

1. Introduction

In recent years, pressing environmental warnings have forced national governments and international organisations to meet in world conferences and congresses, in order to have a better overview of the global environmental situation and, particularly, to jointly discuss the actions to be taken. During these conventions, a worldwide lack of information concerning the global and local state of the environment was pointed out. Both policy-makers and scientific communities became aware that, as environmental problems are equally spread around the world, only a common effort could enable us to face transboundary and/or global threats. In particular, international cooperation might provide assistance in singling out those sectors where the environment is more seriously damaged, and in quantifying such damages. Moreover, in the light of the concept of 'sustainable development', the need for common actions is enhanced. Underneath the complexity of this concept, there is the belief that human kind is causing an irreversible deterioration of the planet, by depleting its natural resources at a faster rate than they can be renewed or restored. Agenda 21 dedicates a whole chapter to the role and importance of accurate and reliable information as a key ingredient for sustainable development.

Accurate and comprehensive spatial data play a critical role in all areas of environmental management and sustainable development but a gap exists between acquired and processed data at all levels of aggregation and the information derived from it. That was one of the main conclusions of the Bridging the Gap Conference held in London in 1998.

Following several debates held at the highest decision-making levels, it is nowadays broadly recognised that any approach to environmental issues should be both integrated and multidisciplinary. However, the level of uncertainty concerning methods and strategies to be applied remains high. Regional groups of countries — like those belonging to the European Union (EU) — where a common supranational legislation provides assistance in coordinating actions, can better experiment with ways of setting up strategies, preparing guidelines, monitoring

the activities of the Member States, checking that deadlines are respected and disseminating information.

The environmental effects of urban growth are one of the main issues on the agenda of most EU countries. This report aims to contribute to understanding this phenomenon, taking into account that urban sprawl is currently one of the most important driving forces of land use changes and economic development.

1.1. Goals and framework

The European Environment Agency (EEA) plays an important role in this area through its objectives of providing the Community and the Member States with objective information necessary to frame and implement sound and effective policies. By ensuring that environmental data are comparable at European level, it aids broad dissemination of reliable environmental facts and stimulates the exchange of information. The EEA is dependent on input from many sources at national and international level. It puts a lot of effort into improving the quality and relevance of the data and information it receives and into streamlining data flows, in order to maximise the benefit and minimise the burden for all involved.

The EEA works closely with national focal points in the national administrations and with its European Topic Centres to define core sets of policy-relevant indicators and derived data requirements for several priority areas, identifying and avoiding redundancy and duplication in current reporting activities.

The EEA has helped develop a consistent and comprehensive structure for its work on indicators, to bring together information needs under the EU sustainable development strategy, sixth environmental action programme (6EAP) and sectoral integration activities (the so-called Cardiff process) into one coherent framework. Headline indicators, environmental indicators (as in the Signals reports series) and sectoral integration indicators (as in the TERM / transport and environment reporting

mechanism report series) (as in the TERM / transport and environment reporting mechanism report series) are all part of this overall package. In this context, the EEA works closely with partners within and outside the Community framework, including Eurostat, United Nations Economic Commission for Europe (UNECE), World Health Organization (WHO), Council of Europe and the Joint Research Centre (JRC). The Directorate General Joint Research Centre (DG JRC) of the European Commission (EC) is in charge of providing scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the EU.

A memorandum of understanding was signed between the EEA and the JRC in 1999, and a joint work plan for 1999–2000 has been systematically implemented concerning mainly the following thematic areas:

- the development of policy-relevant indicators in the fields of nature protection and biodiversity assessment, land cover and land use, soil, marine and coastal areas, and urban areas;
- spatial data and GIS information management support including the characterisation of a European river basins map to support monitoring and reporting under the water framework directive and the EU strategy on biodiversity;
- Clean air for Europe programme — joint support to DG Environment.

In order to be relevant, the information provided by the EEA is structured in four steps:

- identifying redundant monitoring and data;
- streamlining and focusing existing data into policy-relevant indicators;
- improving the data flows and institutional arrangements to avoid duplication and maximise timeliness and efficiency of reporting;
- developing new information needs and assessment tools based on emerging perceptions and priorities.

Over the last two years, the EEA made several strategic decisions concerning dissemination of information tools, including via its web-

based network and information clearing-house called EnviroWindows, a public platform for dissemination of environmental information and data from different actors. This EIONET extension for business and local authorities, which will enable the use of a single electronic repository, provides information for the public in line with the transparency principles of the Aarhus convention (Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters).

In line with these strategic orientations the EEA also started to work on the Urban Communication Platform, as a general tool for dissemination of data and information on urban issues. This tool is proposed to be an open, public, Internet-based platform also accessed through EnviroWindows. Basically, it will offer cities and other stakeholders a source of information and a 'meeting point', to promote and share best practices at different levels.

The Urban Communication Platform was launched at the Hannover 2000 Conference — the third European conference on sustainable cities and towns — as a tool to support, among other projects, European common indicators — Towards a local sustainability profile, a project initiated by DG Environment in March–April 1999. To support the reporting aspect of the common indicators, cooperation with the UNEP GRID-Arendal CEROI (Cities environment reports on the internet) project has been developed, to help adapt the European common indicators.

Finally, negotiations between the European Commission and 13 candidate countries in central Europe and the Mediterranean area on membership of the EEA were successfully concluded in 2001. The new members that have joined the EEA at the beginning of 2002 resulting in a constellation of 31 countries stretching from Iceland to the Caucasus and from Lapland to the Mediterranean. The EEA is the first EU body open to the candidate countries in the enlargement process and provides a pan-European dimension (60 % increase in area and 45 % increase in population) requiring responses to different geographical characteristics and environmental priorities.

The existing cooperation between the EEA and the JRC gave rise to the idea of

generating a joint report on one of the most prominent environmental topics: urban sprawl. A successful research project — Murbandy/Moland — launched and coordinated by the JRC, researching environmental impacts of urban sprawl, has led to some major findings, which are presented and discussed in this report.

Murbandy/Moland project analyses in depth the spatial evolution of a selected set of urban areas with the aim of proposing a methodology for strategic monitoring of the effect that cities have on the environment. Such effects are already recognised as extremely negative for the sustainable development of the whole planet, and actions are being taken at international level to understand and reduce urban sprawl.

This report sets out to describe and assess the results of the Murbandy/Moland project developed for 25 cities and urban areas in Europe. This project is able to organise databases and derive relevant information to construct indicators that can give information about spatial processes such as urban growth, land use changes, intensity and directions of urban sprawl, role of transportation networks, etc. This knowledge is essential, considering the current debate on urban environment indicators. The search for a set of sustainability indicators is an important effort towards the development of common methodologies to achieve sustainability at global and local scales.

While in the past most spatial information was the prerogative of government-sponsored research institutions, resulting in the traditional spatial analysis — the bound atlas — this model is quickly being superseded by digital maps and networked databases, in what we can call new generation atlases.

The development of a (new generation) urban atlas is a strategic goal in the long term. It is an opportunity to coordinate and disseminate urban information and indicators amongst all potential users in line with the concept of sustainable management of urban areas.

1.2. Urban issues

Sustainable development has generated a new kind of thinking. Problems that had, until now, only been taken into moderate

account, have revealed their complexity. Amongst them, one has emerged as an overwhelming priority on the international agenda: urban sprawl. This phenomenon is a complex process that derives from distinctive geographic, demographic and economic circumstances. This pattern, visible all around the world, is generated by current consumption trends and life styles which influence transportation networks and land use changes. Property structures, legal regulatory planning procedures and environmental constraints are some of the further factors that influence urban development patterns.

According to Nivola (1999), urban settlements can grow in only four directions (Figure 1.1):

- in, by crowding;
- up, by increased density and height, such as skyscrapers;
- out, by sprawl, known in many cases as ‘oil spill’;
- down, by subterranean development.

Growth is likely to follow all these patterns, but with greater incidence of the oil spill development pattern (‘out’ growth direction). Urban patterns have been shaped through formal and informal policies and identification of the driving forces is an important field of research in order to understand and improve planning processes.

The most evident effect of sprawl, which leads to extensive patterns of peripheral and suburban development, is perhaps land use change and consumption.

Natural and cultural landscape features are highly threatened, and natural resource consumption and depletion occur. Land use changes must also be seen from the landscape point of view, assessing their effects on landscape structure, connectivity and ecological functions. Spatial dimensions of urban and environmental impacts show the need to develop a new relationship within cities between culture and nature, in order to reconcile urban development with ecological balance. An important field of research towards sustainable planning and management consists of identifying the driving forces of this increasing phenomenon.

The world's cities are, in fact, currently growing by a million people each week, and half of the 6.5 billion people of our planet are already living in towns and cities.

Nevertheless, urbanisation continues and, according to UN projections, in 2025 more than two thirds of us will be city dwellers. Europe is one of the most urbanised continents and already more than 70 % of its population is urban, and more than 25 % of the European territory has population densities above 100 inhabitants per square kilometre (km²). What are the environmental consequences of such patterns? What is the link between urban sprawl and sustainable development? These are the main questions, which should be addressed.

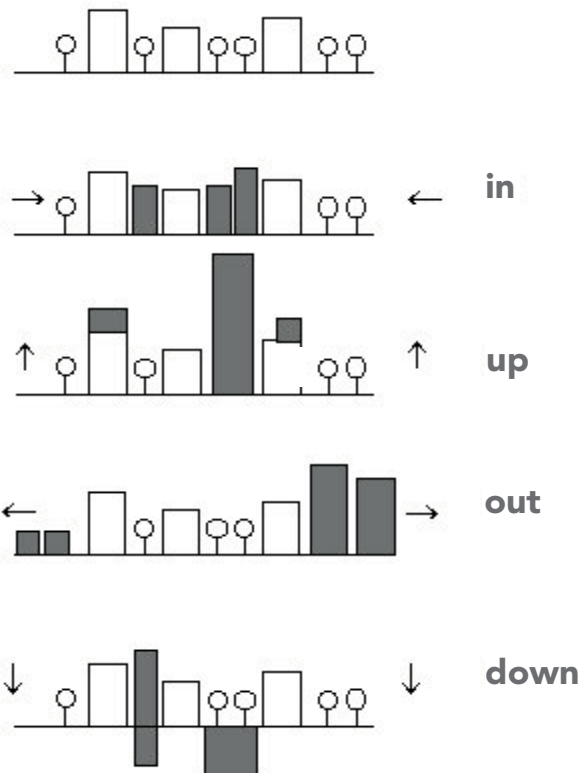
When addressing urban sustainability, city managers and local planners tend to approach the question from a city-centred point of view, focusing on problems such as unsuitable land use, lack of green spaces, rising traffic congestion and pollution. Their actions are dedicated to meeting the requirements and needs of the urban dwellers, who are the main observers of their operations and are willing to recognise policies that are directly beneficial to them. The city is perceived by the people who are used to living within it as a system somewhat isolated from the surrounding background. Still, urban sustainability can — and should — be viewed from at least one other perspective.

Recent studies, while keeping the city at the core of their analysis, consider urban areas as systems directly connected to their regional backgrounds: 'The ability of a nation to prosper in today's highly competitive global economy will depend upon the economic performance of its regions and upon the health and vitality of the cities at their core' (Stegman and Turner, cited in Johnson and Silver, 1996). Such studies point out that, while cities grow to be centres for wealth creation and economic development, they metabolise a large portion of the resources needed to sustain human societies, affecting areas even at a great distance from their location. 'Perhaps the most important insight from this result is that no city or urban region can be sustainable on its own. Regardless of local land use and environmental policies, a prerequisite for sustainable cities is sustainability of the global hinterland' (Rees, 1996). The problem is further enhanced by a continuous migration towards the cities, and by the consequent territorial sprawl and

Main growth directions of urban settlements

Figure 1.1

Directions of urban growth



economic growth, which generate an imbalance between the city and the adjacent areas. An increasing number of regional economies depend on those of their cities, while more and more cities depend on their regional background for supply of resources. Sometimes, problems consequent upon urban sprawl are so dramatic that questions are posed on the sustainability of large regions surrounding the metropolitan area: 'How we anticipate, recognise, measure and interpret urban problems and how we respond to them will determine the overall sustainability of human development' (UNHCS, 1997).

Clearly, the topic involves so many scientific and social disciplines that it is difficult not only to understand how the whole system works, but also to define its limits. Cities are complex entities influencing — and influenced by — an extremely broad constituency that goes beyond pure administrative and geographical borders. Moreover, the great diversity of the territory in which cities are located introduces problems of different scales and dimensions, which makes difficult, if not impossible, a homogeneous planning strategy. Planning for urban areas is, hence, a challenging task when addressing sustainable development.

1.3. European focus

The ongoing debate and search for sustainable urban planning and management is a main concern of decision-making in scientific and institutional arenas. Even if sprawl is not a typical European phenomenon, it is particularly felt in the EU. 'Urban settlements are increasing in Europe with cities continuing to sprawl, causing land use stress and social inequities. The population living in urban agglomerations will increase by more than 4 % over the next 15 years' (EEA, 1999). In the European Union, about 80 % of the population lives in cities and towns, which are therefore the places where the environmental problems most touch the quality of life of citizens. European urban areas suffer from the increasing use of energy, natural resources and pressures on living space even if the population increase is relatively small. In general, the demand for residential areas, social facilities such as parks or sports facilities, and infrastructure such as transport corridors, puts pressure on available space. Several cities may be reaching their limits of sustainability under the current spatial organisation of the urban landscape. The enlargement of the EU will contribute to increasing the spread of 'geographical characteristics' of urban agglomerations with related new issues and trends, including those deriving from migration.

Quality of life in urban areas is high on the agenda of city administrators as well as of the European Commission. Five aspects of particular importance to the sustainable development of towns and cities have been identified:

- control of the physical expansion of towns and cities;
- mixture of functions and social groups (which particularly applies to large cities in which increasingly large sections of the population are threatened by exclusion from urban society);
- wise and resource-saving management of the urban ecosystem (particularly water, energy and waste);
- better accessibility by different types of transport which are not only effective but also environmentally friendly;
- the conservation and development of the natural and cultural heritage.

The Community Framework for cooperation to promote sustainable urban development clearly refers to the fact that the policy options related to Agenda 21 and the Habitat Agenda can best be implemented by a multisectoral, integrated urban development strategy.

'Strategies and instruments helping to achieve sustainable urban development strongly depend on local, regional and national conditions of the towns and cities of the Member States.

'Member States and regional authorities should pursue the concept of the 'compact city' (the city of short distances) in order to have better control over further expansion of the cities. This includes, for example, minimisation of expansion within the framework of a careful location and settlement policy, as in the suburbs and in many coastal regions. It will only be possible to stem the expansion of towns and cities within a regional context. For this purpose cooperation between the city and the surrounding countryside must be intensified and new forms of reconciling interests on a partnership basis must be found.

'Accessibility of cities has an important influence on the quality of life, the environment and economic performance. Accessibility should be promoted by a spatial policy for location that is compatible with land use and transport planning.

'The aim should be to reduce the expansion of the towns and cities and to adopt an integrated approach to transport planning' (European Commission, 1999).

Indeed, many EU policies have an important urban relevance. The Community has the responsibility to ensure that its policies become more effective by taking into account the potential of urban areas and the challenges facing them. This requires the implementation of a monitoring and assessment framework to quantify and compare information on the environmental impact of development and policies throughout Europe. New technologies should be assessed and subsequently adopted to increase efficiency and ease of implementation by the appropriate bodies at European, national, regional and local level.

1.4. Role of the European Environment Agency

In order to achieve environmental protection and improvement, as well as sustainable development, the main objectives of the EEA are:

- to provide objective, reliable, comparable information enabling the Community and Member States to frame, identify, prepare, implement, monitor, evaluate and assess the results of sound and effective environmental policy measures and legislation;
- and for this purpose to collect, record, collate, process, analyse and assess data on environmental quality, pressures and sensitivity, making it possible to describe the present and foreseeable state of the environment.

The EEA was set up as a legally independent Community body under EC Regulation 1210/90, adopted in May 1990 and revised in 1999. The EEA started working in Copenhagen in 1994 with the specific mandate to deliver timely, targeted, relevant and reliable information for environmental policy-making and for the assessment of environmental achievements and outcomes.

This purpose is pursued by orchestrating the development of a shared multi-purpose information system for Europe's environment which has multi-source inputs, multiple outputs and multiple needs of clients and users and is based on sound science and common frameworks of understanding and networking with EU institutions and Member States.

This work is carried out by the staff in Copenhagen, by five European topic centres (ETCs), national focal points (NFPs) and national reference centres (NRCs) in the EEA member countries and in cooperation with EC services and international organisations.

The main clients of the EEA are policymaking agents in the European Commission, Parliament, Council and member countries as well as other policy developers, decision-makers and implementers. The general public, in particular key actors whose tasks are to comment on and influence policy or who can disseminate EEA messages to a wider audience, such as non-governmental organisations, environmental and business organisations, media and national advisory groups or persons, can also be considered as clients.