter in nature. This equilibrium may also be seen as a way of quantifying the concept of the ecosystem of a city. It forms at the same time an interpretation of what may be called, with due reference to Opschoor, 'the environmental margins of the use of space'.
9. The findings have to be used to answer the question: in what way will the quantitative results influence the necessity of solving problems at higher spatial levels? Before the findings become available we can calculate the effects if the findings correspond with the target of the Eco-team handbook. The findings can be measured with respect to the four main flows.

I will focus attention on one flow which is very important for solutions at the level of the city and the region, the flow of traffic. Looking at the possible consequences we will try to say something about the management of the flow of traffic.

## 15.2 The flow of traffic

10. To control the flow of traffic we have to know the causes. We will start at the lowest spatial level as recommended by Sybrand Tjallingii in the ESUD-study: the home.

We distinguish two types of transport within the flow of traffic: the transport of human beings and the transport of goods. From the point of view of the physical needs of human beings we need food, clothing and a roof over our heads. In the development of human society we have changed our way of searching for food. In primitive times people hunted in the bush. Nowadays we need money to buy food in shops, and in general we need a job to get money. So it can be said that traffic caused by the necessity to satisfy our physical needs consists of traffic from home to workplace and from home to shops.

11. Another kind of traffic is caused by emotional needs. We want for instance to visit our family and friends and to see the world around us. This kind of traffic is usually called leisure traffic.
12. The difference between the two kinds of traffic is that we have in society set working times and shopping times and hardly any restrictions on leisure time activities. On the other hand it can be said that most of the leisure time activities take place outside the generally appointed working hours.

Another difference is that the workplace is fixed for most working people. The same can be said about shopping, but people have more choice with regard to shops than is the case with workplaces.

On the contrary the locations where leisure time activities take place vary widely as regards their distance from home. They may also differ from person to person or from household to household.

13. The most interesting questions in the field of controlling the flow of traffic, therefore, are to do with the part played by the home:
  - a. when one is looking for a home in combination with looking for a job?
  - b. as a reason to leave your home for leisure time activities?

These questions are also relevant from another ecological point of view. It becomes desirable to build sustainable houses as well as to keep the existing stock of houses in good repair. Traffic flow management and sustainable houses do not necessarily require the same solution.

Looking at houses we can conclude that they are in fact built for several generations. At the same time households occupy several houses during their life cycle. In the Netherlands they will move seven or eight times during a life cycle. The actual choice of a home depends on one's income and needs at the time, on the one hand, and the price-performance relationship of the desired house on the other. The price-performance relationship is generally less flexible than the development of income and the needs of households. This is the main reason for people moving.

#### **15.2.1 The choice of a home related to work**

14. Aloys Borgers and Harry Timmermans (1993) have published some research findings on the subject of the way residential location choice behaviour is related to the existence of public transport facilities and to distance to the workplace?

'The findings of this research indicate that the preference for a particular residential location is highly dependent on the characteristics of the dwelling and its environment, and to a lesser extent on the travel time to the workplace. The characteristics pertaining to transportation facilities seems to be less important'. This corresponds with the hypothesis we have put forward. It implies that the more rapid the transport facilities are the further the distance becomes within which one may choose. It implies too that it would be better to bring more ecologically sound transport systems to the neighbourhoods, where they are needed, than to force the inhabitants of ecologically sound dwellings to use transport facilities which are not available.

15. The development in the demand for houses has moved in the direction of more detached ones in a good environment with pleasant views. We concluded this after reviewing twenty years of our own research on the housing market in the Dordrecht region. It represents, in fact, a more general tendency in western society. Olof Wärneryd et al (1992) attempt to provide an explanation for these developments. They have traced the effects of changing lifestyles on urban growth in Sweden. It is important to note that the goal for most young people leaving

home today is similar to that of their parents. When we realise that the process of urbanisation started with the migration of people from the country to the city, one can expect that 'living in the countryside' or a suburb remains an option for many children who have become adults. Because of this a new revival of suburbs is expected by the end of the century in Sweden.

I have not traced the development in the Netherlands but due to general urban development in Western Europe we could expect a similar development, I suppose.

### 15.2.2 A reason to leave one's home for leisure?

16. When one is living in a house which one feels is not ideal, it is not always possible to move directly to a house which approximates the ideal. In that case it can happen that one looks for a second home which can be considered as a kind of counterbalancing home, the busy city and the peace of the country divided between two homes. In a recent research project we have tried to explore the question of whether the assumption may be true that there is a type of counterbalancing effect by people who live in certain types of houses. The research is being carried out at the moment in the municipality of Dordrecht. I can at present only relate the findings with regard to the type of house. It is to be expected that the environment of the dwelling is a factor which has to be taken into account. In the Netherlands 4 per cent of households have some sort of second home (CBS, Statistisch Jaaroverzicht 1993) and the situation has been relatively stable over the last four years. The touring caravan is popular in Holland. 8 per cent of households in 1987 and 9 per cent in 1991 owned such a mobile home. We have only looked at the second homes on fixed sites, where one could spend the night<sup>1</sup>.

17. The findings are that around 13 per cent of households have the opportunity to spend the night in a type of second home. In the case of the municipality of Dordrecht it means that the 110,000 inhabitants use land the size of a village of 15,000 inhabitants outside the city.

The differences between households living in an apartment and households living in other types of houses are negligible. The findings give rise to the supposition that a kind of counterbalance is present, generally speaking. Living in a city may possibly cause a higher incidence of second homes. In my opinion it stresses the importance of the choice of the first house and especially the location.

18. The provisional conclusion is that one can expect that the difference between the demand for houses and the supply of houses could create more traffic than would the case when an equilibrium exists. The type of neighbourhood could be a factor

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<sup>1</sup> The sample taken at random included 804 households, 211 of which lived in apartments. The possibilities were an actual second home, a caravan on a fixed site, or a seasonally rented fixed site, where one could place a touring caravan or tent. The first two possibilities are comparable with the possibilities which are used by the Central Statistical Bureau in the Netherlands. 5 per cent of households in the municipality of Dordrecht have such a second home.

which causes a desire for a counterbalancing use of space outside cities. The realisation of this desire creates leisure time traffic.

The location of the sites for second homes is related mainly to the coast, lakes and forests. When traffic is unavoidable the issue of rapid bus systems can be taken into consideration.

### 15.3 Effects of carrying through the ecoteam handbook

19. The target for the city of Dordrecht is to create conditions in such a way that 20 per cent of the households in Dordrecht will participate in the Ecoteam programme. When we achieve the number of 10,000 households and every household achieves the target predicted by GAP, we will be able to say that they have changed their travel behaviour and use 5 million fewer litres of petrol per year. It means that for short distances of less than 5 kilometres they use the bicycle or the bus, and when they use a car they drive more economically. On average they will save 20 per cent to 40 per cent of their usual petrol consumption. It also means they save money.

It may be that there will be a development of new services such as school taxis instead of second cars and mobile shops and tele-supermarkets. Such possibilities are included in ideas which are suggested by 'Environmental Resources Limited' in a book - called 'The Best of Both Worlds Sustainability and Quality Lifestyles' - which was written under the auspices of the Dutch Ministry of Housing, Spatial Planning and Environment (1993).

20. Follow-up research is one of our objectives, and we are not alone in this. The University of Leiden already follows the behaviour of existing participants in the Netherlands. Henk Staats of the University of Leiden told me that they have finished their preliminary research and will start very soon. So the real effects of participating in the Ecoteam Programme on the flow of traffic are not clear yet. As before we can only calculate some effects by assuming they realise a reduction of the use of petrol as mentioned.

The ecological footprint of inhabitants of the Netherlands is, according to Mathis Wackernagel, 3.98 hectares per capita. A large proportion of this footprint is caused by the use of fossil fuels (2.78 hectares per capita). If every Dutchman participated in the Ecoteam programme the footprint would be reduced by 16 per cent to 3.35 hectares per capita. If 20 per cent of households reduce the use of fossil fuels, which is the target for the next three years, the footprint will be reduced by 2.5 per cent to 3.85 hectares per capita. The footprint of the Netherlands would be reduced by 96,000 km<sup>2</sup> or 15,000 km<sup>2</sup> respectively, so that

it is 14.8 times or 17.2 times the area of the country<sup>1</sup>. There is still a lot to be done before the footprint is in equilibrium with the area of the country.

#### 15.4 The transport of goods

21. Considering the transport of goods I will once again start from the scale of the house. Kees Duivesteyn of the Technical University of Delft has developed a method, which gives the opportunity to think in terms of the normal situation (D), a better solution (C), a very good solution (B) and the perfect solution (A) concerning the application of the ecosystem at the level of the house. This method is also being used by the 'Quality of the Daily Living Environment' (KWADALO) and 'Building and the Environment' (BOMIL) project teams in the city of Dordrecht to stimulate constructors to build in an ecologically sound way. They have had a great deal of success with this operation.

The perfect solution concerning the use of energy and water is a zero-energy house where the handling of water is totally autonomous. It probably is not the cheapest solution but on the other hand you may ask whether an investment in the underground infrastructure is necessary. It may be expected that in the period of one generation many dwellings will be built and renewed in a ecologically more sound way. The effect on the transport of goods such as water and energy is at present not clear.

22. When we look at the more sustainable consumption goods, it becomes more and more clear that in the normal economic practice of the production of goods, enterprises try to find out in which country the price-performance relationship is the most favourable. Nowadays logistics is the management of the global pipeline. The growth of the transport of goods is greater than the growth of the economy as a whole. But, suppose the ecosystem principle is introduced more and more into the production of goods. What will happen?

Introducing the principle of the ecosystem into production technologies means an emphasis on recycling. As is well known the car industry is forced to build cars which will be recycled to a high degree. It can mean that the import of raw materials in Europe will be reduced. The perfect solution (A) will be a zero import of raw materials. One may expect that such a development has consequences for the major ports in Europe and specially for Rotterdam. It is not clear to what extent this will be substituted by other flows of goods, because the question is where the recycling will take place? The development of recycling is difficult to analyse due to the lack of available data.

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<sup>1</sup> Mathis Wackernagel et al have used the production of ethanol as a substitute for the consumption of fossil fuels in order to calculate the footprint. Other resources such as natural energy and hydrogen may be considered as substitutes for the production of ethanol.



## 15.5 Management of the flow of traffic

23. The aforementioned gives rise to the assumption that to date human behaviour concerning the choice of house does not support the idea that high density is desired by many people. Possibly there will be a kind of counterbalancing that will be greater if one is living in a city with a high density. This demands more research.

It may be more successful to offer a rapid bus system instead of widening motorways. The route of the rapid bus system would become an element in the urban network of traffic. As has already been suggested by the OECD and myself in Poitiers, workplaces could be created along these networks with shorter distances to the residential areas. The latter is already a political initiative in Dordrecht.

24. Within the built-up area of the city the creation of a network of safe cycling routes will give the people the opportunity to use their bicycles. This is already a political initiative in Dordrecht and is being converted into an action plan. The opportunity for people to really use their bicycles will be greater when the workplace is situated in a mixed environment. Recent - still unpublished - research by the Centre for Social Geography makes it clear that the actual use of bicycles on short trips to workplaces situated in industrial areas is substantially less. Perhaps a solution may be found by designing a more friendly environment for man in industrial areas.

25. A more integrated approach to investment in transport networks is desirable. The route to a more integrated financial approach is, however, difficult, because each transport system in the Netherlands has its own separate financial system with different actors on several governmental levels. A new integrated approach such as is already practised in the city of Curitiba in Brazil may be taken into consideration.

In addition, a type of raw material tax in combination with lower income taxes could create a climate for people to change their travel behaviour because of the fact that they may experience the new situation as a win - win situation.

26. The effects of introducing recycling in the production of sustainable goods on the volume of the transport of goods is a research subject that needs more attention in order to make clear what the effects are on the economic position of the different urban regions in Europe.
27. The transport of information has not been addressed in this paper, but it may influence the transport of persons as well as the transport of goods. A new development is that more attention is given to knowledge economy. The impact of this development on economic theory and policy is not clear yet. It may influence the treatment of information.



High-tech influences the transport of persons as well as the transport of goods, but it seems that high-tech creates a growing need for high touch. However, workshops such as these create as you realise .... TRAFFIC.

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## Levels of Scale: Barriers against Rolling off Effects

*Huibert Haccoû*

### 16.1 Introduction

Within the framework of the research project on Sustainable Development of Urban Systems a study is being conducted which focuses on the question of the (preventive and stimulative) conditions to be met at the appropriate level of scale, to facilitate and enforce ecologically sound behaviour on the individual level.

The levels of scale identified in the study are:

- Urban living environment: building, town quarter, town;
- Urban region: several municipalities up to the scale of a Dutch province;
- Urban network: several provinces up to the scale of the country as a whole.

The study deals with the tendency of problem solvers to externalize the problems to other scales (lower or higher), to other generations, to other sectors of governmental concern. These effects cannot entirely be avoided. Instead of focusing on how these rolling off effects create new problems, the study focuses on the same mechanism, but wants to analyze it for its use in a positive way. The key question is what conditions must be present or created at higher levels of scale to make ecologically sound behaviour possible at the lower levels of scale.

The study goes through the following steps. It starts off with a short review of the strategy and guiding models for ecologically sound behaviour as developed by Tjallingii in his study on Ecologically Sound Urban Development (ESUD) January 1993.

In the second chapter the focus shifts to the real world and describes the development plan for the area between the cities of Nijmegen and Arnhem. At the local level of scale, an extension of the city of Nijmegen is planned, north of the river Waal. In the so called leap across the Waal the state of the art in ecological development has been incorporated. At the regional scale, concepts and developments are of a more economic nature. There the prime focus is on the creation of distribution facilities (multi-functional distribution center) rail-, water- and road transport and on the development of industrial areas. To achieve this, negotiations are underway to create a combined regional authority from the local and the provincial involved authorities. At the national level these regional concepts link up with the concept of the urban ring.

The third chapter discusses guiding models for ecological development in three different disciplines:

- the ecological technological discipline (practical technological solutions);
- the spatial planning discipline (spatial planning concepts);
- the political science discipline (organisation development, policy analyses and planning approaches).

The exercise results in guiding models within the applied scientific disciplines.

In the fourth chapter these guiding models are combined in an improved ecological modelling and structuring of the area between the cities of Nijmegen and Arnhem.

The fifth chapter discusses the problems that may be expected when implementing this improved model for the region and deals with the key question of this study: how can one overcome the difficulties arising from various levels of scale when one tries to implement the ecological models and techniques. Three different approaches are used to develop a better insight in the inter scale relationships. The ecological technological dimension (by Tjallingii), the (urban)conceptual dimension (by Zonneveld) and the planning-procedural/ organisational dimension (by Haccou).

There is a certain logic in the urban projects (sandwich strategy) that dictates that ecological solutions should create a recognizable link between human behaviour and its environmental impact. This tallies with the idea that solutions should be implemented at the lowest possible level of scale to stimulate public participation (principle of subsidiarity).

This paper describes the state of the art with regard to the planning, procedural/organisational dimension. It belongs to chapter 3 and presents a policy making approach which aims at participation through creating a supportive base for the action plans. This is regarded as an essential factor for sustainability.

## **16.2 A policy making approach aiming at sustainability**

In the relations between central, regional and local governments one can also speak of (roll off) processes of externalisation. Apart from the interminable debate on financial aspects, the coordination and integration work has to be done ultimately at the lowest governmental level i.e. by the provincial government and municipality authorities.

In the Netherlands the provinces have an important task in integrating the policies of central governments (the ministries develop their respective policy guidelines in a very sectoral way) and developing integrated spatial plans and environmental plans. These provinces however are hampered by the inability of central government bodies to speak the same language to each other.

In spite of all the efforts the ministries make to develop integrated policies at the national level, they fail to succeed. Bureaucracy and power play means that a lot of energy is wasted in trying to integrate policy making at the national level.

Instead of nurturing the ambition to develop holistic operational plans at the national level, this paper advocates an approach that is more process-oriented and opts for a specific division of roles between the different levels of government.

### **16.3 Sustainable planning**

The central question is how integration is accomplished. By means of developing broad holistic concepts and working them out in operational national plans that have to be implemented by the lower authorities? Or in contrast to this, by means of a more metaplanning approach?

The ECOPOLIS Strategy which is a.o. designed for the participating city in which citizens are involved in the planning process, endorses this more process-oriented approach in which communication is an essential theme. Such an approach tries to facilitate and mediate between opposing and competing interests and mobilizes the expertise, wisdom and know-how for the planning exercise that helps to bridge the gap between environmental awareness and environmental behaviour and triggers active participation on the part of citizens on the good-housekeeping of their own urban living environment.

### **16.4 Experiences with a sustainable open planning approach**

A more open planning approach was introduced in an experimental setting i.e. the combined planning and environmental policy projects on a regional scale.

In this experimental setting, the central ministries relinquished their ambition to determine in detail the contents of a regional plan. Instead a more open attitude was taken towards the problem definitions of the key actors who had to contribute to solving the problems that were felt to be the most important within the region. These problems were not necessarily environmental ones but they had to have a link with environmental questions.

The Ministry Of Housing, Physical Planning and the Environment had a stake in the exercise because of the political goals that had been set for improving the quality of the environment. The ministry took the initiative of providing expertise to facilitate processes of cooperation and of getting the process going.

The social-economic problems of the region were first addressed, the strategy being to get the people who had the key to solutions to participate and act. Once joined in one process, the attention would necessarily shift towards environmental problems and the problems of the quality of the urban environment. Proceeding in this proactive and facilitating way, had a snowball effect and accelerated goal attainment.

The insights, prescriptions and guidelines that are gathered from these experiments can be summarized as follows:

More relaxed planning targets and attitudes which leave room for accommodating the national environmental quality regimes (from the planning and environmental angles) to the size of the region, greatly facilitate implementation. At the regional scale involvement and participation can be more easily activated when participants determine the agenda and the subject matter. For the purpose of integration on a regional and local scale, holistic integrated planning on national level is not a necessary condition. National planning authorities should formulate strategic concepts for every sector of government, understanding that not every strategic aim can, or has to be reached in every region of the country (it will depend on place and time and conditions). The mix of the strategic concept to be realized in an operational regional plan is determined by the regional actors.

The guideline to be drawn from these findings are:

- There is no need for holistic planning at the national level.
- It will suffice to develop per sector of government the strategic notion that regional and
- local authorities have to encompass in their planning, taking into account the characteristics of the region.

The region's problem profile will determine the national strategic elements that have to be dealt with in the regional plan. Integration at the regional level can count on both the appropriate mixture problem - and solving space to construct win-win situations with which carrying capacity for the implementation of the plan can be developed.

To this end a regional authority must trigger a process in which all the key actors are involved and which aims at developing a coherent vision on the environment, both that pays tribute to the functions present in the region (nature conservation, housing, recreation, industry etc.), an action plan in which both governmental (national, regional and local) and non-governmental actors contribute with the instruments at their disposal, contracts between governmental and non-governmental actors to execute the plan of action.

### **16.5 The bottom-upline**

The principle of subsidiarity its most simple form entails that the societal problems must not be solved on a higher level if it can be done at a lower level.

In line with this principle the sandwich strategy states that urban projects are situated between the decentral policies focused on technical solutions and behaviour and central policies focussed on technology development and development of preventive and stimulative conditions. In urban projects, ecological solutions should be integrated in a recognizable way. The sandwich strategy implies thus that solutions should be implemented at the lowest level possible to stimulate public participation. In addition, the sandwich strategy aims at reestablishing the link between environmental awareness and



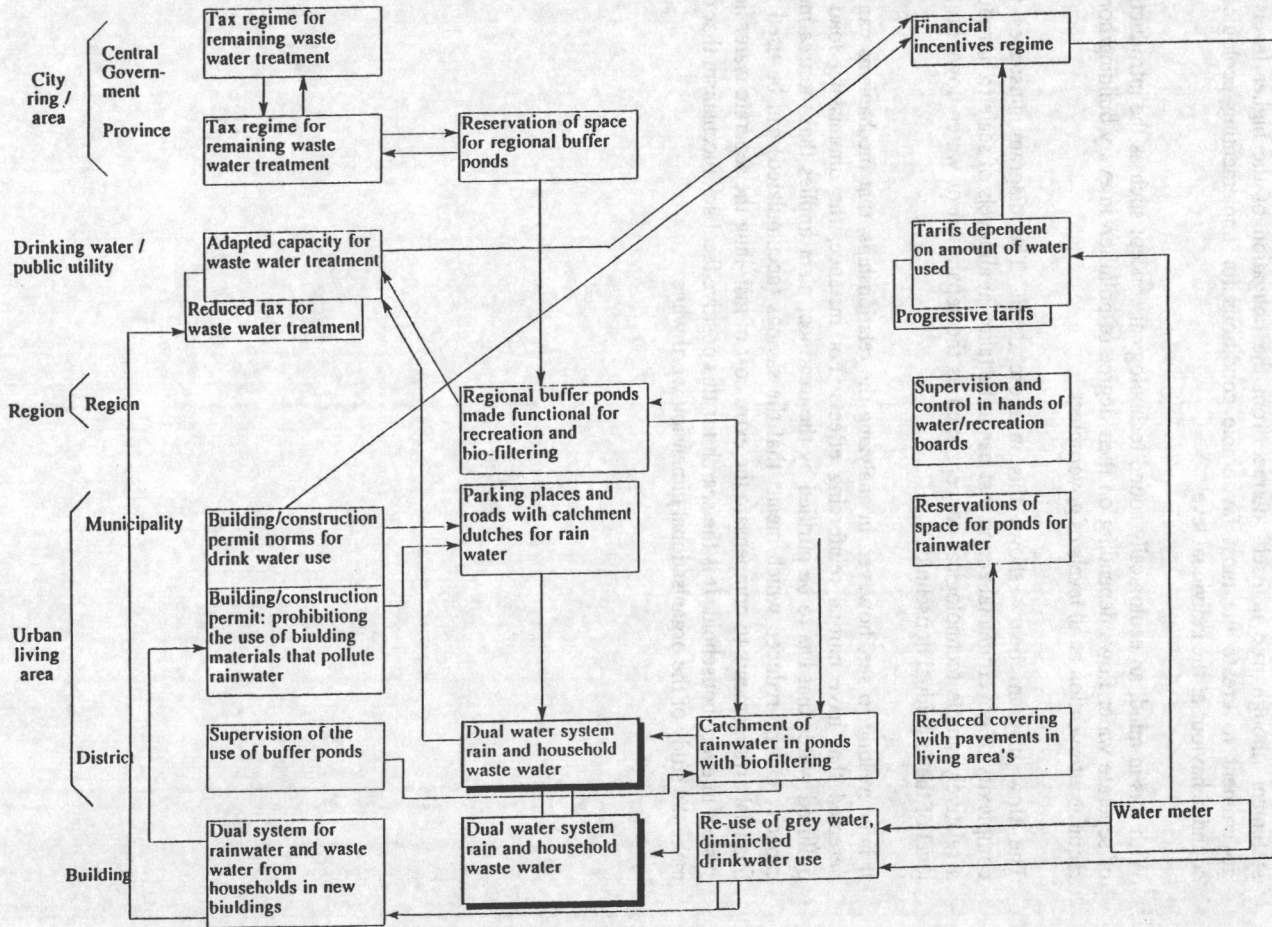
environmental behaviour in making the consequences of environmental unfriendly behaviour visible and tangible.

Solutions have to come from the bottom and have to be made for the bottom. But this statement, though true in itself, detracts from the obligation of the higher levels of government to create the most favourable conditions for implementing ecologically sound behaviour at the individual level.

With this in mind, an ecologically sound technological concept such as the introduction of separate water flows depending on their degree of pollution in every building/home, requires intervention at all levels of government.

The flow diagram below shows this in more detail. The diagram illustrates the complexity of governmental action that has to be taken at all levels of scale to introduce a relatively simple technological concept such as the separation of water flows on the level of the individual household.

It is interesting to see, however, in analyzing the relationships, that mechanisms can be detected that have mutual reinforcing effects. For instance, the diminishing load of polluted water that has to be purified by the treatment plant implies that the treatment capacity can be reduced which means that the savings (accumulated) can be used for financial arrangements to compensate the extra cost of installing the separate water flow system in every household. It is the search for this positive feedback mechanism that can make the study of the organisational dimension worthwhile.



## ***Part IV***

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### ***Conclusions and Recommendations***

Conclusions and  
Recommendations

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## Issues and Challenges

*Sybrand Tjallingii*

These final remarks resume and comment on the major issues that were discussed during the workshop. Some valuable suggestions that could be used to improve the ECOPOLIS strategy framework and its 'guiding models' are not discussed here but have been incorporated in the final text of the first chapter of these proceedings.

### 17.1 Sustainable flow management

#### **The challenge**

The concept of the city as a system of ingoing and outgoing flows is illustrated clearly by the diagrams presented by *Beer*. The diagrams seem to suggest that environmental problems particularly occur as a result of the pollution at the discharge side, but of course there are also problems caused by activities like mining and power production at the supply side. The challenge to urban planners is to develop urban systems that assume responsibility for what happens on both sides. The city as a link in the chain is the true objective of sustainable flow management.

Several speakers underlined the powerful trends of increasing traffic flows and growing refuse mountains overshadowing planning efforts to control these environmentally intrusive developments. End-of-pipe approaches prevail. The difficult task is to get a source oriented policy started.

#### **'Magnetic fields'**

The prevailing economic conditions act like a 'magnetic field'. They influence all decisions. Low fuel prices, for example, are generating cities built for the car. This is a step by step process. Under these circumstances offices, hospitals and university premises are being built in the urban periphery. People tend to move out of the city to live in suburbs and in the countryside. And this physical separation of functions again has a stimulating effect on car use, as was stressed by *Schmitz, van den Heuvel* and others. The Dutch policy on A, B and C locations, discussed in the Breda case study, is an attempt to counteract this development by giving priority to railway station locations. This policy is difficult to implement because it is contrary to the workings of the 'magnetic field'. However, it is successful in specific situations, for instance where offices prefer reliable trains to car traffic congestion. Once a good functioning alternative is available the 'magnetic field' may even change. Thus the physical presence of a good

functioning bus system in Curitiba caused 28% of car owners to opt for the bus. Here European cities might learn from the Curitiba example.

The 'magnetic field' also rules the waste materials flow. In Brandenburg, Moss reported, effective recycling systems that originated under the pressure of a shortage of raw materials and hard currency, were discarded rapidly after the re-unification of Germany. The transition to modern western technology for centralized treatment of waste and sewage requires high investments, far beyond the reach of local governments in Central Europe. Moss made clear that under these circumstances there is an opportunity for small scale decentralized measures. The learning process in Central Europe might generate new combinations of centralized and decentralized measures that may also be of interest to Western European cities in search of effective source oriented environmental policies.

So the rich may also learn from the poor. Systems developed in different 'magnetic fields' may offer lessons to learn. But in the context of capital intensive and highly industrialized economies it is very difficult to implement these ideas.

However, the ongoing discussions on 'energy tax' at the national and the European levels are highly relevant to these problems. With higher prices for energy and hence for transport, a different 'magnetic field' would be operating, beneficial to the development of sustainable flow management. Moreover, there are also local 'magnetic fields'.

#### **The role of local initiatives**

The necessity for international decision making and the long and difficult way still to go and this level, do not leave local governments paralysed and unable to take initiatives in their own area. Especially in traffic and waterfow planning a variety of local projects were described in the case studies presented at the workshop. The Breda case is an excellent example of integrated planning for water and transport flows as a basis for renewal and development of differentiated land use at the urban and regional level. But though it is based on existing local initiatives, the general approach is still at the planning stage. The smaller examples from Örebro and the full size Curitiba case show the real world perspectives of this approach.

Dordrecht has developed an effective tool to influence the choice of building materials, not by strict regulations but by publishing the preferences of the municipality that play a role in its choice of building contractors.

#### **The role of models in flow planning**

Lujanen, presented the EMICUS model, designed to assess the energy effects of building and transport planning alternatives. The model seems to be a useful tool to assess the energy effects at different stages of the operational planning process. However, it remains questionable whether this detailed insight is essential for decision making at strategic levels of flow planning.

#### **The Nimby dilemma**

Decision making on locations for central facilities like power plants, sewage treatment plants or waste incinerators is frustrated by serious opposition from people that do not like these big plants to be located in their backyard. As Burgess stated, the true problem



is not that these people are just selfish but that a few neighbours should be forced to accept the problems the majority is shifting to their doorstep. Apart from other disadvantages of end-of-pipe solutions, also fairness is a good reason to opt for the approach of the 'sandwich strategy'.

## 17.2 Sustainable planning for areas

### The challenge

*Van der Wal* highlighted the planning dilemma of reconciling spatial claims, on the one hand for housing and business areas, and on the other hand for green areas and open space. Within the context of daily decision making this certainly is a dilemma. The real challenge is to widen the scope of possible solutions by generating innovative types of land use and by trying to reach political consensus on regional spatial structures.

### Density

Most people prefer to live in a green rather than in a densely built urban environment, as was mentioned by *Van den Heuvel* and others. People who can afford it migrate to the suburbs and the result is building in the countryside, a high density of roads and peak fuel consumption, clearly demonstrated by the graphs presented by *Schmitz*.

The problem of density in urban settlements is one of the key issues in urban planning discussions. The idea of a 'compact city' has been developed chiefly as a reaction to the visual effects of urban sprawl. But also the pollution effects and the impacts on plants and animals should be considered. The introductory paper discusses these items.

*Ellefsen, Halvorsen Thorén and Nyhuus* reported about actual densification processes in Norway. Green structure planning seems to be an appropriate planning tool, but only so if it does also include ecological quality aspects. Not building does not automatically create conditions for a diversity of plant and animal life. The intensity of agricultural cultivation and urban maintenance practices has to be taken into account. Management and spatial planning should be tuned to each other. For this reason, among others, it was proposed to focus planning on the water network, as a carrying 'bloodstream' of the green structure.

But in doing so, will the planning for rain water retention in urban areas not lead to less densely built cities, and thus increase traffic flow, as is claimed by *van der Wal*? This seems true if we do not consider other options, like the possibility to incorporate rain water retention or infiltration in green area planning, or the option for a higher percentage of multistorey buildings, for example close to railway stations.

### Open space and green areas

The spatial structure of green areas should also reflect biogeographical connections enabling plants and animals to migrate from one habitat to another. In this way populations are able to survive. In many cases these connecting paths are linked to river valleys. These may also be used as public parks or recreational greenways and at the same time they may perform functions for flood control (Curitiba) or drinking water

supply (Örebro). In the Breda case also river valleys give spatial structure to the green area system. Thus a strategic network originates that can be influential in decision making on the location of urban activities.

But not only valleys contribute to this network. The case studies on Örebro and Breda also rightly point at dry 'infiltration zones' as important source areas belonging to the water system and therefore to be kept free from polluting land use. In the discussion also *Duhem* emphasized the limitations of an approach that only includes rivers and other surface waters.

*Ter Heide and Berends* suggest to further elaborate the 'types of neighbourhood', designed for different lifestyles. Thus it will become possible to attune this cultural diversity to the biotic and abiotic diversity. It remains questionable whether these specific types of neighbourhoods need to be defined by the government, or that this differentiation can be left to the self-organizing processes of the market and community initiatives within the limiting conditions of an urban network of public green areas.

#### **Spatial structure of traffic network**

*Schmitz* stated that 'the ideal city with respect to transport is not known today'. However, in her presentation of the Curitiba case, *Vallicelli* clearly demonstrated the significance of a linear spatial structure for the integration of land use and public bus transport. At the city level this may lead to a radial public transport network that connects residential and business areas. The stations may serve as the focal points for location policy. This is not a model for an ideal city, but it offers a guiding model to be used for its traffic network. Obviously also an attractive and safe network of cycle tracks is an essential element of this guiding model, as is demonstrated by the approach adopted in many case studies (Curitiba, Örebro, Breda). River valleys and green areas offer attractive environments for routing.

Providing good alternatives for private car use creates opportunities for speed limits, cutting off thoroughfare car traffic and other measures. Together these policy and planning instruments form a 'carrot and stick' strategy aiming at the reduction of private car use to the benefit of a liveable residential environment.

#### **Data and Monitoring**

Detailed information on all aspects of the built environment and open spaces, especially about abiotic and biotic elements, is essential for all planning efforts. *Beer* demonstrated an elegant and user-friendly Geographical Information System, developed at Sheffield University. The system provides a data base that can be used as a starting point for municipal environmental policy and physical planning, but also to monitor and assess the effects of municipal plans. The system is developed as a simple tool quickly producing maps of a great number of single characteristics and useful combinations of them.

*Ter Heide and Berends* propose a system of auditing at the regional level with the help of an 'amoeba' diagram, representing a set of policy decisions regarding flows and area qualities. This system seems to be appropriate for flow management, but for area qualities the 'strategy of the two networks' is more precise geographically. However, an

'amoeba' concept could be used as a complementary policy tool in operational planning for this category of decisions.

### **The strategy of the two networks**

In the Breda case, set up to test this strategy, the two network approach was elaborated to a step by step method, leading to a lobe model at the city level and a polynuclear model at the regional scale, both carefully tuned to the ecological characteristics of the local landscape. This implies there is, indeed, no 'ideal city model' but rather a general strategy that enables each city to develop its own ideal form. In doing so, of course the local qualities of both the built environment and the green areas, cultural and natural heritage, should be taken into account. The specific role of traffic and water networks in linking the area and flow approaches and in carrying the qualities of residential, commercial and green functions, makes these two networks suitable as the basic tools in long term physical planning. There seems to be no need to add the green structure as a third network at the same level of planning, as was suggested by *Halvorsen Thorén*.

In the discussions the question came up whether other flows like energy and waste are not also playing key roles in environmentally sound spatial planning. This question deserves further study. Undeniably these flows have to contribute to the adjustment of the final plan to local circumstances. But up to now only the spatially organizing capacity of the traffic and waterflows have made them suitable to perform a more general strategic planning function.

## **17.3 Participation**

### **The challenge**

*Beer*, stressed the traditional neglect of the biotic and abiotic aspects of the urban environment by the sectoral approaches. She also stressed that not only governmental agencies but also citizens and companies should accept responsibility for the quality of the urban environment. This idea was shared by many at the workshop and was also underlined by the EC Greenpaper and the OECD report discussed in the introduction. All actors have to participate in ecologically sound urban development. This implies there should be practical means for different lifestyles and different types of business to participate in their own way.

As a basis for all planning efforts to enhance this participation it is essential to deepen our understanding of the social and cultural processes leading to acceptance or rejection of more environmentally sustainable practices. In her research project on this issue *Burgess* found many people are facing serious dilemmas in balancing social needs and concern for the environment. Private cars, for instance are considered indispensable. Women, in particular, find it extremely difficult to perform their dual role as workers and mothers without the use of a private car. This does not affect, however, their propensity to prefer 'green articles' in shops or to recycle empty bottles.

These research findings one more illustrate the need for planning strategies which, on the basis of a general consensus on sustainable management of flows and areas, create conditions for individuals and groups to develop their own practical ways to combine it

with their own cultural social and economic goals and needs. This is fundamental for participation, as the paper of *Ter Heide and Berends* emphasizes. *Duhem* also referred to a general reluctance to adopt a specific 'ascetic' lifestyle as propagated by some environmentalist groups. Given a general need to gear unbridled consumerism to sustainable development, there should be created many roads leading to Rome.

Obviously disadvantaged groups of citizens in urban areas that are facing serious cultural and economic problems tend to think about the environment as a luxury problem that should not be given priority. The challenge to planners is to develop integrated approaches to complex problems. Environmental issues are not only part of the problem, they can also be part of the solution. *Ter Heide and Berends* suggested to focus on 'ecotech' approaches for those who have more money and less time and 'ecotouch' activities for those who have less money and more time to spend.

### **Municipal environmental programmes**

Several case studies, like Curitiba, Örebro and Dordrecht, demonstrated how local governments try to make citizens aware of the ecological nature of the city, through education and by making nature and culture contribute to the identity of the city. Municipal programmes and publicity aim to make ecology a part of the pride and prestige of the city. Important as these programmes may be to reverse the image of backwardness ecology still has to some citizens, the real impact has to be achieved by concrete activities in which different groups and ordinary citizens are able to participate. This is what *Burgess* called: 'making the abstract real'.

The 'waste is work' principle, as practised in Curitiba, providing jobs for the unemployed and integrating the formal and informal sectors, probably is the most fundamental form of participation, a truly integrated approach that meets the challenge mentioned above. Earlier in the Dordrecht ecology week this approach was also discussed for the specific situation of the participants coming from cities in Cameroon.

At the workshop examples of participation were discussed, including school children (Curitiba, Örebro, Sheffield), households, retailers (Örebro) and other groups. Dordrecht set up a special working group to overcome the traditional barriers between the sectors in local administration. Multi sectoral workshops are being organized and an urban ecologist was employed to assist in the coordination of efforts in various departments.

### **Pilot projects**

Pilot projects, like the ecological district Ladugårdsängen in Örebro, demonstrate the way an ecological approach to flow management (traffic, energy, water and waste) can be integrated in the design and management of an urban area. They, of course, also provide us with indispensable information on the way people participate, on costs and on practical ways to organize sustainable urban development.

Dordrecht is planning its 'city fruitful' project to explore new ways of living and leisure in combination with an innovative approach to glasshouse cultivation. The matrix suggested by Naess and used by *Ter Heide and Berends* to classify urban ecological projects, is clearly showing the wide range of experimental projects. The matrix,

however, is not illuminating the link between rehabilitation projects (that may otherwise also include many preventive activities) and structural problems. It is this link that is so important to make the circle full swing from strategies to pilot projects and back.

### **An integrated approach to planning**

*Haccoü* criticized the efforts made to create integrated policy documents at the national government level. These efforts are doomed to fail because of sectoral differences and a great distance to daily life. Recent experiences in regional planning in The Netherlands revealed a high potential for cooperation of the regional actors reaching 'win-win' situations in a programme of environmental restructuring. Participation and environmental quality may benefit if the central government confines its role to creating strategic incentives and setting some limiting conditions.

This clearly is in harmony with the approach of the 'sandwich strategy' presented in the introductory chapter. A leading role of central government, however, is more likely to be indispensable in flow planning than in regional and local spatial planning. This does not imply, however, the regional level is less important in planning for flows. *Ter Heide and Berends* rightly stress the key role of urban regions in this respect.

### **17.4 The next steps for research**

In the discussion *Lambert* remarked that practical problems of daily decision making are missing in the ECOPOLIS strategy and the related guiding models. In a way he is right. The diagram below tries to illuminate this question. Many environmental problems can not be solved within the context of daily decision making practice. Research therefore should not only focus on ad hoc problems but even more on fundamental issues and on the context itself, for example on 'magnetic fields' or on sectoral traditions.

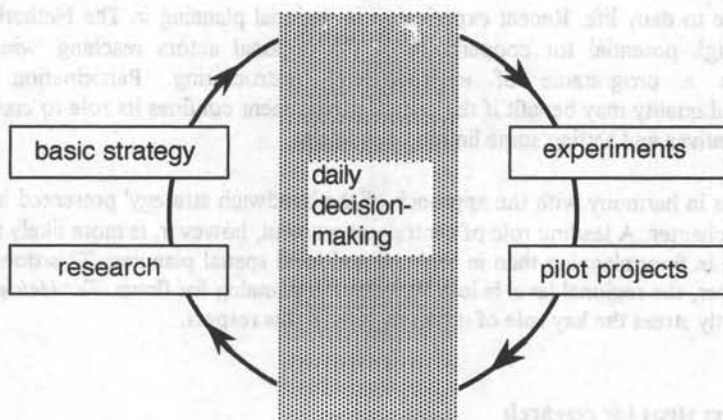
As a next step the results from research projects can be used to generate urban ecological strategies. The ECOPOLIS strategy is an attempt in this direction that tries to overcome the barriers created by the context of traditional sectoral approaches. Criteria to be used in daily decision making may be derived from the strategy. In this way the assumptions of the strategy can be tested and criticized. However, as many problems are linked to the present policy context, it will be necessary to create experimental conditions, for example by setting up pilot projects. A typical pilot project should be designed to open up doors for structural innovations. Here the strategy finds its real testing ground.

Thus a learning process is started that may result in improving the strategic concepts and eventually may enlarge the margins for daily decision making. The learning process, of course, is not only essential for the general strategy but even more so for the specific guiding models and for the ability of plans to create conditions for different lifestyles and businesses in the local situation.

*Ter Heide and Berends* point to the need for research on optimal values for recycling, for spatial diversity of neighbourhoods and for organizational levels to cope with



environmental problems. As far as these optimal values fit to the narrow margins of daily practice they may be very useful at the operational level. Parallel to operational practice, however, it will be necessary to develop the strategic approach. A number of concrete priorities related to different actors in the learning process are mentioned in the introductory paper.



During the workshop some networks of researchers from universities and institutes emerged. A group involving participants from Great Britain, Norway, Sweden, Denmark and The Netherlands decided to set up research cooperation on the role of green structure in urban planning. After their first meeting at Dordrecht, they met again in Sheffield in february 1994. Another group, including researchers from France, Norway and The Netherlands, decided to cooperate in research related to urban density problems. They had a second meeting in Oslo in june 1994.



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## Perspectives for further coöperation

*Dick van Alphen*

### 18.1 Working out the coöperation agreements

In these proceedings it is clear that the workshop was successful as a platform for the exchange of knowledge and experience in the field of sustainable urban development. The differing approaches and divergent research traditions in Scandinavia, the United Kingdom, Germany, the Netherlands, France and the eastern European countries were clearly highlighted during the workshop, and served to inspire both researchers originating from those countries with a well developed research tradition and researchers for whom ecological awareness and research in this field are still at an early stage. The importance of further exchange of information within the ECE and other contexts was widely supported.

The Platform for Spatial Research/ECE workshop underlined a research approach, mainly focussed on drawing up plans and less on the evaluation of plans. Ecological research is often concerned with the weighting and evaluation methods of non-economic measurable quantities in decisions about urban planning, design and management. In the case studies and strategies discussed during the workshop, the main question was how sustainable urban development can be achieved.

Furthermore, it was clear that a great deal of research is needed into the way in which, within existing socio-spatial circumstances, the pre-conditions can be created for sustainable urban development. That means that fundamental knowledge is needed about the (economic) circumstances which prevent an ecological planning approach, and the actual possibilities of altering this situation. The paper by Moss indicated what the possibilities are in this field in the eastern European situation. The public sector cannot only exert influence by building expensive infrastructure (for example, a waste recycling plant or nuclear power station) but also by rewarding innovative behaviour by households by reducing their taxes.

The fact that the workshop appeared to be an interesting mix of researchers and policy-makers in the field of urban ecology, which appeared to produce new angles and new information for all participants, contributed a great deal to its success. Moreover, it was explicitly stated that workshops such as this should take place regularly as they fulfil a clear need. They contribute in their own way to new knowledge and the creation of

information networks and form in this way an essential pre-requisite for international cooperation.

In this light the agreements about further research in relation to sustainable urban development, which were made at the end of the workshop, are important steps towards further international cooperation. The following are the most important themes:

- Research into green infrastructure in which the following are participating: the Agricultural University of Oslo, Norway; the Chalmers University of Technology of Göteborg, Sweden; University College, London, England; the Agricultural University of Wageningen, the Netherlands; and the SIB, Copenhagen, Denmark.
- Research into urban density, for which there is interest in France, the Netherlands, Norway, Switzerland and Finland.

International cooperation on these two themes is taking the following form:

- The initiative for the research programme on 'the role of green structure in urban planning' has been taken by researchers from Denmark, Great Britain, The Netherlands, Norway and Sweden. It is thought useful to make a start with this group, with the intention to extend the network of participating researchers and cities to eastern and southern Europe in the next future. The participants are already involved in research projects and investigations in this field. They expect to learn from a comparative analysis of case studies and from the exchange of experiences, methods, concepts and theories.

In the first stage data will be collected from 5 medium sized cities. Spatial structure, design, use and maintenance of green areas in 1950 and 1994 will be compared and, in addition, planning approaches during this period will be assessed.

- The research into the relationship between urban density and sustainability has only just begun in the three countries that are taking part in a workshop between 23 and 26 June 1994 in Oslo. Moreover, there are (still) differences in emphasis between the separate problem hypotheses. In Norway and France the emphasis is on increasing the density at the urban structural level in order to keep ecologically valuable areas free from urbanisation (compact city discussion). In France attention is being devoted to density and sustainability orientated on the, in terms of scale, more limited residential environment and the relationship is interpreted as a confrontation between the effect of the residential function on the physical space and carrying capacity. The initial findings of this research were presented in Oslo<sup>1</sup>. Further cooperation between the three countries has considerable potential. Further meetings are planned as soon as more (interim) findings of current research projects are available.

It is also good to mention here the 'twin cooperation' on which the city of Bamenda (Republic of Cameroon) and the city of Dordrecht agreed upon. As a result of the Dordrecht workshop a cooperation emerged between the two cities, the Agricultural

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<sup>1</sup> BRO Adviseurs (1994), Research project 'sustainability and density'; summary first results. Vught: BRO Adviseurs.

University and the Institute for Forestry and Nature Research, both at Wageningen, The Netherlands. In 1994 a group of 6 students from different disciplines went to Cameroon to join the Bamenda municipality in a project focussing on urban ecological issues, particularly waste management and composting of organic waste.

## 18.2 Strategies for coöperation

Since the above mentioned initiatives are merely a first stage in a process of international exchange, they can be lauded, even if the agreements refer exclusively to countries which - for the most part - have comparable levels of development. Firstly, there are differences in degree of knowledge which work as barriers when there is no form of reciprocity. A situation in which some partners are mainly consumers, because they are not themselves in a position to make an innovative contribution, is for the partners who contribute new information and knowledge of little interest. Initiatives for co-operation are, therefore, in general only viable if there is knowledge and information exchange on a reciprocal basis.

Secondly, there are institutional barriers in the form of the actual possibilities of developing and extending international contacts. The preparations for this workshop showed how many complications there can be for researchers (financial, organisational) to take part in such a form of international exchange. In general, it can be stated that the institutional barriers are smallest where international exchange of information has become routine. Countries which already have an internationally oriented research infrastructure, are in this field in an advantageous position vis a vis countries which still have to realise that high quality international contacts are necessary to be quickly aware of the latest knowledge in order to participate in international cooperation networks.

In the future efforts must be made to extend this cooperation to countries with a limited knowledge and research tradition in the field of sustainable urban development, such as the eastern European countries. It is important that these countries are encouraged to exchange knowledge and experiences with each other, and attempt to achieve cooperation, however difficult that may be.

International fora such as the ECE and other European networks can be an important stimulus by organising meetings at which important policy issues are discussed for which research is urgently required. In this way the researchers receive important pointers for the setting up of research programmes and projects, and make contacts in the policy circuits for the financing of the programmes.

An approach such as followed at this workshop, in which case studies and strategies in eastern Europe were given central prominence, can result in recognition of the small scale approach in eastern Europe as an example which is integrated in joint research projects with western European countries, which can learn from them. Participation from eastern Europe is desirable mainly for this reason: because of the lack of technological development there an approach is followed (of necessity) which can be more highly valued from the ecological-urban design perspective than is actually the case on the

ground. That is particularly the case where the workshop showed that, as a general strategy, local resources are being optimally utilised. In terms of implications of this for scientific research, general rules must always be sought based on specific cases or areas.

It is important to learn from practical experiments which are integrated in character, since the ecological approach in urban planning must be internalised into the everyday practice of planning, implementation and management. If this does not happen, the ecological approach in urban planning is limited to ecological cosmetics when a fundamental, different ecologically oriented approach is needed.

Practical experiments can, therefore, contribute in two ways to a learning process. Firstly, case studies can be set up which have the objective of bringing into contact and cooperation the many and varied policy areas and disciplines which must be involved in integrated ecological urban planning. This is a learning process in a broad sense.

In addition, there is a learning process in depth from practical experiments, namely through developing practical points of contact, with the aid of strategies and models, to make an ecological approach possible within the sectors which must be involved in sustainable urban planning. For example, Dordrecht, Orebrö and Curitiba revealed striking results in this respect.

### **18.3 Networks for cooperation**

In particular in the European context, networking is becoming more and more important, both with respect to effective influence on the policy of the European Commission and access to European research funds. In both areas, as far as sustainable urban development is concerned, important recent initiatives have been taken with respect to which cooperation agreements, made during the workshop, will be further developed.

In the policy field, at the end of May 1994 in Aalborg, Denmark, a Charter for the Sustainable Development of Cities was signed by representatives from 30 European and 3 non-European countries. This charter makes local and national governments jointly responsible for environmental problems and calls on local authorities to pursue more environmentally friendly policies because environmental problems, which manifest themselves at the national and global scales, originate in the cities. In addition it was explicitly stated that the cities which sign the charter "must base our policy-making and controlling efforts, in particular our environmental monitoring, auditing, impact assessment, accounting, balancing and reporting systems, on different types of indicators, including those of urban environmental quality, urban flows, urban patterns and, most importantly, indicators of an urban systems sustainability".

Furthermore, a network of sustainable cities was set up, with a campaign which will run for two years. One of the activities will be "to collect and disseminate information on good examples at the local level". The PSR/ECE workshop showed how important such an approach is for the further development of knowledge in the field of sustainable urban development. The possibilities created within the Fourth Framework Programme of the

European Union for the financing of demonstration projects can possibly play an important role in this information exchange. The 'Ecological Cities Network' can, moreover, play an important role in the preparation and submission of proposals for research projects within the Fourth Framework Programme.

Important in this context is the fact that the signatories are obliged to contribute to the implementation of the Fifth Environmental Action Programme 'Towards a sustainable future' of the European Union. This is a specific research programme for the environment within the Fourth Framework Programme for Research and Development, in which the emphasis should be placed on the effects of urbanisation, wastage of water and the different land uses.

The Fourth Framework Programme on Research and Development runs from 1994 to 1998 and has at its total 12.3 billion ECU's at its disposal. It contains in total 20 specific programmes in which for the first time all research measures which were spread over various policy areas are brought together. In this way it is possible to relate the research efforts more closely to each other, which with respect to research related to sustainable urban development is extremely important. Although financially rather insignificant, care for the environment, the quality of the existing situation and the removal of disadvantageous situations have come more to the foreground since explicit attention is given to the effects of research in society.

The possibilities for research in the Fourth Framework Programme are in concrete terms in the Environment and Climate Programme, in particular with respect to environmental technologies (part 2.6), the non-nuclear energy programme (part 2.11), in particular with respect to energy storage and energy optimization in urban transport, in the Transport Programme (part 2.12), in particular as far as mobility and urban transport are concerned, and in the Socio-economic Research Programme (part 2.13), in particular the development of indicators.

In addition the Fourth Framework Programme offers financial possibilities for cooperation between countries outside the European Union and with international organisations. International cooperation is particularly encouraged between the countries of Central and Eastern Europe, the developing countries and the major industrial countries outside Europe. In this way an instrument is available for cooperation between countries with a highly developed level of knowledge, suggested earlier in this chapter, in the field of sustainable urban development and for those with a less developed level of knowledge to work with each other.







# Appendix

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This publication aims at providing inspiration for further research and planning, contributing to the development of guidelines for sustainable human settlements planning and identifying possibilities for research coöperation.

Three major issues are discussed in these proceedings. Sustainable flow management is about the concept of the city as a system of ingoing and outgoing flows. The city should be seen as a link in a chain. Challenge to urban planners is to develop urban systems that assume responsibility for what happens on both sides. Sustainable planning for areas is concerned with the planning dilemma of reconciling spatial claims. On the one hand for housing and business areas and on the other hand for green areas and open spaces. The challenge is to widen the scope of possible solutions by generating innovative types of land use and by trying to reach political consensus on regional spatial structures. Participation means that not only governmental agencies, but also citizens and companies should accept responsibility for the quality of the urban environment. All actors have to participate in ecologically sound urban development.

The topic of sustainable urban development is still quite new and in progress. The various papers in these proceedings will provide a great deal of interesting information about the state of the art.

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