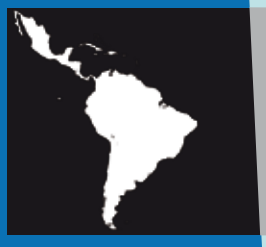


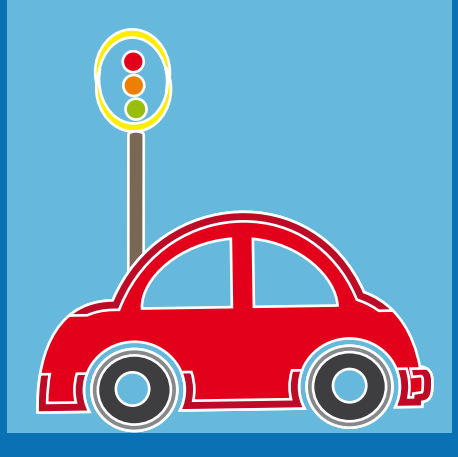
Methodology

for the preparation of

GEO Cities Reports

Training Manual

Version 3



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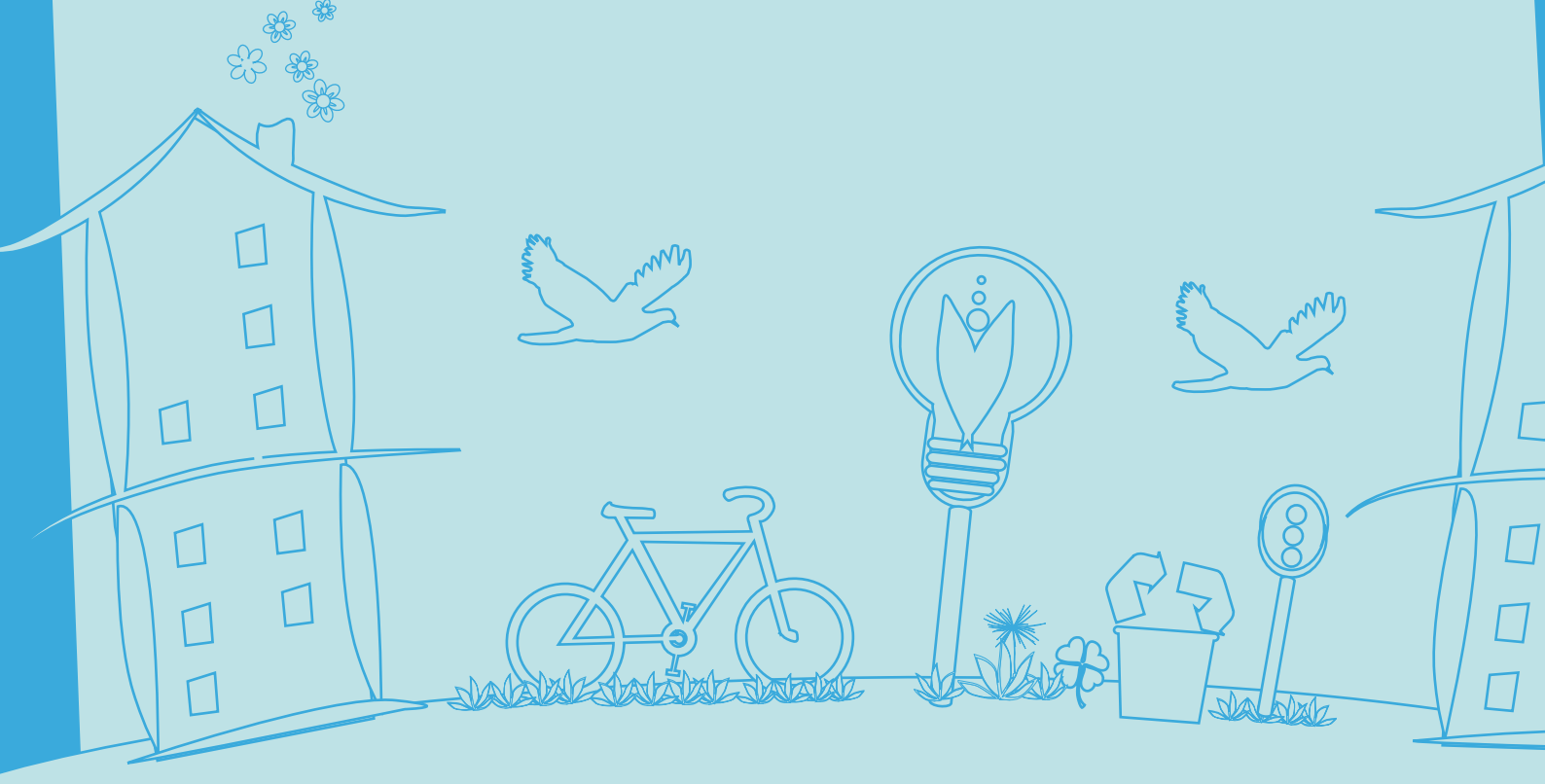

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We also express our thanks to our colleagues in UN-HABITAT whose experience of almost 15 years in preparing environmental profiles of cities provided inputs to develop this third version of the manual, and for joining forces with UNEP to help cities, by using this methodology, to develop their integrated environmental assessments (IEA) or GEO reports.

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Table of contents

List of Acronyms

CAMISEA	Natural Gas Project in Peruvian Amazon
CEROI	Cities Environment Report on the Internet
CONICET	National Council of Scientific and Technical Research (Argentina) *Consejo Nacional de Investigaciones Científicas y Técnicas (Argentina)*
ECLAC	Economic Commission for Latin America and the Caribbean
CONAM	National Environment Council (Peru) *Consejo Nacional del Ambiente (Perú)*
FTA	Free Trade Agreement
FTAA	Free Trade Area of the Americas
GEO	Global Environment Outlook
IBAMA	Brazilian Institute of Environment and Natural Renewable Resources *Instituto Brasileiro do Meio Ambiente y de los recursos naturales renovables*
IEA	Integrated Environmental Assessment
IISD	International Institute for Sustainable Development
IMAE	Environment and Ecology Institute (Argentina) *Instituto de Medio Ambiente y Ecología (Argentina)*
IPCC	Intergovernmental Panel on Climate Change
MMA	Environment Ministry (Brazil) *Ministério do Meio Ambiente (Brasil)*
NGO	Non Government Organization
OECD	Organization for Economic Co-operation and development
PARC21	*Consorcio Parceria 21*
RMSP	Sao Paulo Metropolitan Region
ROLAC	Regional Office for Latin America and the Caribbean
SCOPE	Scientific Committee on Problems of the Environment
SEDAPAL	Lima´s Drinking Water and Sewerage Services *Servicio de Agua Potable y Alcantarillado de Lima*
UN HABITAT	United Nations Human Settlement Programme
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNSCD	United Nations Commission for Sustainable Development

Preface

The GEO Cities Project is part of the GEO (Global Environment Outlook) series of reports of the United Nations Environment Programme (UNEP); the series was initiated in 1995 with periodic reports being published on the state of the environment at global, regional, sub-regional, national and urban levels. This initiative led to an important group of reference documents being prepared on the environment including: at global level, Global Environment Outlook (GEO 1, GEO 2, GEO 3, and GEO 4); at regional level, Global Environment Outlook for Latin America and the Caribbean (GEO LAC 2000, GEO LAC 2003 and GEO LAC 2009); at sub-regional level, (GEO Andean, GEO Caribbean, GEO Central American) and at national level (GEO Peru, GEO Costa Rica, GEO Chile, GEO Brazil, GEO Barbados, GEO Nicaragua, GEO Panama, GEO Bahamas, GEO Cuba, GEO Guatemala and GEO Mexico, among others). Also published are thematic reports: GEO Amazonia and GEO for Youth in Latin America and the Caribbean, a document designed to promote environmental awareness among young people.

The fundamental objective of the GEO Cities Project is to promote better understanding of the interaction between urban development and the environment, providing the region's local governments, scientists, policy-makers and the general public with reliable and up-to-date information to help them improve urban environmental planning and management. The GEO Cities Project publishes assessments to provide information on the state of the environment, the main factors for change, policies affecting the environment and emerging themes.

This Project is a response to Agenda 21, decisions of the UNEP Governing Council, the Malmö Ministerial Declaration adopted by the Global Forum of Ministers of the Environment (May 2000), the Latin American and Caribbean Initiative for Sustainable Development passed by a Special Session of the Forum of Ministers of the Environment of Latin America and the Caribbean at the World Summit on Sustainable Development in Johannesburg in 2002, and the Millennium Development Goals, especially Goal 7 "To ensure environmental sustainability".

GEO Cities Project - Background

- The 13th meeting of the Forum of Minister of the Environment of Latin America and the Caribbean (LAC) (October 2001) requested UNEP to prepare integrated Environment Assessments on urban zones.
- In 2001 the Ministry of the Environment of Brazil (MMA) proposed that the Integrated Environmental Assessment (IEA) / GEO methodology be adapted at city level.
- In November 2001 the first workshop was held in Mexico City to officially put into effect the GEO Cities Project.
- The first phase of the project began in 2001 with 7 pilot cities: Rio de Janeiro, Manaus, Mexico City, Buenos Aires, Santiago, Bogotá and Havana.
- In November 2003 the second regional GEO Cities workshop was held in Lima, Peru, with 10 new cities participating.
- In 2003 the first version of the Methodology to prepare GEO Cities reports was published in Spanish
- In February 2004 UNEP's Regional Office for Latin America and the Cafribbean (ROLAC) and UN-HABITAT/ROLAC signed the Environmental-Urban Strategy for Latin America and the Caribbean.
- In May 2005 the Third Regional GEO Cities Workshop was held in Havana, Cuba, with 28 cities participating.
- In June 2005 UNEP participated with GEO Cities at the World Meeting on Sustainable Cities and Local Agendas 21 organized by UN-HABITAT in Havana, Cuba.
- In 2005 an English version of the Methodology to prepare GEO Cities reports was prepared.
- In August 2005 the GEO Cities Project was presented at the Fourth Environmental Urban Fair of the Latin American Environmental Authorities.
- In June 2006 the regional offices of UNEP and UN-HABITAT jointly organized the panel on Urban Environmental Planning at the Third World Forum held in Vancouver, Canada.
- Since it started with 7 pilot cities, 37 additional cities have been added, making a total of 44 cities.
- In November 2007 the GEO Cities Project was presented in Santiago, Chile, at the Sixth Seminar of RED (The Network for Environmental Management in Latin America and the Caribbean).
- In 2008 the third version of the Methodology to prepare GEO Cities reports was published.
- The methodology to prepare GEO Cities reports is an integral part of the GEO Cities Project, initiated by UNEP with technical support provided by Consorcio Parceria 21[1], and with financial backing by the Ministry of the Environment of the Government of Brazil (MMA) and the governments of Belgium, Norway and The Netherlands

[1] *Consorcio Parceria 21 comprises the following organizations: Brazilian Institute of City Administration (IBAM), Institute of Religious Studies (ISER) and the Human Development Network (REDEH), all very active locally and nationally on matters concerning the environment and urban development.*

I. Introduction

In Latin America and the Caribbean the concentration of the population in urban areas has intensified in recent decades, making it the developing world's most urbanized region with three quarters of its population living in cities. Five of the most populated cities in the world are in Latin America: Buenos Aires, Sao Paulo, Rio de Janeiro, Mexico City and Lima.

Cities make a significant contribution to a country's socio-economic development. They are, at all levels, important centres of productive activity and economic growth, playing a primordial social development role. They offer basic services such as drinking water and sanitation, education, health and housing. They are spaces of progress, culture, knowledge and political leadership. However, the speed at which they are expanding has negative effects on the quality of the urban environment and puts at risk their contribution to a country's socio-economic development.

There has been a marked deterioration of urban environmental conditions in terms of pollution of springs and aquifers, air pollution, deficient urban waste management, and of green areas and others that put the population's health at risk. To this is added the high incidence of natural phenomena that regularly affect the region (hurricanes, cyclones, earthquakes, volcanic eruptions and droughts), all of which have serious implications on how their human settlements are configured. The recurrence of these phenomena, combined with economic conditions and institutions so structured that they have limited capacity to prevent and mitigate their consequences, have converted extensive regions and their urban centres into extremely vulnerable zones, both physically and socially.

The confluence of all these elements results in urban vulnerability and strikes especially hard at the poorest communities that are forced to occupy areas with most physical and environmental risks.

Effective management of the environment and natural resources requires a firm information base about the state of the environment. At the beginning of 2003 the Methodology for GEO Cities reports was prepared as a guide for our partners and to help with training on how to successfully develop Integrated Environment Assessments (IEAs) in cities. The GEO Cities reports are based on the GEO Cities methodology that focuses on the environmental tensions inherent in the dynamics of urban development.

The GEO Cities methodology, available as an application manual, is a very useful tool that will strengthen institutional capacities to prepare environmental assessments and reports on cities and that, over the long term, will lead to better urban environmental management and improve the quality of life of their inhabitants.

Based on the IEA / Global Environment Outlook (GEO) reports, the GEO Cities Methodology provides the local GEO technical teams with a guideline on how to use information to assess the state of the urban environment. The purpose of this manual is for the local team to:

- Learn the meaning of and how to use the integrated environmental assessment and prepare a report
- Become familiar, both in theory and practice, with their components and structure
- Learn and practise how to organize and manage evaluation processes and reporting

- Exchange views with colleagues through exercises and informal discussions
- Know what tools are available to carry out this task

The emphasis of this methodology is on understanding the DPSIR (Driving forces, Pressure, State, Impact, Response) matrix that organizes the way in which the information to prepare the report is analysed.

The methodology takes for granted that sustainable development places new demands on the assessment and on the report, including how to:

- Recognise the interactions between environmental conditions and human activities, especially those related to urban development.
- Highlight the need for a long-term outlook.
- Consider gender equality, and equality among and between different generations.
- Encourage all sectors of society to participate in decision making

The specific objectives of the GEO Cities manual and the training workshops are to:

- Serve as a guide for the local technical team to prepare the urban-environmental integrated assessment.
- Direct the technical team in their search for scientific facts and data about the environment in cities, as well as to communicate with society to promote better management of the locality's natural resources and about environmental vulnerabilities.
- Train the technical team to assess the state of the local environment by analysing the determining factors of urban development and their relationship with ecosystems and natural resources, and about environmental vulnerabilities.
- Establish an urban-environmental database to permit continuous follow-up of the state of the environment, based on appropriate urban-environment indicators.
- Make it possible to formulate preventive strategies and programmes to help cities deal with environmental risks.
- Establish a consensus about the most critical environmental problems in each city by holding a permanent dialogue between the different social stakeholders, including specialists on environmental subjects that involve the local government and society.
- Contribute to building technical capacities to prepare and disseminate an integrated assessment of the state of the environment.
- Build capacity on how to assess the impact of urban development on different ecosystems.

These objectives are dealt with in each chapter of this document. The idea is that, at the end of the process, the local teams will be able to assess the state of their cities' environment and point out how to solve problems highlighted in the report.

It is hoped that, over the long term, the evaluations will support better informed decision making as well as better urban-environmental planning and management to improve the quality of life of those who live in the region's cities.

II. GEO Cities Methodology

1. Focus of the analysis; urban development and its effect on the environment

The main point of the methodology is urban development action on the environment from the point of view of sustainability. In the GEO Cities assessment the interaction between urban development and the environment is analysed by using the Driving forces-Pressure-State-Impact-Response matrix. The purpose of preparing the assessment is to learn how urbanization affects the environment because of factors that put pressure on local natural resources and ecosystems and leading to a determined state of the environment – with impacts on the quality of life of cities and causing specific responses by the government and local society.

The analysis, therefore, brings together the social, economic, policy and territorial characteristics of the urban development process and its interaction with the environment. In this respect, it is important to know the characteristics of the municipality's main economic activities, the structure of the city's social inequality, the main determining factors of land occupation, the local institutional structure with emphasis on public bodies that defend the environment and social participation mechanisms in preparing public policies, among others.

2. Analytical framework: DPSIR matrix

The analytical framework used in the GEO Cities assessments is the **Driving forces-Pressure-State-Impact-Response (DPSIR) matrix** that defines and relates the group of factors that determine the characteristics influencing the environment at any territorial level whether local, regional national or global. The DPSIR matrix must be seen as an analytical instrument to direct the work of analysing the interactions between what is urban and what is environmental. Also seeks to establish a logical link between its components to direct the assessment of the state of the environment from the factors that exert pressure on natural resources, and that should be considered as the "causes" of the present state so that each locality's responses serve to confront its own environmental problems. The matrix, therefore, is a model to organize the work of assessing the state of the local environment and does not pretend to be a faithful copy of the true characteristics between what is urban and what is environmental which, as we are aware, cannot be entirely known.

The matrix's components respond to the following basic questions, whatever territorial scale is considered:

1. What is happening to the environment? (State)
2. Why is this happening? (Driving forces and pressure)
3. What is the impact? (Impact)
4. What are we doing? (Response)
5. What will happen if we do not take action now? (Future outlook)
6. What can we do to reverse the present situation?

These questions relate to the different processes analysed in the GEO Cities assessments including devising future outlooks for the local environment, as well as preparing an integrated environmental report that goes beyond the usual methods of assessing the state of the environment; it is a "process of producing and communicating information on interactions, the point where the natural environment and society meet" [2].

[2] *UNEP, IISD and Ecologist International, 2000, Training on integrated environment assessment and preparing reports "Report Assessment Process" Training manual , second edition, p. 5*

Defined below are the DPSIR matrix components:

Driving forces: Driving forces are sometimes referred to as indirect or underlying forces. They relate to society's fundamental processes that promote activities having an indirect impact on the environment. Key forces include: the population's demography; consumption and production behaviour; scientific and technological innovation; economic demand; market and trade; distribution patterns; institutional and socio-political frameworks; and value systems.

The characteristics and importance of each driving force show substantial changes from one region to another, between regions and between nations. For example: in the area of population dynamics, most developing countries' populations are still growing, while developed countries have stable and ageing populations. There is unequal distribution of resources and opportunities within and between regions. These and other socio-political factors have reinforced the principle of common, but differentiated, responsibility in the area of international environmental governance.

Pressure: This refers to underlying economic and social forces such as population growth, consumption or poverty. From the policy point of view, pressure is the starting point from which to confront environmental problems. Because it comes from socio-economic databases, information on pressure tends to be more readily available. Awareness of pressure factors seeks to respond to the question: **Why is this happening?**

State: refers to the condition of the environment resulting from pressure; for example, the level of air pollution, soil erosion or deforestation. Information on the state of the environment responds to the question: **What is happening to the environment?**

Impact: is the effect produced by the state of the environment on aspects such as quality of life and human health, on the environment itself, on the built-up environment and on the local urban economy. For example, an increase in soil erosion will have one or more consequences: reduced food production, increased food imports, more use of fertilizers, and malnutrition.

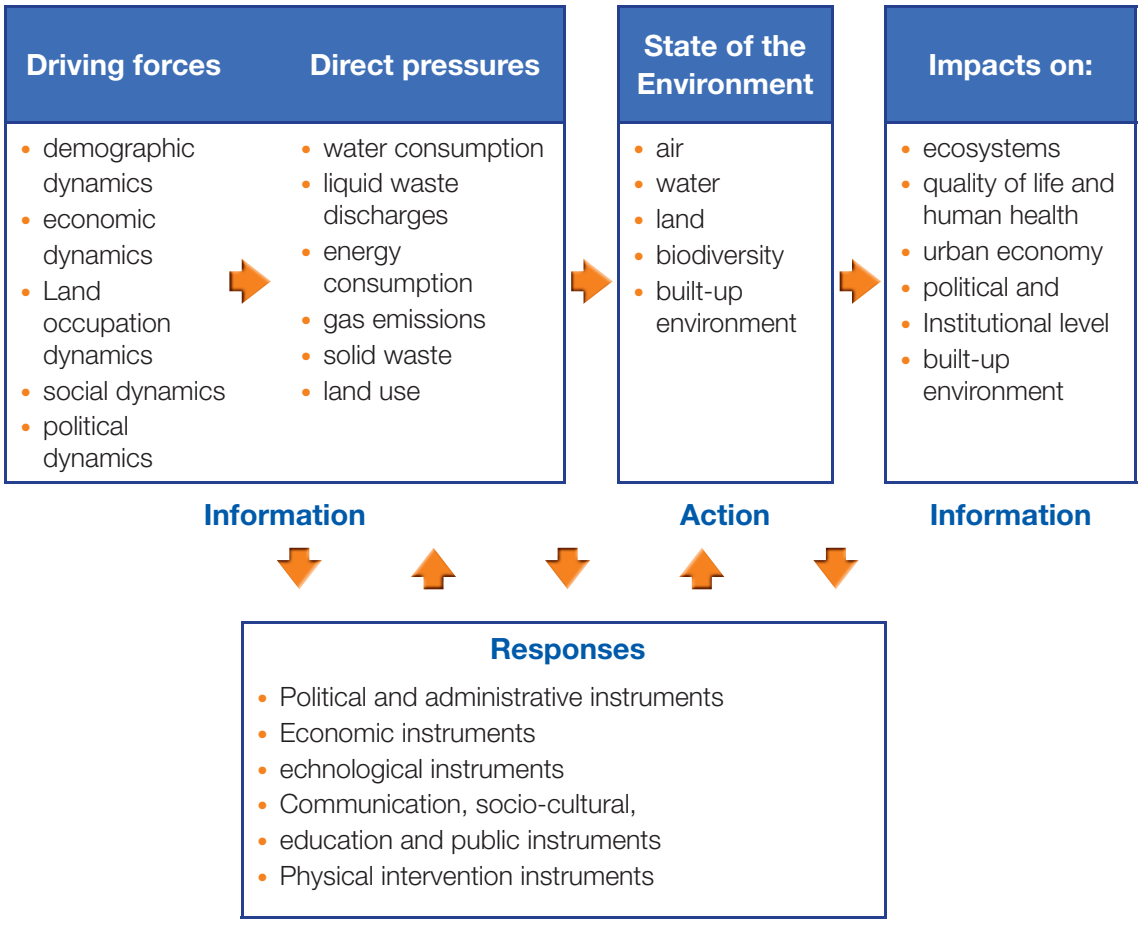
Responses relate to collective or individual actions that lessen or prevent negative environmental impacts, correct damage caused to the environment, conserve natural resources or help to improve the quality of life of the local population. Responses may include activities on regulation, environmental or research costs, public opinion and consumer preferences, changes in administrative strategies and providing information about the environment. To measure how society responds requires the local team to do more analysis and interpretation work[3]. The instruments included in this matrix category attempt to answer the question: **What are we doing?**

Responses to the: **What will happen if we do not act now?** attempts to direct the analysis of future outlooks on the local environment by assessing its present state. The underlying logic of the DPSIR matrix allows links to be established to project future manifestations of present environmental conditions encouraging analyses to be made of the possible consequences of present actions. This raises the possibility of strategic action being taken to change the direction of each locality's environmental problems.

Table 1 shows the principal elements of each of the matrix's categories and the relationship between them. As can be seen, the DPSIR matrix seeks to exactly define possible relationship patterns between different anthropic actions and the environment and applied, in this case, to relations between what is urban and what is environmental.

[3] *UNEP, IISD and Ecologistics, 2000*

Table 1: Interaction of urban-environmental components in the DPSIR matrix



It is important to show a degree of flexibility when considering these components. The DPSIR matrix is simply the analytical instrument that permits the logical organization and grouping of factors that act on the environment, the effects produced by human activities on ecosystems and natural resources, and the impact they have on health and on nature itself, as well as interventions by society and the local government to confront problems caused by anthropic action. This logical organization also permits an assessment to be made of this dynamic interaction and for changes in some elements of these components to be considered. This is particularly relevant in the case of factors related to the matrix's response dimension.

When the state of the environment is assessed as a "snapshot" of environmental conditions at a given moment (synchronic outlook) it is easier to define the type of components that are related to determined human actions and environmental factors. In this way a more exact definition can be given of whether a determined instrument is part of the responses or of the pressures on the environment. This shows that intervention instruments such as environmental policies and programmes, direct urban projects, and environmental management projects, belong in the responses category.

However, as it is also necessary to follow the movement or the dynamics of the urban-environmental interaction over the long term (diachronic outlook), some factors in this new logic – which in the synchronic outlook are found in the responses category – could be interpreted as pressure factors on the environment.

Actually, when processes are mentioned such as those found in the urban-environmental relationship, a flow of interactions over time is always assumed. This implies that, at a later date, the factors that belong to the responses category may be considered to be part of the pressure mechanisms on the environment. This happens both in the "positive" sense, for example when they function as limiting factors to the amount of pressure the population or business places on natural resources or ecosystems, and as "negative" when they cannot reverse the trend of pressure detected earlier, or if they unintentionally place more pressure on the environment.

Finally, the importance must be stressed of the integrated and sequential assessment of the environment suggested by the matrix in table 1.

One purpose of the GEO Cities assessment is to help in decision making and formulating public policies; it is important, therefore, to be aware of the factors that correspond to each of its components. Such awareness will allow an assessment to be made of how the responses are adapted to the environmental problems detected, and the measures suggested in this document to be either corrected or projected for future action. Adopting this outlook will make it easier to detect difficulties in implementing the responses given at local level, delimiting the different degrees of responsibility of each of the social agents that act in the locality (federal, state or local governments, businesses, civil society organizations, local population, among others).

3. GEO Cities report structure

Using the DPSIR matrix as a guide to collecting, organizing and analysing information will allow the local team to construct, step by step, the report on the state of the environment. It is also important to define the structure of the report on the basis of each city's priorities and needs, observing their physical-geographic, institutional, economic and social peculiarities (see the proposed structure on p. 22)

Urban-environmental components of the DPSIR matrix

Interaction between urban and environmental components is the key to preparing the GEO Cities reports. To do so, account should be taken of:

- The urbanization process components needed to understand the pressure exerted on the environment, and
- The factors that make up the environment whose state, qualitative and quantitative, will be the report's objective.

We find three main components in the urbanization process: demographic dynamics, economic dynamics, and territorial occupation dynamics. These components are the driving forces that propel urban development: population, economic activities, and the territorial basis on which economic activities are developed.

These factors, even though they must be classified as a central part of the process of interacting with the environment, are only presented indirectly in the matrix suggested. They are included in the matrix by means of different indicators, selected to allow an assessment to be made of the state of the local environment.

To analyse the environment two components were considered: natural resources, from a broad perspective that includes water, air, soil and biodiversity; and ecosystems, considered as the result of the interaction of natural resources.

Concerning ecosystems, account must be taken of local delimitations for each one, given the variations in terminology and concepts used to define them (how many and which ecosystems in each locality). It is suggested that more attention be paid to the most relevant ecosystems in each city, according to their importance for the environment's equilibrium and the local population's quality of life.

Applying the DPSIR matrix is a useful instrument which, together with the use of urban-environmental indicators, is capable of expressing the behaviour of the relevant factors and trends over time. The theme of indicators will be dealt with in the chapter on producing information to prepare the report.

GEO Cities Reports – Proposed Structure

Chapter 1: Introduction to the City

- 1.1 Location and relation to other cities
- 1.2 Geography and topography
- 1.3 Ecosystem and climate

Chapter 2: Socio-economic and political context (DRIVING FORCES and PRESSURES)

- 2.1 Description of local political and administrative structure
- 2.2 Analysis of local socio–economic factors
  - 2.2.1 Urbanization and territorial occupation dynamics
  - 2.2.2 Demographic dynamics
  - 2.2.3 Social dynamics
  - 2.2.4 Economic dynamics
  - 2.2.5 Consumption of resources
  - 2.2.6 Atmospheric emissions
  - 2.2.7 Waste production
  - 2.2.8 Sewage treatment and sanitation
  - 2.2.9 Solid waste
- 2.3 Chapter synthesis

Chapter 3: State of the environment (STATE)

- 3.1 Local ecosystems
- 3.2 Analysis of the state of the environment's natural resources
  - 3.2.1 Atmosphere
  - 3.2.2 Water
  - 3.2.3 Land
  - 3.2.4 Marine and coastal resources
  - 3.2.5 Biodiversity
  - 3.2.6 Forests and green areas
  - 3.2.7 Built-up environment
- 3.3 Chapter synthesis

Chapter 4: Impacts of the state of the environment (IMPACT)

- 4.1 Impact on ecosystems
- 4.2 Impact on quality of life and human health (inequality and poverty)
- 4.3 Impact on urban economy (external causes)
- 4.4 Impact on built-up environment (human settlements)
- 4.5 Impact at political and institutional level4.6 Socio-environmental vulnerability
- 4.7 Chapter synthesis

Chapter 5: Urban environmental management policies and instruments (responses)

- 5.1 Identification of the principal stakeholders concerned with the urban environment
- 5.2 Urban environmental administration structures and their environmental-urban management and planning functions
- 5.3 Putting environmental policies and instruments into practice
  - 5.3.1 Political-administrative instruments
  - 5.3.2 Economic instruments
  - 5.3.3 Technological instruments
  - 5.3.4 Physical intervention instruments (public investments)
  - 5.3.5 Socio-cultural, educational and public communication instruments
- 5.4 Chapter synthesis

Chapter 6: Future outlooks (SCENARIOS)

- 6.1 Definition of emerging themes
- 6.2 Building scenarios: local trends (inertia, the best and worst cases)
- 6.3 Chapter synthesis

Chapter 7: Conclusions and policy proposals

Chapter 1: Introduction to the City,

The presentation of the GEO Cities report must begin with a general introduction about the city to make it known to readers of the report. To do so, it is proposed to analyse the following themes:

Principal physical and geographic characteristics,

To better understand the themes developed in the chapters that follow, this chapter should present context information; to do so it is important to present the relevant and significant facts or characteristics of the theme being analysed, that is to say, the pressures on the environment, the state, the impacts and the responses.

The analysis of this point should include a brief description of factors such as:

1.1 Location and relation to other cities

The city's location in the national territory and its relation with the network of surrounding cities, that is to say, its function in the context of the urban network and its surroundings; for example, whether it is a capital city or the dominant city in a metropolitan area, or a dormitory city.

1.2 Geography and topography

Its geography and topography present the factors that geographically characterize the city, such as its hydrology (rivers, lakes, water basins, etc.), the main orography components (principal elevations, average altitude), dominant soil types (sandy, rocky, etc.), dominant vegetation (wooded areas, pastureland, etc.),

1.3 Ecosystem and climate

Its ecosystem and climate, describing dominant ecosystems (tropical forests, mangroves, beaches, etc.), rainfall regime, pluviometry, average annual temperatures, microclimates, principal fauna and flora, etc.

Note: Given that the GEO Cities report is intended for different readers (politicians, academics, students and the general public), as far as it is possible to do so, technical terms should be avoided. If they must be included, it is suggested that a glossary explaining them be included as an annex, or each term be explained in a footnote.

Chapter 2: Socio-economic and political context (DRIVING FORCES and PRESSURES)

This chapter's objective is to historically contextualize local urban development so that factors that condition the present characteristics of the interaction between the city and its environment can be understood.

The analysis made in this chapter is of great importance in so far as it will be used by the local technical team to identify local dynamics and the social stakeholders who exert pressure on the natural resources, causing a determined state of the local environment.

On the other hand, once the reasons are identified that explain the state of the environment, the elements will be available to analyse whether the already-existing responses to these problems are adequate, and what other action should be taken to reduce the pressure on natural resources, improve the environment and the quality of life of the population.

To do this, it is proposed to analyse the following themes:

1. Political-institutional dynamics
2. Urbanization and territorial occupation dynamics (land occupation and land use over time)
3. Demographic dynamics
4. Social dynamics
5. Economic dynamics
6. Resource consumption

Extending the details of these factors will depend on the availability of information for each city and the importance of each factor in relation to the urban area and surrounding ecosystems.

It is important that those using this methodology make analyses that allow them to:

- Understand the propelling forces, trends and problems related to local urbanization.
- Use it as a reference when making decisions about the growth of cities, investing public resources and formulating public policies.

2.1 Description of local political and administrative structure

This topic seeks to indicate the elements necessary to analyse the local political, social and administrative elements necessary to have a broader understanding of the context of local urbanization and how it effects the environment.

2.1.1 Local public authority administrative structure

Characterizing the local political-institutional structure is a very significant factor when considering the importance of action taken by the local government concerning rules and regulations, norms and control, as well as controlling urban growth and protecting the environment.

The growth of cities and their influence on local ecosystems is determined, to a great extent, by the characteristics, scope, intervention capacity and constitution of the local government apparatus, as well as by the dynamics of their relationship with other relevant social stakeholders (civil society and business).

Processes that have a dual determination in territorial occupation are: natural resources use; distribution of people and activities in the urban space; characteristics of urban constructions; definition of the local transport structure; construction of water supply and sanitation systems; and the definition of the population benefiting from such services. These processes respond to the economic and political interests of the different local-level groups and social stakeholders who want to exercise their strategic and relationship resources to broaden/improve their relative positions in the urban space, and are the object of a permanent regulatory and normative dynamics expressed in the set of laws, norms, regulations, tax system and control practices adopted by the local government and now by society.

For this reason, we need to know about the local political-institutional structure as an aid to identifying instruments now available, or that will be needed to confront problems detected in the urban-environmental interaction in each city.

> **References to describe the local political and institutional structure:**

a) The local governmental and administrative structure underlining administrative bodies related to environmental and urbanization matters; ministries or secretariats, public bodies to collect waste, collect/distribute water, environmental sanitation, etc.

b) The existence of Master Urban Plans, urban development induction/regulation instruments with their desired characteristics.

c) The existence and description of Environmental Administration and Local Environmental Legislation Plans, as well as Protected Areas Plans.

d) Funds available in the municipal budget for projects to protect and conserve the environment.

2.1.2 Characteristics and role of civil society organizations

The end of the twentieth century saw civil society being strengthened as social stakeholders actively participated in formulating, managing, implementing and following up public policies. In the new scenario of democracy and participation, non-governmental organizations (NGOs) stand out, as do community representatives, professional associations and churches, among other social stakeholders in this sector.

Today, these organizations are a fundamental counterbalance to the political power of local government agents and the private sector. This makes it important to be aware of them so as to analyse their present or possible contributions to understanding the state of the local environment and to solve the problems it poses.

> **Topics for analysing civil society organizations:**

a) The number of organizations/associations working on social and ecological themes;

b) The area of performance, the principal public objective, projects that develop institutional capacity, and the number of people working on them; whether there are joint environmental and social projects with local government or business;

c) Whether such entities have participation mechanisms to define, administer and assess local public policies; if they do not, including civil society stakeholders in public sector decision making is not, and will not be, effective;

d) Whether such organizations participate in implementing Local Agenda 21 processes or other sustainable development projects;

e) The principal existing social and environmental conflicts in the locality and the stakeholders and interests involved, as well as the position each of them adopts. How these conflicts affect the city and its surroundings.

2.1.3 The local private sector

To complete the study of this chapter, it is important to analyse the main characteristics of the local private sector which, mainly because of its economic activities, is one of the most important stakeholders where putting pressure on the environment is concerned.

The theme of entrepreneurs is, almost by definition, controversial since economic activities are very often associated with environmental degradation, whether through deforestation caused by different activities, by air, soil and water pollution, by land building speculation, among many other reasons.

On the other hand, taking into account that, in general, the predominant logic in economic activities is short term, or immediate gain without much concern for the sustainability of the natural resources on which their activity and the collective wellbeing are based, it can be understood how important it is, when preparing the GEO Cities assessment, to analyse business behaviour in each city.

> **Topics for local private sector analysis**

- The principal characteristics of local business organizations (number, business sectors represented);
- Their influence on urban-environmental themes in the city, their participation in public forums related to these themes;
- The positions taken by the business sector on the city's environmental urban management themes.

2.2 Analysis of local socio-economic factors

The interaction between the dynamics of urbanization (demographic, economic and territorial occupation) is complex and has an effect on the social structure at all levels; this defines its characteristics and, to a great extent, determines the significance and consequences of the urban-environmental relationship.

To analyse the present interest in urbanization pressures[4] a description must be given of each element and how it has to be related to its corresponding indicators.

2.2.1 Urbanization and territorial occupation dynamics

Indicators:

- Area and population of legal and ilegal human settlements
- Total volume of untreated domestic sewage
- Modal transport distribution
- Motorization index
- Land use change from non-urban to urban
- Vegetal Cover reduction

Others

- % of urban area and its grow rate
- Extension of the urban area and its grow rate

Land occupation is the material/environmental expression resulting from the interaction of demography and economic activity.

It is the adaptation and progressive incorporation of the territory's environmental resources to expand the urban area, which implies a certain degree of destruction and threats to the ecosystems' integrity.

[4] *Existing pressure: set of dynamics that act to determine the state of the environment. The elements mentioned above are the historic inheritance of local*

Urbanization necessarily implies territorial occupation to have a physical basis for the following activities:

- Housing construction
- Opening streets and avenues
- Building industrial plants
- Warehouses
- Hotels and stores
- Preparing land for agricultural production to meet the needs of urban consumers
- Building places of worship and of entertainment
- Health and education
- Building drainage, water supply and energy infrastructure

The determining factors of land occupation are:

- The degree and characteristics of social inequity
- The characteristics of the economy
- How the local government is structured and acts
- How civil society organizations act
- The territory's physical and natural characteristics
- Including the city in the international network of cities

The following factors should be highlighted when making the analysis:

- Distribution of the population and activities within the territory
- Occupation/production in vulnerable areas and use
- Construction and use of the infrastructure
- Water consumption (source, volume, spatial social distribution, uses)
- Access to drainage services (volume, social and spatial distribution, types of treatment).
- Production of solid wastes (volume, type, final disposal, principal sources)
- Local energy consumption (main sources, origin of the energy, measuring consumption, and others).

> Determining factors of territorial occupation

If the pressure exerted on nature is inevitable, there are many different forms of territorial occupation with equally different environmental results.

This difference is due to the degree and the characteristics of local social inequality that helps to determine the distribution of urban zone population, the characteristics of urbanization (presence of lost cities/run-down areas, significant occupation of sites, deterioration of ecosystems due to disorganized urbanization) and of population risks and pressure on the environment. Social inequality is also a central component in differences of having access to services.

The characteristics of the local economic dynamics define the rhythm of urban growth, zones of expansion, degree of attraction of the population of each city and, to a large extent, the configuration of how the territory is occupied.

How the local government is structured and acts, in particular the existence of bodies and legislation to defend the environment, as well as control and follow-up action by public and private agents. Public intervention instruments such as Urban Master Plans and Environmental Management Plans are important to define the limits and desirable characteristics of urban growth and how the social stakeholders and sectors interaction with the environment.

The degree of organization and qualification of civil society organizations and the extent to which their participation is institutionalized in defining the local environmental agenda will establish the local control possibilities in formulating, managing, following up and assessing public policy in that area

The physical-environmental characteristics of the city's locality may determine how vulnerable the ecosystem is during anthropic action; this, for example, is the case of the greater fragility of mangroves and reefs.

There are other factors that combine the above elements, such as public insecurity (due to violence and crime) and the dynamics of the local property market, that are the result of the interaction of economic dynamics, social inequality and how the local government acts. These factors may exert pressure to create exclusive spaces such as the gated condominiums so common in Latin America and built on the city's urban zone outskirts and that expand in the direction of still unoccupied natural areas.

Local insertion in the international structure of cities, united by economic globalization of production processes, stimulates urban expansion. This is relevant for large cities and/or those in the most important metropolitan areas where large international enterprises operate and demand spaces to develop their activities and attract other enterprises

2.2.2 Demographic dynamics

Indicators

- Population growth
- Area and population of legal and illegal human settlements

Natural population growth and the flow of population towards a specific point of the territory are two of the most important factors in understanding how urbanization influences the growth of society and, as a consequence, the urban-environmental relationship. Some natural and social processes are of particular importance.

The first, concerning demography, is the natural dimension of the birth rate and mortality. In fact, the population's natural growth and renovation are based on the interaction between some central processes.

There are objective and subjective elements with respect to the relationship between the number of live births (birth rate) and deaths per year (death rate). Among the objective elements mention may be made of: the family's economic income, the structure of the public health system and infrastructure services, including women in the labour market, medical scientific knowledge. Among the subjective elements are: the family's educational level, religion, local culture and customs, the use of birth control methods, activities of social movements that defend reproductive rights. These processes are not only natural; they change because of transformations in the structure of contemporary society. However, the situation is very different in societies were stakeholders are organized around more traditional cultural values.

For example, the infant death rate is a measure of the population's conditions and quality of life. It varies according to economic income levels, level of education, and access to essential urban services such as: water supply and drainage, and the public health system. Therefore, it reflects poverty and social inequality, air pollution, the lack of investments in public health and lack of sanitation. This case shows the influence exerted by environmental conditions such as how the quality of water affects the quality of life.

The second process – migration – is also an important factor in growing city urbanization. Migration is generally related to the concentration of economic activities in a determined area. At present half of humanity now lives in cities, and within the next two decades, 60 per cent of the world's people will reside in urban areas. Urban development in Latin America and the Caribbean, the most urbanized region in the developing world, is also characterized by a high degree of urban primacy with one-fifth of the region's urban residents living in cities with populations of 5 million or more.

However, one of the most distinctive features of urbanization in the region is the rapid growth of small cities, which are home to nearly 40 per cent of the region's urban population. Another distinctive characteristic of the region is that urban growth is often the result of people moving from one city to another, and not from rural areas to urban areas[5].

Migration dynamics: emigration (people leave) and immigration (people arrive) may be of the following types:

- Rural-urban migration
- Urban-rural migration
- Pendular migration (due to activities such as: tourism, daily flow of workers, flow of vehicles, cultural events, etc.)

[5] *UN-HABITAT,2008*

Each one has particular effects on urbanization and on pressure on the environment.

Population growth as the result of such natural variants and growth caused by migration (social process), will determine the interaction between the demographic dynamics and the environment, exerting pressure on natural resources such as soil, water, vegetal cover, etc.

This information may be easily obtained from national and regional statistics institutes and public health services in each city or state.

> **Graphic presentation of data**

To present demographic data, it is recommended that graphic instruments be employed: tables, graphs, charts, maps, satellite images to help visualize the information and the analysis made in the text.

One of the instruments is the "population pyramid" that allows population distribution to be represented by ages (at five-year intervals) and by gender, facilitating the graphic evaluation of characteristics such as, for example, the proportion of young people or of third age adults in the population.

Another instrument is the projection of the population's future behaviour: the global trends (growth rate, absolute numbers) and particular characteristics (growth rate of the percentage of young people and of third age adults, expected differences in the number of men and women, among others).

2.2.3 Social dynamics

Indicators

- The GINI Index (social inequality)

Others

- % of the population living in poverty
- % of the population living in extreme poverty
- % of the population or housing units with drinking water service, by principal zones
- % of the population or housing units with sanitary service (drainage), by principal zones
- % of the population or housing units with electricity, by principal zones

For the GEO Cities assessments, social inequality goes beyond the income differences between social classes, even though they are central to its classification. Social inequality is also assessed by the inhabitants' access to urban services essential for a good quality of life, such as drinking water supply, drainage system and domestic waste collection, and to urban land suitable for housing.

The failure to provide services to marginalized citizens puts pressure on the local environment, contributes to water and soil pollution and damages flora and fauna (plants, trees, animals). Marginalized groups are generally the first to be affected by environmental degradation such as the proliferation of malaria-transmitting mosquitoes, yellow fever and dengue fever, that have a serious impact on human health and the quality of life, and causing the problems denounced by the environmental justice movement[6].

[6] *For more information about the environmental justice movement, consult:*
- *http://www.scorecard.org/community/es/ej-index.tcl,*
- *http://jades.socioeco.org/es/, and the book,*
- *Environmental rights and sustainable development: the access to environmental justice in Latin America, Mexico, UNEP, 2000, p. 227*

For their part, the richest social groups put pressure on the environment by, for example, building condominiums in environmental protection areas. On the other hand, civil construction industries and companies discharge polluting substances and, in coastal cities, occupy local fauna natural reproduction areas such as mangroves and reefs.

The following should be analysed:

1. Local income distribution, specifying how it affects places where people live in cities.
2. Social and territorial distribution of essential urban services, how they interact and how they are affected by local income.
3. The social groups and areas producing most environmental degradation and pollution, or that suffer from the most negative effects of environmental problems, to establish the relationship between them and the supply of urban services.
4. The principal local housing market characteristics.
5. The relationship between social inequality and the local transport system, with emphasis on time spent travelling from home to work, transport availability and conditions.
6. The local population's access to education, specifying average years of study, the distribution of students in formal education and the number and frequency of dropouts.

> **Signs of social inequality in cities**

If we observe the growth of urbanization in Latin America and the Caribbean in the last two centuries it is evident that, from the territorial occupation point of view, even today the poorest sectors of the population always tend to occupy the cities' outlying or run-down areas which, in general, have the fewest urban services. This means these sectors almost always suffer from insufficiencies, in quantity and quality, of:

- Drinking water supply normally associated with serious infant diseases such as diarrhoea caused by water pollution and resulting in high infant death rates in countries in the continent.
- No access to drainage systems so that, on the one hand, they dump their waters into bodies of water such as nearby rivers and lakes, adding to the pollution and environmental degradation of these aquatic systems and, on the other hand, they suffer from more water-borne diseases than the other local social groups facing the same pollution.
- Local waste collection, due both to the lack of attention by the public sector and bodies responsible for providing this type of service to the city areas occupied by social groups with the fewest resources, both because of the usual difficulties on land they occupy -- heavily sloping ground, hillsides, etc. – and the characteristics of the land: unplanned, with narrow streets and with no space for transport or room for collection vehicles to move, among others.

2.2.4 Economic dynamics

In most cases the economy is the determining factor of a country's urban development and places heavy pressure on the environment.

Economic activities demand natural resources and interact with the environment by:

- Consuming raw materials
- Using land for agricultural production, constructions, highways and streets, storage, and others
- Disposing of solid and liquid wastes
- Different types of polluting gas emissions

In most cases, few attempts are made to adapt agriculture, industry, business and services to the environment; as a result destructive effects are caused such as pollution and the extinction of flora and fauna.

The ecological crisis is, to a large extent, the result of an economic production model. With the passage of time it becomes unsustainable because of the environmental degradation it causes. That model is based on overexploiting natural resources, in particular non-renewable resources, or those with a very long-term replenishment cycle.

Nature provides all the goods consumed by society so it is inevitable that economic activity puts pressure on the environment. Hence it is important to identify and assess the type and scale of different activities that use natural resources and have an impact on the environment, and to analyse how they interact with the urban environment. The prevailing model usually overexploits resources, degrades the environment or puts ecosystems at risk, thus endangering biodiversity.

An activity sector is defined as a group of organizations and people engaged in the same general economic activity; that is to say, a development activity category within the city. Each activity sector will include groups and organizations with broadly similar interests and needs, and a similar relationship with development and the urban environment[7].

Because the situation is different in each city, there is no fixed rule for identifying and categorizing activity sectors. As local circumstances will be reflected in the list of activity sectors, it is important to identify activities that help to understand the situation, for example: environmental administration, mining, industry, housing, transport, agriculture, etc.

Each activity sector will be described separately; each description should concentrate on the sector as a whole without describing individual enterprises or subgroups.

In some cases, for example the industrial sector, it is very useful to describe the most important sub-sectors (chemical, pharmaceutical, steel); in particular if they are ones that cause a great impact on environmental resources. It is recommended that precise descriptions be given; a small statistical table may be the best way of transmitting key information. At least for the main activity sectors, their geographic distribution should be illustrated with a simple map.

Once the city's activity sectors have been satisfactorily identified, the following information should be presented in the order mentioned and individually.

[7] *UNCHS-UNEP. Preparing the SCP Environmental Profile. The SCP Source Book Series: Volume 1, 1999*

a) Characteristics of the activity sector

Give a brief description of the nature and characteristics of the activity sector including, where appropriate, the following information:

- General types of activities in the sector
- Approximate number of people working in the sector; where applicable, separately for the formal and informal sub-sectors
- Recent growth or decline, employment, etc., in the sector (and sub-sectors, if any)
- Important links, if any, to other activity sectors

Identify groups, institutions, companies, individuals, ministries or secretariats, sector representative bodies, etc. that are important in organizing how the sector operates. Describe any special arrangements made to link the sector with environmental administration activities in the city.

b) Use of environmental resources

Give a general description of the use of environmental resources by this activity sector, in both quantitative and qualitative terms:

- What specific resources are used (water, air, land, minerals, trees, etc.) that are essential to the activity?
- What is the amount or approximate scale of the use of these resources?
- What has been the recent trend in the sector's consumption of resources? What are likely future consumption patterns?

Energy consumption differs according to the activity and the support needed; the production industry is very greedy. In addition to electric energy, a large part of the energy for industrial use comes from fossil fuels: petroleum, natural gas and mineral carbon; thermo-electrics that employ fossil fuels and carbon mineral; and, to a lesser extent, nuclear, solar and wind energy. The last two are considered to be clean energy sources.

Describe the availability of these environmental resources for the sector according to:

- What are the main supply sources for these resources? In particular, identify input sources found in the city or its surroundings.
- Are there specific shortages of certain resources or problems in obtaining the quality or quantity needed?
- How readily available are the resources used by the sector? What special measures have been taken to expand available supplies or to protect existing supplies?
- Does this sector compete directly for supplies with other activity sectors?
- Are any particular initiatives being taken in response to the shortage?

c) Impact of the activity sector on environmental resources

Describe in general terms the impact of the activity sector on different environmental resources, that is, on degradation and/or depletion.

- What are the activity sector's main pollution effects and how do they affect different environmental resources?
- Does the activity sector's use of resources cause any observable depletion of any environmental resource?

- Have any projects or programmes been undertaken to alleviate the impact of this sector on different resources?

Civil construction and transport activities in urban centres exert direct pressure on the environment: they require space for urban expansion, occupying and building in important ecosystem areas, threatening local biodiversity and freeing polluting chemical products.

> **Analysing industrial pressure on the environment**
>
> Energy consumption characteristics: sources of energy consumed, location of industries, price of energy, shortage, population's access.
>
> - Acid rain producing gas emissions cause the greenhouse effect and/or deplete the atmosphere's ozone layer (types, sources, volume);
> - Discharge of industrial waste/effluents into bodies of water (types, sources, volume);
> - Solid wastes (types, volume, final destination);
> - Industrial wastes (toxic, non-toxic and inert).

Liquid and solid wastes also cause pressure on the environment. Nowadays, much environmental pollution is caused by indiscriminate elimination of industrial activity sub-products, for example: atmospheric emissions (gases and particles); liquid wastes/effluents that contain toxic or polluting chemical products; and industrial wastes (solid) dumped into rivers, lagoons and seas.

d) Agriculture

In urban centres, in particular near medium-size cities, agriculture has lost ground to other activities.

Where agriculture continues to be important, a description should be given of its main characteristics to calculate the pressure it exerts on the environment. These characteristics include: the number of people employed, types of products, destination of products, area occupied, use of pesticides, growth of the occupied area, production techniques, rate of expansion of the municipal area used, etc. Attention must be paid to such matters as: deforestation resulting from using new land for agriculture; soil and water pollution caused by using agricultural toxins; forest fires to clear land for cultivation; and threats to springs from deforestation and pollution.

e) Commerce and services

The relationship between commerce and services and the environment is less direct These two aspects require the construction of buildings, stores and shopping centres, and so on, and also produce solid and liquid wastes that pollute the soil and water and damage biodiversity.

Some of these pose particular threats to the environment; for example, pollution caused by pathological agents in hospital waste which, when freed untreated into the atmosphere, become biological and chemical vectors that may easily spread diseases and pollute both the soil and water, threatening the environment and human health.

Tourism involves the hotel and other related sectors. It puts pressure on space by building hotels and, perhaps, intruding on still-preserved environmental spaces; it produces solid and liquid wastes and consumes energy.

2.2.5 Consumption of resources

a) Energy consumption:

Indicator

- Annual per capita energy consumption

Urban energy consumption in Latin America and the Caribbean is linked to development, health and the quality of life of citizens, and it has serious repercussions on the national and global environment. Energy production in these countries involves the use of soil and, therefore, affects the environmental equilibrium. There are indications that other sources, less clean from the point of view of climate change, will have to be used to satisfy the growing demand for energy over the short and medium term.

Prospects are promising for further strengthening renewable sources; however, large investments will be needed. In the urban context, for the coming decades a source with great investment potential is methane gas (CH4) from landfills. In most cases the gas is burnt as flares to avoid explosions.

However, its controlled burning may provide energy to supply local networks although not large cities. The practice would also help to reduce greenhouse gas emissions which would be in the spirit of the Kyoto Protocol that encourages the use of low-impact alternative energies.

Building hydroelectric plants produces regional environmental impacts with repercussions on urban areas. Flooding in areas where barriers are built affects local flora and fauna. Some impacts are: loss of cultivable land; imbalances in wetlands; displaced populations; and a deterioration of water quality during construction. From the economic point of view, transmitting this type of energy is very costly and, because of the possible difficulty of access to the areas it is hoped to supply, it is also limited.

In Latin America and the Caribbean many cities and communities are not interconnected to regional hydroelectric networks; in these cases energy is obtained by using firewood and coal. Other isolated communities use diesel to generate energy.

The energy consumption indicator should differentiate between the use of electricity and fossil fuels by public and private transport; this is to make a clear distinction between the impact on local air quality and human health by tracing a direct link between transport and the industrial sector and the impacts, both regional and local, of emissions of gases that cause greenhouse effects and acidification.

This indicator should also be associated with the urban transport distribution model and motorization index. Local and regional air quality is also traced by intersecting these indicators in the analysis.

b) Water consumption

Indicators

- Total water consumption
- Total volume of untreated domestic sewage

As a natural resource, water is essential for almost all human activities and is an indispensable part of the entire planet's ecosystems; it is central to the analysis made to assess the state of the environment all over the world. Freshwater is also indispensable for all terrestrial ecosystems.

As the population and economic and social activities grow so does the demand for water that has to be brought from ever more distant sources, making it more costly to collect, treat and distribute. Also, as pollution increases and springs are affected, water becomes scarce and conflicts arise about who owns it and its use. This endangers both the quantity and quality of available freshwater.

Much of the world faces serious water shortage problems, pollution of water sources, unequal distribution between different social groups and conflicts about its multiple uses: domestic and sanitary, agricultural, industrial, urban development, energy generation, fishing, transport, recreation, etc. That is why water is one of the two principal themes on the world public agenda on the environment.

The steady supply of clean water and sanitary services plays an important role in efforts to protect the environment, improve the population's health and counteract poverty in urban centres.

2.2.6 Atmospheric emissions

Indicators

- Atmospheric emissions
- Modal transport distribution
- Motorization Index
- Emission gases producing acid rain

Urban centres produce the most polluting gases in the atmosphere. An analysis must be made of the pressure on air quality from pollution sources in cities. Motor car, bus and truck exhausts are main sources of the greenhouse gases responsible for the planet's global warming. Gases that make the biggest contribution to this phenomenon result from burning fossil fuels: carbon monoxide (CO); carbon dioxide (CO_2); nitrous oxide (NO_x), one of the ozone gases, (O_3); and sulphur dioxide (SO_2)[8].

Consideration must also be given to emissions from fixed sources, especially industry[9] and, in some cases, from agriculture by burning grassland for planting. Besides greenhouse gases (CO, CO_2, NO_x), industrial activity, for example mining in urban centres, also emits substances that deplete the ozone layer, in particular chlorofluorocarbons (CFCs) and diverse particle material (PM).

2.2.7 Waste production

Indicators

- Solid waste production
- Solid waste disposal

[8] *Gas emissions may be harmful to human health (cardiorespiratory diseases) or have negative effects on flora, fauna and ecosystems Because the wind disperses gases over cities, such effects are felt not only at the place of origin but also in other places, perhaps hundreds of kilometres away. These emissions also contribute to climate change and global warming*

[9] *In industry the emission of greenhouse gases is due to the use of what is known as dirty energy because it comes from burning fossil fuels that free pollutants into the air*

Accelerated population growth, the exponential increase in all types of consumption, the lack of financial and technical resources to collect and finally dispose of waste, as well as depositing it in the wrong places, are some of the factors that make the waste problem a matter of great concern.

It is calculated that urban centres produce an average of 1 kg/per capita/per day of waste, with some variations between the wealthiest people and the poor in each society and between the inhabitants of developed and developing countries. The quality of domestic waste is also a problem because of growing amounts of non-biodegradable products such as plastic, aluminium and glass, as well as a vast array of substances hazardous to the environment and to human health: toxic, corrosive, radioactive, inflammable, reactive or infectious substances. Difficulties in disposing of waste in each country are added to those in applying existing legal norms.

Infrastructure for waste treatment is not always adequate to handle the volume and types of urban waste. There are usually problems in collecting and disposing of very large objects like motor vehicles, furniture and domestic electric appliances. These types of wastes are often dumped into bodies of water, increasing environmental degradation and the cost of collecting and treating water. It may also cause biodiversity loss.

Most solid waste is disposed of untreated in open-air dumps and, by polluting the soil and aquifers, causes serious damage to the environment and to the quality of human life. A small proportion of the waste is taken to sanitary landfills where it may be separated according to type and properly stored, thus controlling its impact on the environment[10].

> Principal solid waste final disposal sites

In general, authorities in poor countries dispose of untreated solid waste by using conventional methods such as open-air dumps or deposits.

Local dumps are unhealthy, sources of urban pests (rats, cockroaches and mosquitoes); they are unsafe, attract garbage collectors, including children, looking for a way to survive. Grease contaminates the soil and bodies of water. Another recurrent risk is the clandestine disposal of toxic waste from industry, agriculture (pesticides), minerals such as lead and from hospitals (infected or hazardous material). These dumps produce methane gas that could cause explosions and worsen the situation.

The solution most used by controlled systems is sanitary landfill with a protection system consisting of:

- a waterproof layer to avoid grease contamination,
- draining and treating the grease,
- collecting, burning and storing methane gas.

For safety reasons, sanitary landfills should be located far from areas with springs and close to clayey soils. Burning is another alternative in cities with little available space, or for hospital waste. This is done at high temperatures, above 1200°C, and filters should be used for particle material. There is a risk that toxic substances (dioxins, furans and heavy metals) will be freed into the atmosphere and there is also uncertainty about the content of the emissions. The ashes are toxic and the filters of doubtful performance. This is a very expensive process.

[10] *See "GEO Latin America and the Caribbean" op.cit. p.51-53*

2.2.8 Sewage treatment and sanitation

Indicators:

- Total volume of untreated domestic sewage
- Quality of water supply, measured by the biological demand for oxygen, DBO and the concentration of faecal material

In developing countries, the lack of sanitation is one of the most frequent urban-environmental problems.

Although many cities have solved the problem of accessing the resource, it is a different matter when the focus is on areas with no water or sewage treatment. The most serious problems are contamination caused by untreated domestic drains, disposal of industrial wastes and effluents in bodies of water, salinity and erosion.

As a consequence, having information on freshwater quality and availability is very important for urban environmental administration, particularly in coastal zones, on riversides and in mangroves, and in ecosystems that shelter urban populations and are directly sensitive to water quality.

Disposing of untreated domestic effluents into bodies of water is a serious source of biological contamination that could affect human health. In that case the most frequent example in Latin American and Caribbean countries is infant death caused by water-borne diseases due to water contaminated with faecal material.

Indicators of water quality, already internationally established, may be applied with complete confidence to all human settlements.

Other third type (local) indicators must be identified locally based on the administrator's need to attend the city's specific needs, its activities and ecosystems. For example, in the case of marine ecosystems (costal zones and islands) the indicators must be broadened to measure the degree of pollution on beaches and of salinity.

Difficulties associated with domestic and industrial effluents are similar to those related to solid wastes.

Serious environmental damage is caused by discharging untreated urban effluents into bodies of water and harming people's health. One of the most common damages is that caused by polluting springs, surface and groundwater, rivers and oceans; this is a serious threat to human health, especially among the poorest people living in cities.

Problems related to effluents also include limited urban drainage and sewer system coverage, not enough treatment stations for the volume of effluents produced, poor collection system distribution in cities at both the territorial and social levels; in developing countries there are financial limitations on expanding the service in cities where the urban growth rate outpaces the capacity of local governments' budgets and there is limited national and international financing for these services.

The difficulties mentioned are still more severe in the poorest countries where the most marginalized populations may become even more socially disadvantaged.

Untreated effluents most frequently dumped into bodies of water are:

- Domestic or sewage water discharging organic material that pollutes and alters the ecological balance;
- Industrial effluents and chemical substances resulting from production processes; these are mainly oil-combustibles:
- Hospital waste with a high potential to pollute and transmit diseases to the population.

The growing world shortage of freshwater highlights the importance of analysing effluents for each sector of activity.

2.3 Chapter synthesis

It is suggested that each chapter end with a synthesis of its most notable points to allow the reader or decision-maker to concentrate on what is most important in each chapter. However, it is not meant to make an early presentation of the conclusions, but simply to give a brief summary of the main points dealt with.

Chapter 3: State of the environment (STATE)

This section analyses the state of the local environment with respect to priority themes including, among others: water, air, soil, biodiversity and the built-up environment. By using concrete examples and indicators, it should give a comprehensive picture or a synthesis of each city's environment and the state of its ecosystems. This will help to answer the question: **What is happening to the environment?**

This section is at the centre of the GEO Cities assessment. The analysis presents a definition of the essential points to assess the different environmental sectors and their respective indicators.

To begin with, the analysis must take into account the development model of the local society being considered. Although the methodology proposed is designed to assess the state of the environment resulting from human pressure, it also includes elements needed to analyse overall urban development.

In this context, indicators of state will help to describe and analyse the ecosystems in which the cities are located, including their conditions and support capacity which, as a result, reflect development models and their elements. For example, sources of natural resources or deposits for the waste produced by urban processes.

The result of this process may be seen in the quality and quantity of local ecosystems that extend beyond their bioregional limits. It is important, when observing how the state of the local environment evolves, to consider the region according to the ecosystem and the element in question.

Although actions taken are centred on human beings, the analysis is of benefit to environmental indicators that include: water resources in their different manifestations (bodies of water, springs, groundwater, surface water and sea water. etc.); air; local, regional or global atmospheric resources; soil; geomorphology; land use and occupation, biodiversity, fauna

(native, exotic, type, presence and quantity); and the built-up environment that is characteristic of the artificial urban environment: housing; urban infrastructure; equipment; buildings and architecture. This analysis also includes the vulnerability of urban areas and the effect it has on the people living in these zones at risk of natural disasters.

The assessment of the state of the environment should be both quantitative and qualitative. The relation between both types of variables is quite close and they are both determining factors. Therefore, an assessment of the state of the environment basically seeks to determine quality in terms of its elements and those of its ecosystems. To reach this objective, defined and accepted national and international parameters can serve as an assessment reference.

Such parameters are quantitative indicators of, for example: the number of faecal coliforms considered acceptable in water for human consumption taken from a specific river; above that number, water is not considered fit for use unless it is treated to reduce the number of coliforms according to water quality references. Another example is to determine how many species of flora and fauna survive in a given ecosystem, taking into account the wealth and complexity of the local biodiversity.

The examples can be multiplied for all natural resources considered in this methodology, indicating the qualitative effects that result from the quantitative behaviour of the variables chosen to prepare the GEO Cities assessment. It is important to understand that, since they are complementary, there is no contradiction between the quantitative data and the qualitative analysis.

3.1 Local ecosystems

To begin the state of the environment assessment process (analysis), it is important to define the field of analysis and the variables to be taken into account when establishing the assessment's priorities, without disregarding the notion of an inter-related system.

The ecosystems to be analysed should be identified by marking the territorial boundaries set for this study, whether a municipality or a metropolitan area, that do not always coincide with natural boundaries such as water courses or the region's specific geomorphological characteristics. Account should also be taken of natural systems which, while outside the context being studied, are associated with or linked to the ecosystems analysed.

In each city the description of local ecosystems should take into account its most important ecosystems based on their contribution to:

- Recycling the environment's natural resources: water, air, biodiversity, etc.
- Environmental services they provide to improve the local population's quality of life: water supply, regulating the local temperature, etc.
- Economic activities that make local urban life sustainable.

It is hoped that the data on ecosystems will give a better understanding of how the life support systems represented by ecosystems in general contribute to the quality of urban life.

The focus on ecosystems should take account of the natural resources available in habitats that are of significance for the life of the species that contribute to each locality's economic activities.

For example, in a coastal zone where fishing is the preponderant activity, good quality estuary systems are essential if the sustainability of the local economy and its inhabitants is to be guaranteed to ensure the environmental conditions are appropriate for the fish to reproduce.

> **Elements to characterize local ecosystems**

- Quantitative and qualitative description of the main features of the municipality's predominant ecosystems from the point of view of their physical environments and resources, including existing biological diversity and the habitats they occupy.
- Hydraulic resources and the distribution of bodies of water.
- Climate: rain, relative air humidity, etc.
- Urban fauna: native and exotic.
- Urban flora: forests, green areas, type and quantity.
- Land: type, use and area.
- Vulnerability to disasters, both natural and human-induced.
- Type of occupation in risk areas

In addition to the indicators proposed in the methodology, the analysis should describe in detail how the ecosystems can support urban development policies. By separating the environment into different sectors the environmental impacts of urban development may be quantified and qualified; however, the assessment cannot be confined to this point.

3.2 Analysis of the state of the environment's natural resources

The reductionist method should be used to begin assessing the state of the local environment; that is to say, each of the natural resources should be analysed separately. Afterwards, the assessment will be more general and comprehensive.

The natural resources in the urban development/environment cycle can be included in different ways, for example as raw material, as an urban waste sink, or as territorial support.

Therefore, qualitative and quantitative information on the state of the resources will show the result of this interaction from the environmental point of view, as well as the quality of life of the population that depends on these resources.

3.2.1 Atmosphere

Indicators:

- Air Quality
- Concentrations of (CO, CO_2, NO_x, SO_x, PM10, PM 2.5, lead)
- Sources of atmospheric emissions (composition of the vehicular fleet, size of the fleet, length of time operating, number of polluting industries)
- Sulphur content of fuels
- Number of daily journeys
- Emissions of greenhouse gases

No other natural resource is less limited to a locality than the atmosphere: however, measuring local air quality[11] is essential when assessing urban environmental quality and the inhabitants

[11] *That is to say, emissions originating on land (exhaust pipes or industrial chimneys and their geographic location). Air quality also includes regional and global plans to measure the presence of pollutants emitted by transport and industry and causing acid rain and concentrations of gases that may later have some effect*

quality of life. A drop in air quality has environmental, social and economic implications with long-term, and perhaps irreversible, consequences such as the loss of biodiversity or the impact on the health of children and third-age adults; for example, respiratory infections that may even be fatal.

Although air pollution is one of the most serious signs of poor environmental quality, in Latin American and Caribbean cities it is a secondary priority, with the exception of some megacities such as Mexico City, Santiago, and Sao Paulo,

The simplest way to obtain direct data on air quality in cities is to measure the concentration of particle material and motor vehicle emissions. In recent decades industries have reduced their emissions of polluting substances into their locality's atmosphere by using improved production technologies and changing urban activities, especially in the services sector. Vehicular emissions bear much of the responsibility for air pollution.

Depending on local conditions, other indexes may be added; for example, emissions of ozone-depleting gases, measured by production and consumption of the fluorocarbon family of gases (CFCs) or the concentration of tropospheric ozone that has a direct impact on human health.

3.2.2 Water

Indicators

- Quality of water supply
- Water shortage (frecuency, extension, duration)

Others

- Total volume of untreated domestic, industrial and mining sewage
- Volume of leachates filtering into aquifers
- Drinking water demand compared to production
- Drinking water consumption

Water is an essential element for the life of species, ecosystems and cities. As a resource, its main uses are domestic, industrial, energy generation transport and even recreation. For the environment it is a vital resource for natural cycles of ecosystem renovation[12].

The complexity of urban environmental management is made more evident when the state of water is analysed. Many populations in non-industrialized countries are threatened by water shortages. Although in Latin America and the Caribbean there is an abundance of water, there are doubts about how it is distributed and managed.

Urban demand for water is mostly for industrial and domestic use. To assess the resource, consideration must be given to the quality of the water supply, its availability and accessibility, as well as to the replenishment capacity of bodies of water. The analysis assesses the source (surface or groundwater), the type (freshwater, brackish or salty), and the ecosystem (coastal zones, mangroves, lakes, rivers, etc.).

Freshwater is the main source of supply in Latin America and the Caribbean. Analysing salty and brackish water is also important to indicate the state of the general ecosystem that not only supports the survival of species, but is essential for the most important economic activities in many cities in the region, in particular coastal cities.

[12] *Water resources management has repercussions on all types of territories and is related to environmental themes such as climate change, biodiversity, human health and land use changes*

3.2.3 Land

Indicators:

- Percentage of geological unstable (risk areas) areas occupied
- Polluted sites

From the urban development point of view, land problems are revealed by how the land is used, its distribution, degree of permeability, level of solid waste pollution and eroded areas.

As a natural resource, the land provides raw material and support for other biosphere systems and environmental services, such as drainage, and for agriculture and urban development.

Changes in land use for urbanization can have serious environmental, social and economic impacts. As human settlements expand uncontrollably towards natural areas adjacent to cities, the quality of the land deteriorates together with other ecosystem elements, and causes landslides, erosion and pollution of bodies of water.

The most frequent changes in the state of the land relate to:

a) Increased vulnerability to natural disaster risks such as landslides and floods due to its basic physical-chemical structure (gradient, porosity and compaction) as well as the loss of vegetation as this removes an important containment element.

b) Pollution from chemical products either disposed of directly or as the final result of grease-producing solid waste (effect of decomposing organic material in waste without proper final disposal).

c) Loss of biodiversity directly related to uncontrolled land occupation and linked to deforestation, reduction of vegetation and pollution.

To assess the condition of urban land, consideration is given to the most relevant aspects of the "basic basket" of indicators, including information on occupied unstable or risk areas and contaminated sites. In this case, providing data on such occupied and polluted areas gives the municipal administrator a panorama that includes the city's social, environmental and economic characteristics and points out its demands in terms of urban-environmental management.

This helps to prepare a more in-depth analysis on themes such as poverty, social inequality, civil defence and the health system's response capacity.

3.2.4 Marine and coastal resources[13]

The Latin American and Caribbean coastal zone extends over 64 000 km, with a marine territory of 16 million km^2 [14] . Human activities have caused its transformation by changing land use for urbanization, tourism and agriculture.

Human intervention disturbs the hydrological cycle, destroys natural breeding grounds, and alters coastal systems' morphology with constructions and by discharging industrial and domestic waste.

Pressure is put on these ecosystems by human activities, both economic and physical, especially such economic activities as marine fishing and tourism. Ecosystems are being degraded, both directly and indirectly, by the expansion of maritime transport.

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[13] *Since this type natural resource is found in ecosystems in certain cities, the local team should introduce and analyse the indicators to assess the state of such resources*

[14] *Ibid, pp 39-45*

Cities add to the degradation of coastal zones by occupying mangroves, coral reefs and estuaries and damaging their ecosystems' environmental services. Coastal areas such as bays, beaches, and estuaries protect against flooding, storms and erosion, filter bodies of freshwater flowing into the sea, inhibit salinization, store and circulate nutrients and support the survival of innumerable marine and aquatic species that provide subsistence for the same communities.

Vulnerability to natural disasters increases when risk areas are occupied and human activities take place; the risk increases when urban populations settle in such areas.

Urban activities that degrade the environment, such as deforestation to make room for urbanization, cause soil erosion and produce sediments that are frequently deposited in coastal zones. In Latin American and Caribbean coastal cities it is a common practice to discharge untreated sewage through the drainage system that runs directly into the sea.

3.2.5 Biodiversity

Indicator

- Extinct or endangered species/known species, measured by the number of known endangered species in the local environment. It is a transversal indicator that will help the impact and response analysis

Biological diversity is one of the principal resources in Latin America and the Caribbean where there are very particular ecosystems as well as most of the world's tropical forests.

Biological diversity is associated with the survival of urban communities and centres. In fishing, for example, quality depends on the guaranteed environmental biological diversity of mangroves and coastal ecosystems.

Although it is nationally, regionally and globally that biodiversity conservation is most important, fragmenting natural forest areas (restricting species and limiting their sustainability) also begins with urbanization.

Urbanization poses a threat to biological biodiversity because of: deforestation (see next topic), overfishing, introducing exotic species, polluting air and water, occupying risk areas and making endangered species more vulnerable

3.2.6 Forests and green areas

Transversal indicator

- Vegetal Cover

Others

- Reduction of vegetation
- Number of m^2 of green areas per inhabitant

Destroying natural habitats not only damages resources but, as a chain reaction, it also harms all the region's systems. Deforestation increases erosion, puts rivers at risk, disturbs the hydrological cycle, and causes the loss of flora and fauna.

The use of forest resources is, in certain regions and cities, an important economic factor for activities such as the timber industry, energy generation, the iron and steel industry, recreation and spare time activities. For cities where forests are a significant economic resource, it is important to pay attention to how they are used and to how their use affects the state of the local environment.

Some 66 per cent of the global forest cover loss from 2000 to 2005 occurred in Latin America, while the region contains over 23 per cent of the world's forest cover (FAO 2005). South America suffered the largest net loss (almost 43 000 km^2/ year), of which 73 per cent occurred in Brazil (FAO 2005). Because of urbanization, in many areas of the continent such as the Brazilian Atlantic Mata region, ecosystems are fragmented.

Removing vegetation and waterproofing the soil harms the microclimate and makes it more likely that flooding, landslides on gradients and loss of biodiversity will occur.

Green areas directly regulate air quality, temperature and noise. The size of green areas per inhabitant is a parameter of the quality of life and human health: the World Health Organization recommends that cities should have 12 m^2 of green areas per inhabitant.

How to make forestry and urban systems compatible is a challenge to the administration. Therefore, the GEO Cities reports assess the state of vegetation in urban centres (forests, planting trees in urban zones, green areas and native species).

So that the indicator effectively reflects the quality of urban life, a check should be made of how the existing vegetable mass is distributed. Most of the city's remaining vegetation tends to be concentrated in the wealthiest urban areas.

3.2.7 Built-up environment

Indicator:

- Percentage of deteriorated areas (historic centres or buildings) in relation to built-up urban areas.

This indicator refers to urban areas with buildings of great historic or architectural importance. It is a negative indicator that assumes recognition of the state of degradation of what is considered to be a patrimony; it is important, therefore, to consider other indicators for an overall analysis so that this indicator is assigned its proper place in the general assessment.

Important themes concerning the built-up environment are:

- Quality of built-up environment, shown by the state of conservation of the urban landscape and its buildings.
- Cultural, architectural and historic patrimony of buildings and groups of buildings.
- Quality of housing, especially for the city's poorest population.
- Urban infrastructure and services.

It is important to clarify that the information to which this last-mentioned element refers is related only to the state of the urban infrastructure and how it is distributed in the city's urban zone and not to any other attributes; it is a theme that should be dealt with in the chapter on pressures on the local environment. It is important to know whether, for example, there are no breakages in the basic sanitary network to anticipate the impact on the environment and the local population's health. The same happens with the quality of asphalt paving, the local communications structure and other components of how the city normally functions.

Because it involves the economy (historic patrimony deterioration), social inequity (migration) and quality of life (urban landscape and efficient basic infrastructure) analysing the built-up environment is complex.

Neglecting this aspect in Latin America and the Caribbean creates characterless cities whose inhabitants are out of touch with the environment. Cities that invest in maintaining or rescuing the quality of the built-up environment are in contact with the inhabitants who not only are more able to identify with the quality of urban life, but are more interested in environmental themes related to local urban development.

3.3 Chapter synthesis

At this stage of the analysis a summary should be presented on the general local environment conditions, assessing each element and the relations between ecosystems and urban activities.

It is important to use transversal indicators to establish these relations, both between the urban environment elements and between the different levels of analysis within the driving forces-pressure-state-impact-response structure.

This assessment will be the instrument that combines public sectorial policies and demonstrates the consequences that partial measures have on the city as a whole. It will help to take an integrated approach to environmental management.

Chapter 4: Impacts of the state of the environment (IMPACT)

Chapter 4 includes information about the impacts the state of the environment causes on natural ecosystems and their constitutive elements of water, air, soil, biodiversity; on the quality of life of citizens; on the built-up environment, buildings, urban infrastructure, and so on; and on economic activities that stimulate the city's development.

This information will help to answer the question: **What is the impact of the state of the environment?**

It should be stressed here that one of the central points when analysing the impact of the state of the environment refers to the theme of urban-environmental vulnerability that is responsible for many problems in Latin American and Caribbean cities, as well as in other parts of the world. As can be seen in the section concerning this theme, environmental vulnerability is keeping up with the times because of the planet's climate changes, as well as the social inequality that has a significant effect on the poorest urban population sectors and threatens their quality of life.

Impact indicators are of help when making a strategic analysis where decisions identify the action and investment priorities taken by local decision-makers. Information on impacts, included to make the general analysis, is intended to estimate economic and social aspects; this could help legislators to calculate environmental damages caused by external influences. Quantitative information is organized according to subject: ecosystem, quality of life, urban economy, political and institutional level, and urban vulnerability. Data give a more qualitative assessment when analysing quality of life impacts.

For this assessment the following, mostly transversal, impact indicators should be used:

- Biodiversity loss.

- Costs, including water collection and treatment
- Frequency of floods and landslides
- Cost of work to prevent and contain environmental risks
- Property value depreciation
- Deterioration of historic centres
- Incidence of water-borne diseases
- Microclimate changes
- Public health costs of water-borne diseases
- Cost of repairing monuments and restoring historic centres
- Frequency of diseases caused by poisoning and contamination: skin, eyes, etc.
- Loss of urban attraction
- Juvenile crime rate
- Incidence of cardiorespiratory diseases
- Loss of tax revenue

The impact assessment will be as detailed as the administrator requires. Whenever possible, to ensure that the analysis gives a comparative view, also to be considered should be data from national and international sources.

- Impact on ecosystems
- Impact on quality of life and human health
- Impact on the urban economy
- Impact on the built-up environment (urban vulnerability)
- Impact at political-institutional level

4.1 Impact on ecosystems

Indicators:

- Biodiversity loss
- Microclimate changes

Occupation of natural areas, cleared and levelled to allow for urbanization, land use change from agricultural to urban, dumping waste and polluting products into the environment, and consuming natural resources such as water, minerals, plants and animals, make the growth of cities a vector of environmental impacts.

One impact on the ecosystem is the immediate or progressive destruction of native flora and fauna by removing vegetation, introducing exotic species, levelling land in restricted areas, clearing hillsides of trees, and dredging rivers and lakes. In smaller communities, economic activities like extracting forest products, overfishing, and illegally settling on environmentally protected areas also have a direct impact on ecosystems. Another cause of damage and soil pollution is dumping domestic or hazardous waste into water courses and unsuitable sites without any sanitary control. The local urban population's demand for food causes natural areas to be changed into cropland.

In urban areas modifying ecosystems causes natural areas to be fragmented and changes to occur in the natural dynamics and original food chain; this leads to loss of flora and fauna[15] .

To show the impact of urban growth on the local environment, the local analysis should include all the relevant factors to be taken into account; the conclusions should point out the priority problems local authorities have to deal with.

4.2 Impact on quality of life and human health (inequality and poverty)

Indicators

- Incidence of water-borne diseases
- Incidence of cardiorespiratory diseases
- Incidence of diseases caused by poisoning and pollution
- Juvenile delinquency index

The quality of life impact indicators mainly assess the health and well-being conditions of city inhabitants.

How human pressure affects the population is expressed in the incidence of environment-related diseases. As a consequence, the negative effects on labour (weakening workers' physical capacity, making it more difficult to join in recreational activities and sports linked to environmental resources) and the spread of urban inequality and poverty are central to assessing the state of the environment impact.

Foremost among diseases that harm the quality of life are those related to poor sanitation and urban cleanliness: for example, water-borne diseases; in cases of cardiorespiratory diseases, those caused by air pollution.

Determining factors in water-borne diseases are drinking water quality (may be contaminated by bacteria causing diarrhoea), the condition of basic sanitation to which people have access, the existence of sewage ditches and polluted water currents.

Water-borne diseases appear, above all, among people with few resources and living in degraded areas, or with no proper urban infrastructure; they may live in illegal settlements, small overcrowded tenements, or shelters where precarious building or environmental conditions help spread infectious disease vectors. In developing countries, recurrent environmental diseases such as diarrhoea, yellow fever, dengue fever, intestinal infections, tuberculosis, as well as dehydration, are directly associated with the poverty and social inequity closely linked to environmental degradation.

The main cause of these diseases is the lack of basic sanitary services in the cities poorest areas. Due to the absence of garbage collection services, of drinking water distribution systems and drains, most of the settlements inhabitants have no choice but to dispose waste into the open air, into streams or clandestine connections to the rainwater network; they have to use community latrines and septic tank systems that pollute water deposits and put the population at risk of consuming products such as fish and fruit contaminated with faecal material

This leads to diseases for which the cost has to be covered by public health services and that cause a drop in productivity, low school attendance and high rates of infant mortality.

[15] *An example of a conventional urban biodiversity indicator is the number of birds or bird species present. This is an important measurement of the city's environment quality*

Chemical soil pollution also harms human health. This type of pollution may originate in industrial chemical effluents, grease contained in waste matter or landfills, or clandestine toxic waste deposits. Improper handling threatens the quality of urban life[16].

Industries are responsible for heavy metals contamination because there is no control on how they deposit waste and effluents. That practice harms the health of the low income groups living close to industries where they look for work and where illegal plots cost very little; they consume products polluted by heavy metals, for example contaminated fish from rivers, lagoons or polluted coastal regions.

Finally, the effects of urban development on the environment in relation to the quality of local life also include the deterioration of urban environmental quality, shown in pockets of warm spots and in floods that result from the high extent to which urban land is waterproofed, in pollution in areas with springs and in air pollution.

4.3 Impact on the urban economy (external causes)

Indicators

- Quality of water supply
- Public health costs due to incidence of water-borne diseases
- Water collection and treatment cost
- Cost of containing and preventing environmental risks.
- Cost of rehabilitating monuments and restoring historic centres.

Other

- Public health costs due to diseases caused by pollution of air and soil.

The state of the environment causes impacts on the urban economy and on productivity in general. This is shown, for example, by how urban functions and living conditions in the most vulnerable zones cause environmental degradation (floods, erosion or soil pollution in water basins, pollution of air basins, warm spots) or by worsening risks to housing.

Health problems resulting from by air and water pollution or environmental disasters reduce labour productivity because of absenteeism due to illness, thus affecting the cities' economy. They also increase public health costs that could be avoided if preventive measures and proper socio-environmental policies were adopted. In Peru in 1991, in the cholera epidemic on urban outskirts, 2 600 died and, because of the drop in exports of agricultural and fishery products[17], damages were close to US$1 000 million.

In the specific case of water, the impact of heightened demand and poor water quality increase collection and treatment costs that could be avoided with the right policies on prevention, environmental education and waste control. Concerning the water supply, the pressure of population growth and increased economic activities place demands on the natural resource and on the response by the local government, obliging it to invest in collecting water from ever more distant sources. In many large cities, treated water ends up being used for purposes other than human consumption, and meaning that much of it is wasted. As to sewage water treatment, more users mean higher treatment costs. An economic saving would be the result for the water authorities if they introduced proper management to reduce pollution at its origin.

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[16] *Families who live on dumps and separate toxic, harmful or organic waste is one of the most serious social problems. UNICEF promotes a campaign to get children away from the dumps. Even garbage collection in those countries may cause problems because usually toxic, harmful or organic waste is not separated. The lack of sanitary control over the destination of the garbage encourages improper or clandestine disposal, perhaps causing a resurgence of infectious diseases or diseases due to poisoning.*

[17] *Velásquez, L.S., 2001, Urban management indicators for sustainable development, Urban-territorial observatories for sustainable development. Manizales, Colombia. Environment and Development series, Economic Commission for Latin America and the Caribbean. ECLAC. Santiago, Chile.*

The urban economy is also harmed by loss of attraction and competition between cities whose economic activity depends on natural resources, as happens with touristic cities. Such reductions in the city's economic activity imply, in turn, a loss of tax revenue due to lower tax rates and reducing the capacity of municipalities to provide the services the public expects. Information for the transversal indicator that measures the attraction of urban zones is specific to the locality being studied and is based on its economy.

When it comes to the economic impact of biodiversity loss, recovering degraded areas or those prone to disasters such as floods and landslides, it is a question of environmental engineering costs such as building contention barriers, drainage ditches and others. These stop-gap measures end up consuming resources that could be used to prevent such damages.

In developing countries, the low-income marginalized urban population can only inhabit risk areas close to hazardous industries or on unstable land, such as outlying or hillside areas subject to flooding or landslides; they become more vulnerable to urban risks and in emergencies have less access to support services. The most developed countries are those least vulnerable to the impact of disasters and have more effective conservation and recovery measures. [18]

Although natural disasters cannot be avoided, their impact may be mitigated by preventive action. The incidence of floods, landslides and other disasters indicates how vulnerable the population is to risks that have social causes. Budgets for health, civil defence, environmental recovery work and others that may be applied to preventive action and urban improvement are used to remedy situations that could have been avoided.

4.4 Impact on built-up environment (human settlements)

Indicators:

- Loss of urban attraction
- Property depreciation
- Incidence of floods,landslides etc

Others

- Deterioration of historic centres

The built-up part of a city has physical and structural functions and is a basic reference for its inhabitants and their activities. This environment consists of buildings, architectural combinations and monuments, of the infrastructure itself, and of urban installations in general that must be considered when assessing its state.

The impact on the built-up environment refers to general living conditions in the city, how it functions, and its urban landscape; these conditions are affected by events such as floods, erosion or soil pollution and by hydrographic and air basins.

Degradation of human settlements includes destroying and abandoning buildings and failure to conserve such urban infrastructure as water supply and energy networks. One expression of the impact on the built-up environment is how the historic, cultural and architectural patrimony of the city deteriorates, apart from the depreciation of historic buildings in some urban areas because of health risks due to soil or air pollution, or to excessive noise on the busiest city streets.

[18] *In Latin America and the Caribbean natural disasters are part of the inhabitants' daily life because, after Asia, it is the region in the World where disasters are most frequent. According to the GEO report Latin America and the Caribbean 2000, in the past 30 years the annual cost of disasters in the region was between $700 million and $3 300 million U.S. dollars. In the last 30 years alone, there were 45 000 deaths, without counting the medium-and long-term economic impacts.*

In this case, impact indicators should be locally defined and serve as a complement to other specific urban environment indicators in making a general analysis of the city. The definition criteria will be monuments of historic, cultural and architectural patrimony, whether national or local; if there are no national criteria the UNESCO principles may be observed.

The impact on the urban infrastructure is now shown in costs such as maintaining and repairing networks, in data on the property market that may indicate the loss of real estate market value in some city areas. Other important impacts are: loss of urban attraction; difficulty of attracting private investment; or an influx of business or tourism that stimulates local economic growth.

In Latin America and the Caribbean tourism is one of the main economic activities. Although natural areas are the main attraction, cities directly depend on environmental quality to guarantee the activity will continue. Cities may also be tourist attractions or they may support sustainable tourism; however, if poor urban environmental management means they lose their attraction, the result is likely to be negative. From the economic and social point of view, the analysis should take account of job losses, a reduction in trade and the loss of an economically active population.

4.5 Impact on the political-institutional level

Indicator:

- Loss of tax revenue

The above-mentioned impact may have an apparently secondary effect but one which, since it may affect the capacity to regulate and intervene on a political-institutional level, tends to become central in urban dynamics.

If so far the central government has left environmental matters in second place now, prompted by the political need to create conditions for urban centres to develop economically, attract foreign investment, provide jobs and increase taxation in the locality, it is under pressure to include such matters as a mainstay of its public policies; that is provided it does not affect its capacity to properly guide local development.

Environmental themes will not only become part of the public agenda with growing political weight but, because of the need to consider the importance of these problems in relation to local public management capacity, they could also seriously affect local and urban administration

Environmental problems increase public health sector spending to: combat diseases caused by poor quality water and air and by the lack of sanitation; contain occupied unstable hillsides and risk areas; prevent or combat socio-environmental effects that cause floods; and environmental engineering works meant to solve contamination and deforestation problems. They also cause a loss of public income due to fewer rates and taxes being collected because of the downturn in economic activities such as tourism and services, industry and trade, affecting the local government's capacity to take action on sustainable urban-environmental management.

In spite of the possible difficulty of properly assessing this impact, and in view of the need to develop clearer measuring instruments, this must be evaluated and be made a permanent part of the process of assessing the state of the local environment.

4.6 Socio-environmental vulnerability

Indicators:

- The percentage of geologically unstable areas (risk areas) occupied.
- Percentage of risk areas occupied and subject to flooding
- Population living in vulnerable urban areas

Vulnerability to environmental disasters is now associated with global climate change with repercussions on human society[19] , although other natural factors, such as areas subject to seismic events, as well as social factors like human occupation of areas at environment risk, must also be considered.

Brown Agenda[20] themes in developing countries have become more important since the picture has been darkened by the accumulative effects of environmental degradation that goes hand in hand with human poverty. During natural disasters, the lack of support infrastructure, transport, hospitals, shelter and food, causes more than the expected number of victims.

Urban vulnerability may be accentuated due to:

- Economic and social concentration or discrimination; concentration of socially and economically vulnerable groups;
- The complexity and interconnection of urban systems; dependence on the infrastructure and its integration into urban systems;
- The location of settlements in unstable or critical areas;
- Accelerated urban environment degradation;
- Irregular, inadequate and precarious buildings and infrastructure;
- Lack of political and institutional will;
- Lack of effective regulatory instruments and control mechanisms on land use and occupation, and on activities harmful to the environment.[21]

Poverty increases vulnerability to natural disasters. Most affected by disasters are the poorest groups living in run-down housing; this population is being pushed towards areas unsuited for occupation, economically marginalized, vulnerable and polluted, with no proper infrastructure and are those most affected by floods and landslides caused by rain.

Natural disasters are happenings whose danger level is associated with natural causes such as floods, fires, earthquakes, tropical storms, and volcanic eruptions.

To the effects of natural events may be added disasters caused by human beings; for example, environmental degradation, polluting or harming strategic natural systems that help to maintain urban environmental quality and reduce their capacity to resist disasters while making it more likely that such events will occur, and increasing the potential magnitude of natural disasters.

Table 2 summarizes the clearest indications of urban and environmental vulnerability in the countries and regions of Latin America and the Caribbean

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[19] *Developing countries are especially vulnerable due to financial, human and technological limitations to prevent and recover from the impact of climate change, as stipulated by the International Panel on Climate Change (IPCC) in its third report (IPCC, TAR – WGI, 2001.*

[20] *The terms "Brown Agenda", "Green Agenda" and "Blue Agenda" refer to important themes on the world's public agenda on conserving and protecting the environment and deal with themes related to environmental pollution, forests and deforestation, as well as the quality and quantity of the planet's water resources*

[21] *Cf. Velásquez. 2001:13*

Table 2: Vulnerability in Latin America and the Caribbean[22]

Countries	Urban problems	Natural Disasters
Mexico	• Proliferation of shanty towns in principal cities • The poor with inadequate housing • The poor without basic sanitation • Rapid unplanned urban growth • Inadequate solid waste treatment and disposal • Deficient hazardous waste administration	• High incidence of natural disasters: hurricanes, floods, earthquakes, drought, erosion, landslides, volcanic activity
Central America	• Proliferation of shanty towns in principal cities • The poor with inadequate housing • The poor without basic sanitation • Rapid unplanned urban growth Inadequate solid waste treatment and disposal.	• High incidence of natural disasters: hurricanes, floods, erosion, landslides and mudslides; lack of planning, prevention and mitigation in vulnerable areas
The Caribbean	• Proliferation of shanty towns in principal cities. • Rapid unplanned urban growth • Inadequate solid waste treatment and disposal.	• Earthquakes and volcanic activity, frequent hurricanes and floods; lack of planning, prevention and mitigation in vulnerable areas
Andean countries	• Proliferation of shanty towns in principal cities • The poor with inadequate housing • The poor without basic sanitation • Rapid unplanned urban growth • Inadequate solid waste treatment and disposal. • Deficient hazardous waste administration	• High incidence of natural disasters, erosion and mudslides; occupation of unstable areas vulnerable to natural disasters • Meteorological events; strong rains • Lack of planning, prevention and mitigation in vulnerable areas
Brazil	• Proliferation of shanty towns in unstable vulnerable and risk areas such as hillsides and areas prone to flooding in the principal cities • The poor with inadequate housing. • The poor without basic sanitation • Rapid unplanned urban growth • Pollution, noise and traffic jams from the large number of private vehicles • Inadequate solid waste treatment and disposal	• Occupation of unstable areas vulnerable to natural disasters • Lack of water basin administration causing erosion, floods; poor handling of hazardous substances (petroleum). • Growing vulnerability to forest fires
Southern Cone	• Proliferation of shanty towns in principal cities • The poor with inadequate housing • The poor without basic sanitation • Rapid unplanned urban growth • High solid waste production	• Substantial damage caused by constant floods due to insufficient draining and the lack of zones for that purpose • High incidence of natural disasters, erosion, landslides and mudslides

[22] *Source: UNEP, 2000: GEO Latin America and the Caribbean: Panama Environmental; World Resources Institute, World Bank Staff*

Chapter 5: Urban environmental management policies and instruments (RESPONSES)

Chapter 5 of the GEO Cities report attempts to answer the question: **What are we doing now?**

That means assessing the intervention instruments created by the different sectors taking action in the city to promote changes in pressure on the environment dynamics to reduce or eliminate their possible negative impact on the environmental resources under consideration, either taken separately or integrated into the ecosystems, and on the quality of life of the local population.

The response instruments adopted have different formats, are meant for different social stakeholders, respond to the city's different environmental problems, use particular tools and have determined consequences in the urban-environmental interaction process.

This manual's presentation is general, considering that how these instruments are used in each city tends to be quite specific due to a series of factors (economic, social, political and cultural) particular of each one. The local technical team should consider and analyse the peculiarities of each instrument, as well as how efficient it is in redirecting the actions (pressures) that social agents exert on the environment.

This section, therefore, should only take a general approach to the city administration, concentrating its attention on specific aspects related to city urban-environmental management, bearing in mind that the administration's most general elements should have already been analysed in Chapter 2 of the report in the section on "Description of local political and administrative structure".

The purpose of the chapter on responses is, therefore, to highlight actions or proposals being implemented to solve some of the difficulties identified earlier in chapters 2, 3 and 4 regarding all the factors involved in the state of the local environment.

With this in mind, the report should contemplate analysing the responses or actions being taken by different sectors of society – local government, civil society, and private economic sector[23] to deal with local environmental problems.

For that reason the report examines the composition of social stakeholders with a bearing on the dynamics of the city; that is to say, political, social, administrative and management organizations and activities that determine how the city confronts its environmental and development affairs[24] . Chapter 5 is, therefore, divided into three sections:

1. Identification of key stakeholders related to the urban environment.
2. Urban environmental management structures and how they function.
3. Implementing environmental policies.

Identification of key stakeholders related to the urban environment

This section identifies the key local participants and interest groups – the people and organizations with important roles to play concerning environmental resources; collectively, they are called key actors or stakeholders. The purpose is to see the full range of stakeholders in

[23] *The main characteristics of these sectors should have already been analysed in the chapter on the context of the city's socio-economic and political urbanization process and they need not be repeated; it s enough to refer to them to help support this segment's analysis*

[24] *UNCHS-UNEP, 1999*

the city and to understand the ways in which they now, or might later, affect urban development and environmental management processes. This section will include key stakeholders in the public sector as well as those in private business, NGOs, communities and elsewhere.

When describing the various key stakeholders it is useful to discuss briefly their activities and roles in relation to the following three aspects of urban development and environmental management:

a) Information, knowledge, technical expertise.

This concerns the information, specialized knowledge, and technical expertise that different key actors may possess or have access to. It is important to be aware that relevant and useful knowledge is much more than simply the technical skills of trained professionals; informal knowledge and practical experience are often as useful as academic knowledge.

b) Decision making, policy formulation and policy coordination.

This depends on the extent to which various key stakeholders are involved in designing policies and in the different stages of the decision making process. Even if public organizations are the main actors in this respect, private sector and community key stakeholders can have significant influence and an important role to play in formulating policies and in decision making.

c) Policy implementation.

This concerns the roles different key stakeholders play in the city's development and in environmental policies, programmes and projects. Their involvement may be formal, as in the case of key stakeholders in the public sector with legal implementation responsibilities, or informal as in the case of the roles played by communities, NGOs and private sector groups which, while not so explicit, can be very important.

Urban environmental management structures and how they function

This section should focus on the city's urban environmental management and explain its administrative structure. An overview should be given of the city's organizational structure, explaining each department's responsibilities and how they are related. In addition, a dynamic description should be given to explain how the administration functions in practice, how the system actually works, and how the departments and organizations cooperate and coordinate.

Therefore, this section should focus on four key factors:

a) Organization and structure.

This means the basic structure and organization of the city's urban-environmental management; in other words, the institutions and groups responsible for the different aspects of local urban-environmental administration.

b) Information, knowledge and technical expertise.

This refers to organizations and groups responsible for collecting, distributing, analysing, managing, and using information and specialized knowledge. It means having access to information and the main areas of technical expertise available to city management.

c) Decision making, policy formulation and policy coordination.

Identify those involved in formulating urban-environmental policies, and the main organizations and groups with decision making power. Explain how these policies are coordinated individually and with others and implemented at local level (for example with a policy to encourage tourism), who is responsible and how this is done and, in particular, how policies and decisions are coordinated.

d) Policy implementation.

Explain which organizations are mainly responsible for implementing public policies in the different sectors and areas of study.

In describing this section it should be borne in mind that there are dimensions or levels of activity in making policy decisions and in formulating and implementing them; these levels may be described generally as:

- Political
- Management/administrative
- Operational/technical

Implementing environmental policies

This section discusses current initiatives and efforts to strengthen the cities' urban environmental management systems so as to improve local capacities to plan, coordinate and administer sustainable urban development. This section should only deal with the city administration in general rather than going into details about management arrangements for specific activity sectors, specific environmental resources, or specific environmental hazards, as was done in chapter 3.

The purpose is to highlight actions or proposals being taken to solve some of the difficulties already identified in chapters 2 and 3.

This means an assessment is needed of the instruments being used to reduce pressure on the environment, so to lessen any negative impact such pressure places on environmental resources. These response instruments have different formats, are designed for different social stakeholders, use specific tools and have determined consequences when interacting between urban surroundings and the environment.

The local technical team must consider and analyse each instrument, as well as its effectiveness in helping to protect environmental resources and improve urban environmental management.

5.1 Political-administrative instruments

Indicators

- Urban master plan in place
- Legislation to protect springs in place
- Regulation on controlling emissions from mobile and fixed sources in place
- Local Agenda 21 activities
- Environmental education programmes
- Number of environmental NGOs

Local government uses the policy and administrative instruments to define:

- Rules on using urban and non-urban space; for example, by establishing acceptable building norms and objectives in urban environmental conservation areas and within city limits.
- Allocating public resources; that is to say, establishing priority areas for positive action (investing in new works and maintaining and rehabilitating urban and environmental sites, as well as providing the local population with services) and areas of what might be called negative action (supervision, follow-up, control and regulations), establishing limits for action taken by the different social sectors and society in general.
- In the ideal city, the environment, the method and type of development (economic, social and environmental) that it is hoped to establish in the locality is made by setting objectives, goals, and indicators, by designing mechanisms and instruments and estimating the budget needed.
- Political-administrative instruments are mechanisms, usually mandatory, that drive the actions of interested local public and private stakeholders. Such instruments indicate that the public sector is aware of the different urban demands, needs and problems, and how they are related to the local environment.

Their use and the way in which they are employed suggest that, if the local government really wants to get results, it should invite the sectors interested in or affected by the policy in question to participate, to a greater or lesser extent as required. If there are no such instruments, or they are inefficient, it may be concluded that the local government and/or groups of society are not, or were not, capable of creating the proper mechanisms to deal with the problems putting pressure on the environment.

These instruments include a broad range of initiatives, such as:

- Policies: environmental protection, urban development, transport, environmental pollution control, health.
- Normative/legislative: norms, regulations, laws, local, national, regional and global urban-environmental laws that have a local effect, such as assigning environmental commitment terms and applying ISO 14000 criteria.
- Institutional: creating ministries or other environmental agencies, programmes, projects and institutional action, multilateral agreements.
- Follow-up and control: control mechanisms to reinforce standards, laws and public policies, urban-environmental supervision and control instruments.
- Presence of Local Agenda 21: bodies linked to Agenda 21, social participation projects, programmes and related activities, resources allocated, participating organizations.
- Territorial planning: urban master plans, environmental management plans, land use laws, distribution of zones according to economic and ecological characteristics, environmental protection areas.

5.2 Economic instruments

Indicators

- Tax system based on the polluter/payer or user/payer principle in place
- Preventive warnings and fines for violating waste disposal standards

Economic instruments are very important in promoting behavioural changes. They are needed to improve the state of the local environment if, on the one hand, account is taken of

their capacity to intervene in economic activity and the interested private stakeholders profits and, on the other, the possibility is considered of imposing charges on the economic and other sectors of society (including government agencies and individuals).

Economic instruments are generally associated with local government and its capacity to impose taxes on society, but they may also originate in the private sector.

The ISO 14000 standard, for example, was created in the private sector to assess the suitability of businesses and groups interested in environmental conservation and sustainability activities. Although this is a voluntary instrument and does not impose any direct economic cost on interested economic or government groups, the lack of an ISO 14000 certificate may imply indirect costs since it would signify the loss of markets, or make it difficult for companies to obtain financing for a project from government institutions or bodies.

Therefore, one way for the local government to use the ISO 14000 standard is to adopt it as a precondition for contracting engineering services and thus encourage changes in production models and make companies more aware of the environment.

The analysis of economic instruments is divided into:

- Financial: funds for activities to protect and/or conserve the environment, subsidies for territorial occupation and for other activities that do not damage or that protect the environment. Budget resources.
- Taxes: ecological ICMS[25] , taxes, fiscal instruments.
- Others: fines.

5.3. Technological instruments

Indicator

- Investments in solid waste management

Technological instruments are also important when assessing responses about the state of the environment.

Pressure to acquire new technologies is greater on private enterprises because of market competition that demands the constant addition of new technologies, or because of government environmental control measures. However, also to be considered is the adoption of new technologies by the public sector that may be positive when defining new ways to assess environmental pressure caused by different urban activities.

The analysis should focus on technological advances adopted by the public or private sector that may be able to change environmental conditions through:

Processes: new technologies, solid and liquid waste treatment, pollution from industrial gas emissions, recovered or degraded areas, recycled material.

Products: industrial filters, automobile catalysers, CFC-free sprays, unleaded gasoline .[26]

To make the most appropriate assessment of these technologies they should be related to cases where the processes are induced by local legislation, regulations or standards that will

[25] *The ecological ICMS is a differentiated sharing in the distribution of increased resources among municipalities. In Brazil it refers to the status after charging a tax on the circulation of goods and services. The states or municipalities that can demonstrate they have taken action to protect or conserve the environment receive a bigger contribution than the federal government. Because it is an economic stimulus, municipalities include environmental protection policies in their own policies.*

[26] *With respect to Brazil, in addition to extracting lead, alcohol is added to gasoline to reduce the environmental effects of using fossil fuels*

also allow an assessment to be made of the effectiveness of the State's policy-administrative instruments.

An indication must also be given as to whether information is available about to what extent pressure on the environment was reduced thanks to the introduction of industrial filters, automobile catalysers or CFC-free sprays. This information will permit an assessment to be made of the new technology's effectiveness in improving the state of the local environment.

5.4 Physical intervention instruments (public investments)

Indicators:

- Total rehabilitated areas in relation to total degraded areas
- Investment in green areas
- Investment in environmental recovery
- Investment in public transport
- Investment in water supply and drainages systems
- Investments in waste management
- Access to and quality of local infrastructure services

Others

- Household connections

The principal mechanisms to improve the local environment include physical measures used by society, in particular the local government, to reduce the pressure urban activities place on the environment.

These are generally sanitary engineering works such as building drainage networks or networks to collect, treat and distribute water, or other works designed to correct socio-environmental problems caused by uncontrolled land occupation of, for example, areas at risk of landslides or subject to flooding.

If no account is taken of the conditions in the ecosystem in which they are applied, these measures also run the risk of putting pressure on the environment.

The following engineering operations and works should be analysed:

- Increasing access to public health services; building, expanding and improving infrastructure, connecting to drainage networks, collecting and treating solid waste, decontaminating rivers and other water courses.
- Creating and reclaiming green areas, parks, gardens, environmentally protected areas, even when finance alone is not a good indicator of whether the response is effective.
- Water supply system; financing, source, socio-spatial distribution supply/demand relation.
- Drainage systems; financing, source, socio-spatial distribution, supply/demand relation.
- Final disposal of solid waste; financing, source, type of treatment, location of garbage deposits, socio-spatial distribution.
- Reducing areas subject to landslides; number of areas benefited, contention areas, resources, distribution in the urban area, population benefited.
- Channelling rivers, clearing water courses, protecting springs within the municipality, conserving river banks; resources employed, areas benefited distribution in the urban zone, population benefited.

- In areas subject to flooding; types of operations, resources, areas and population benefited.

5.5 Socio-cultural, educational and public communication instruments

Indicators

- Environmental education
- Local agenda 21

Instruments that try to promote changes in how individuals, companies and government bodies behave are increasingly used to deal with problems threatening the environment.

This practice is the result of understanding that, if social stakeholders do not change their positions with relation to the proper and sustainable use of natural resources, using other response instruments will have a very limited effect.

Environmental organizations, local government bodies involved in protecting and conserving the environment, and national and international development organizations, have now reached a consensus on the central role of environmental education and communication in halting irresponsible use of the environment.

The success and continuity of contemporary production and consumption models are supported by the constant use of advertising and marketing resources. In this respect, in recent years a wide range of instruments have been used to change consumption practices that are incompatible with the natural cycle of replenishing environmental resources; they are also used to make people more aware of the interactions between society and the environment.

Such instruments include mechanisms that encourage greater social participation in formulating, managing and following up on local public policies, and on decision making on urban-environmental concerns about quality of life, whether of the entire population or certain sectors of it.

In analysing the type of response the focus should be on:

- Civil society participation, incentives to participate in social organizations, in decision making and in implementing public policies on the environment, state/civil, society/private sector projects, participating in electing organizations that prepare environmental audits
- Educational programmes and services; environmental education, campaigns on the use of natural resources, selective collection of waste, recycling material.
- Use of information technology to promote environmental communication, making environmental information available on the Internet, radio and television programmes.

Chapter 6: Future outlook (SCENARIOS)

The objective of this chapter is to build a future picture of the city's urban-environmental evolution so that the different social stakeholders can formulate public policies and take action; such policies and action may serve as responses not only about the present state of the environment but also about how it might evolve in future. In doing so account should be taken of the analysis made and of how the data and information are presented in the GEO report.

The chapter deals with two important components: Emerging Themes and Future Scenarios of the city's urban-environmental development.

6.1 Definition of emerging themes[27]

One of the purposes of the IEA/GEO report is to prepare a strategic panorama to serve as a guide for action taken by the public authority and local society in terms of the city's urban-environmental management. To do this the local technical team must identify the emerging themes that will be important when defining future urban and environmental policies.

In defining the IEA/GEO methodology[28] , emerging themes are those relevant to urban-environmental management that will have an impact over the medium and the long term. These themes also include environmental changes caused by short-term human activity with long-term effects.

It should also be considered that emerging themes are not only problems; they could also be opportunities that may appear in the future and would have a positive impact on the environment. However, whether problems or opportunities, a common characteristic is that they are surrounded by uncertainty and controversy.

Environmental changes caused by human activities, and apparently of little or no importance, may have accumulative effects over time and sometimes appear after more than two generations. It is difficult, therefore, to recognize changes in the global scene over a period of one generation's life expectancy or a government term; accordingly, there is always the possibility of uncertainty and controversy about which emerging themes should be considered important when making the analysis.

It is impossible to predict all the variables influencing changes in the environment; however, scientific uncertainty does not justify failure to take measures to protect the environment[29] . Therefore, the strategy employed to identify critical points and to plan and execute preventive measures, is based on the precaution principle that recommends the public administrator be on the look out for, and anticipates, future environmental effects of the city's present dynamics, and act so as to prevent or reduce such effects.

The IEA/GEO methodology identifies three categories of environmental material that could, perhaps, be very important in the 21st century:

a) Unexpected events and scientific discoveries. For example, links between climate changes and health, the use of Genetically Modified Organisms (GMOs), biodiversity and health, the use of pesticides and health.

b) Unexpected changes in long-established themes. For example, trade and environment, competition and local development limits because of environmental liabilities.

c) Changes in known themes that now have the right responses but whose consequences over the medium and long term are unknown. For example, leachates, CFCs, cloning and cancer.

There are various advantages in taking account of emerging themes in urban-environmental management: first of all, raising awareness among citizens about the inter-relationships between the local and global environment. Second, taking early action to ensure adaptation and avoid a

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[27] *In defining the IEA/GEO methodology (consult Pinter, Zahedi and Cressman, 2000:101) the "emerging theme" concept presupposes a notion of medium and long term*

[28] *UNEP, IISD and Ecologistics International, 2000. Training to prepare integrated environment assessments and reports, Training manual*

[29] *This is a recent concept that was recognized in the last decade to implement inter-media or public environment policies. The United Nations Framework Convention on Climate Change, 1992, serves as a legal basis for international agreements, such as the Kyoto Protocol, that seek to reduce the effect of greenhouse gases.*

crisis. Third, providing better guidance about research and systematic data collection. Fourth, promoting understanding about how human activities and the environment are connected. And, finally, making scientific knowledge available to the public administration.

In the not very distant future emerging themes will be part of the public agenda that takes account of as yet unsolved accumulated environmental problems (environmental liabilities) that generally go hand in hand with urban development and the growth of cities. The following are some matters that have to be faced.

- Polluted locations or old industrial zones and their impact on the health of ecosystems. Environmental conflicts related to economic losses and damage to health and quality of life caused by environmental pollution.
- Environmental compensation for pollution caused by industrial activities in the locality.
- Environmental responsibility related to creating environmental liabilities.
- Advantages of and limits to compensation and local development resulting from each locality's environmental liabilities.
- Urban vulnerability and environmental disasters; the effect on our planet's present climate change due to local industries emitting greenhouse gases into the atmosphere.

Emerging themes will depend on the specific relation of the local urban situation to the territory's natural resources and ecosystems. This stage, together with that on recommendations, is a dual resource that should help local public policy decision making.

The definition of emerging themes also permits an assessment to be made of the responses given to the city's main urban-environmental problems. Such responses, therefore, should be assessed on two levels: already existing problems, and emerging future themes.

Table 3. GEO Lima and Callao emerging themes

1. Conflicts over water shortages.
2. Conflicts over territorial demarcation and land use.
3. Water basin management and payment for ambulatory services.
4. Use of alternative fuels.
5. Business social responsibility.
6. Youth participation in environmental policies.
7. Environmental impacts of the Free Trade Agreement

An explanation will shortly be given about the scope of some of them.

Conflict over water shortages: The city of Lima and Callao faces a critical situation between the growing demand for water and ever more polluted supplies. A debate has recently begun about the new Water Law and privatizing SEDAPAL, the water and sewage services company, as an option to increase investments in the costly infrastructure needed to meet the needs of 100% of the citizens of Lima and Callao; They, however, are not convinced of the benefits of privatization. The international debate about water conflicts and the human right to water, privatization agendas and the real daily difficulties faced by those who do not have a water service, intensify conflicts about the resource in the capital.

Conflicts over territorial demarcation and land use: The debate about territorial demarcation and land use will soon be reopened due to attempts to invade coveted land on

urban outskirts, such as the zone bordering the Pachacamac Sanctuary, the Ventanilla sands or the San Bartolo pampas; debated also are structural changes induced by decentralization, economic-ecological zoning regulations and the new land use proposal for Metropolitan Lima. The effectiveness of land use instruments and public consultation mechanisms will be put to the test and there will be no lack of pressure from land speculators, large property interests and citizens concerned about the quality of life in the city.

Water basin management and payment for ambulatory services: In Peru, and in Lima and Callao, a new land management for development model is being promoted. This new management with a territorial focus is being tried out by an initiative called Rio Lurin Pilot Project (PROCUENCA-Lurín), with local stakeholders active participation in building the democratic governability, economic development and social well-being of the basin's population. This programme could become a new territorial management model for other urban basins in the country. In addition, it will revive the debate about the search for recognition mechanisms and payment for the environmental services the basin provides to the city.

6.2 Building scenarios: local trends (inertia, the best and worst cases)

The other important component of this chapter concerns formulating scenarios.

Besides being stimulating, building scenarios is an important exercise because it makes us think about how the city's dynamics should evolve and the consequences for the local environment; it considers certain trends that may now be detected and, amplified, will allow us to build different scenarios to be used in urban-environmental management.

Important: Scenarios are not predictions but they suggest a range of options to reduce the uncertainty surrounding policy options. It is not expected that in future they will perform exactly as foreseen in the different scenarios proposed in the IEA/GEO report. However, formulating public policies and action based on these possible scenarios allows us to anticipate problems and be better prepared to face them.

For sustainability to be feasible in cities, long-term processes and the projection of scenarios must reflect responses, given by both the public authority and civil society, to environmental problems caused by urban development.

With the help of the simulation study, administrators will assess the purposes and progress of urban environmental policies according to their objectives and availability.

Definition

Scenarios are portrayals of the future based on suppositions told with words and numbers; they present a coherent and multidimensional view of how events occur. They are developed to help decision-makers to foresee future situations with different degrees of probability and, thus, direct events along sustainable paths and avoid adverse consequences.

The description includes, among others, qualitative elements such as behaviour, values, cultural influences, and changes; there are also quantitative elements that provide greater precision and details about possible results and make the scenario more consistent and rigorous.[30]

[30] *Kartha, Sivan. (2005) SEI Presentations. In Workshop on National*

Preparing scenarios implies putting into effect possible future visions using present options; building them requires qualitative and quantitative information. Some trends will be easier to outline than others.

The result will be a mixture of indicators, trends and potential goals, with explanatory texts explaining how the history evolved. Information on costs and benefits is also relevant since it permits the analysis to determine how feasible is each scenario's economy and financial needs.

Scenarios are built by considering three types of trends.

The inertia trend

This trend considers the possibility that no responses are formulated to confront the environmental problems detected, that such responses are not adequate, or that the conditions to implement them do not favour achieving the objectives. In this case the future scenario will project an increase in, or even worsening of, environmental problems detected.

In this case, it could happen that:

- No response has been formulated to confront environmental problems detected.
- The responses are inadequate.
- Implementation conditions do not favour achieving the objectives.

The best case trend

This is situation where local government and society would give perfectly adequate responses to the problems and there would be no impediments to putting such responses into effect. In this case, the scenarios will project the overall improvement in the local environment, or in the sectors in which social agents intervene.

In this case:

- Responses by local government and society will be quite adequate to tackle the problems.
- There are no impediments to implementing the responses.

The worst case trend

This is where there is no response to the problems, or where the conditions to put the responses into effect either do not help, they place hard-to-overcome obstacles in the way, or mistaken decisions made by social agents worsen or amplify factors that put pressure on the environment.

The future scenario will project a serious worsening of environmental problems.

In this case:

- There is no response to the problems encountered.
- Implementation conditions do not help or put hard-to-overcome obstacles in the way.
- Wrong decisions worsen or amplify factors that put pressure on the environment.

Besides the steps described above, to build the scenarios it is still necessary to take into account a set of elements so that they make sense and are useful for urban-environmental management.

- Future developments should consider environmental implications.
- Scenarios should have an integrated approach to sustainable development but should provide an environmental window to highlight environmental descriptions and policies.
- The scenario is to be presented with a narrative and, whenever possible, with quantitative elements that can be understood and are coherent and consistent.
- The narrative should include the present state, driving forces, discussions about the future and the view of the future, as well as considering the stakeholders, events and context.
- Scenarios should be limited as to space and time.
- The same environmental themes highlighted in the report on the State of the Environment should be included and analysed in the retrospective as well as in the prospective chapters [31]*.

Scenarios for the GEO Cities report.

The collection of IEA/GEO documents prepared under the guidance of UNEP have been using a set of scenarios based on accentuating some of the most outstanding factors to allow a more precise characterization to be made of each scenario. In Latin America the IEA/GEO documents have been structured around the three main scenarios that consider the possibility that the region and its cities might follow world trends, and these are:

> **Markets First**

Most of the world adopts values and expectations now prevailing in industrialized countries. The well-being of nations and the optimum role of market forces dominate social and policy agendas. Confidence goes beyond globalization and liberalization to increase corporative well-being, creating new enterprises and sustenance, and thus helping people and communities to afford insurance against environmental and social problems. Ethical investors, together with citizens and consumer groups, try to exert a growing corrective influence but they are undermined by the prevailing economy. Growing demands continue to overwhelm the power of governmental authorities, planners and legislators to regulate society, the economy and the environment.

> **Policies First**

Decisive initiatives are taken by those who govern in an attempt to achieve social and environmental objectives. Coordinated pro-environment and anti-poverty actions balance economic development. Environmental costs and benefits are included in policies, in regulatory frameworks and in planning processes. All these are strengthened in the fiscal area or by incentives such as a tax on carbon emissions.

[31] *Kartha, Sivan. (2005), op.cit*

> Sustainability First

A new environmental and development paradigm emerges in response to the challenges of sustainability, backed by new and more equitable institutions and values. A more visionary state prevails about what happens, in which radical changes in the way people interact with others and with the world around them stimulates and backs sustainability policy measures and responsible corporate behaviour. There is more collaboration between governments, citizens and investors in decision making on themes of common interest. A consensus is reached on the need to satisfy basic needs and to achieve personal objectives without harming the future outlook

> What are the scenarios analysis lessons?

The scenarios analysis teaches:

- How to contrast possible happenings that show what will occur over the long term, for example 10, 20 or 30 years, and will have implications for the environment and sustainable development.
- How to identify the environmental impacts of human action, or inaction, on policy decisions.
- Achieving the social and environmental objectives will require great coordination and agreement between stakeholders today and for many years to come. This includes preventive and adaptation measures.
- How to identify existing links between environmental matters and social themes: synergies, joint benefits (health and environment).
- It must be taken into account that, for environmental governance, a prerequisite for different policies is having solid institutions.
- Bear in mind that having accessible and reliable information is the key to decision making.

Below an example is given of GEO Lima and Callao, summarizing the possible scenarios for these two cities

Table 4. "Environmentalization" level under the three scenarios[32]

Environmental policies and programmes	Unregulated market	Scenario Reform	Sustainability
Institutions	Multidistrict administration, dispersed, unarticulated and weak. Environmental management from subsidiary municipal offices.	Multidistrict administration with metropolitan outlook. All municipalities have first-rank environmental directorates.	Integrated metropolitan administration. Environmental management included in all urban policies and monitored from a central unit.
Economic policy	The FTA, FTAA and international agreements define economic behaviour. The beneficiaries and large enterprises. The "trickle down" theory has failed. Poverty increases.	World integration continues and domination by translational enterprises, but redistributive policies are applied. Joint ventures in projects profitable from the economic, social and environmental points of view. Poverty increase halted.	Development policies designed based on a wider range of economic tools and on producing goods and services with added value. Strong impulse to small and micro enterprises and productive chains. Poverty in decline.
Urban and housing policy	Urban plans are dismantled, urban-environmental land use is non-existent or ineffective, the view is of an expansionist horizontal pattern, and for housingts emphasis is on quantity rather than quality.	More articulated urban plans, better urban oversight and control, pilot projects to improve districts and urban outskirts, successful repetition of densification programmes.	Metropolitan plan and district plans included in the regional economic-ecological zoning programme, massive neighbourhood improvement programmes; urban densification and control of outskirts.
Energy and transport policy	Low energy reconversion with the massive CAMISEA transport pilot project,	Moderate CAMISEA project reconversion and massive transport programmes successful.	Strong CAMISEA project reconversion with alternative transport programmes.
Industrial policy	Environmental regulations in some sectors, poor control and ineffective sanctions system.	Environmental regulations in all sectors and productive branches, effective control.	New production sectors developed, coefficient concept included, strong control.

[32] *Source: GEO-Lima and Callao. Level of "environmentalization" of the policies under the three scenarios*

Investment in environmental policies	Very low, strong dependence on foreign cooperation and benefactors.	Moderate mixed municipal and private investment.	Strong environmental investment in all policies and programmes.
Social and citizen participation policy	The free market prevails, social policies are assistentialist, some participation but limited models are tried (participatory plans and budgets, LCC).	Moderate market regulation, social policies prioritized with pilot programmes on empowerment and environmental citizenship, diversification of public participation mechanisms.	Strong regulation and market control, massive empowerment and environmental citizenship programmes, participatory democracy is a common practice.
Water and sanitation policy	Emphasis on supply, diversion of basins and investment megaprojects, technology and conventional infrastructure, centralized system to treat drains, state monopoly or privatization with little regulation.	Emphasis on demand, pilot water saving projects for agricultural, industrial and domestic use, new technologies on saving water and decentralization treatment systems. Concession of services with moderate regulation and control.	Strong management of demand, planning and integrated administration of water basins, huge increase in efficient technologies, water re-used and recycled. Concession of services with strong regulation and control or state management restructured.
Environmental quality policy	Reactive policies (end of pipeline control) pilot projects on recycling residues, environmental recovery of ecosystem redoubts.	Repeat of successful pilot projects, moderate investment in recovering symbolic environmental ecosystems (rivers, wetlands).	Preventive policies, programmes to minimize residues and effluents, public-private partnerships to recover large ecosystem corridors (valleys and basins, hillsides, wetlands and marine-coastal zone.
Patrimony management	Prompt recovery of monuments in the interest of private and international benefactors.	Urban policy to conserve and manage patrimony sites by municipalities, pilot restoration programmes.	Patrimony becomes an urban asset. Massive restoration and conservation programmes with private and citizen participation.
Environmental citizenship	Little citizenship awareness, the environment is seen as being subsidiary to other interests and needs.	Moderate awareness, the environmental begins to become part of daily life.	Broad environmental awareness, responsible behaviour prevails.

III. GEO Cities Process

Preparing the GEO Cities report implies a series of stages that must be thought through to allow the local technical team to produce the document while keeping in mind principles and experience already acquired, not only in Latin America and the Caribbean but in other parts of the world as well.

To prepare the assessment and the GEO Cities report, a technical team officially backed by the local public authority is needed, information must be collected, an extensive analysis made of the state of the environment, and solutions developed or suggested for the different problems detected.

This manual describes each stage of the process. It seeks to encourage participation by different sectors in preparing the report and to demonstrate the importance of communicating the results and proposals to the greatest possible number of interested social stakeholders, both in local government and society.

At each stage of producing the assessment activities must be carried out with relative interdependence and, according to local circumstances, in a different order than that proposed in this manual, based on what best suits the political and institutional situation in each city.

Stage 1 Institutional

The first, or institutional stage, is where important decisions are made about preparing the institutional conditions to produce the report. This is also the stage where the local technical team is defined, stakeholders identified who will be invited to contribute to the document, training will be given on the GEO Cities methodology, and responsibilities will be established for the report's production.

An institutional collaboration and organization framework will be established: in order to pinpoint common points of interest, this will identify and make contact with different institutions with a mandate or an interest in environmental themes. Discussions will be held and agreement reached on the objectives and responsibilities in preparing the GEO Cities report.

1.1. Installation activities[33]

Why is the process important?

As we have seen, the objectives of an integrated environmental assessment report are broader than those of traditional environmental reports; therefore, they should be made known to the public and to organizations.

The technical team members come from different disciplines, organizations and even different social strata; they probably have different outlooks, all legitimate, about the environment and the economy. Learning opportunities are brought to light when interaction among them produces new information.

Sequence is the order of the key questions (table 5) that guide the process. First, we need to know what is happening to the environment in order to understand why it is happening. To be able to discuss what action to take, or the consequences of not taking action, we also need to understand the driving forces and the main causes.

[33] *This section is completely based on the chapter "Assessment and producing reports" in Section 1 of the UNEP, IISD and Ecologistics international Training Manual, 2000, Training to prepare Integrated Environment Assessments and Reports.*

Cooperation depends on the capacity of the team to work together. Integrated environmental assessment requires linking information and insight usually scattered across a wide variety of disciplines and organizations. Therefore, it also requires bringing together organizations and people who usually do not work as a team; in this respect there is a high potential for tension along professional, bureaucratic, religious or political lines. Confidence, trust and cooperation between key organizations and individuals are vital for success.

Appropriation. The objective of this report is to increase knowledge about the interaction between society and the environment so that needed changes can be made. The best way to ensure that the report's observations and recommendations influence decision making is by involving people whose task this is, as well as those who might be affected by the results.

Clarity. It is important that, from the beginning, uncertainties and suppositions about how the report is to be prepared should be clarified so that groups with different interests can participate throughout the process; the participants might see this as a challange.

One of the main characteristics of the GEO Cities process is its perspective based on three basic principles: it is participatory, multidisciplinary and multisectorial. **Participatory** means that the different stakeholders in an interactive process promote exchange of knowledge and information, as well as helping to clarify their positions and interests about a given problem. Involving different stakeholders will give a better understanding of the themes and improve both the process and the quality of policy decisions. **Multidisciplinary** means that to make an integrated environmental assessment it is crucial to have the support of different branches of scientific knowledge. Discussion, construction and analysis by the different disciplines all help to enhance the quality of the assessment. Finally, it is **multisectorial** because environmental questions have links to economic and social themes. In this outlook it is necessary for the different sectors (public and private) to participate in preparing a satisfactory assessment, as well as ensuring that the assessment will result in responses being given and appropriate action taken.

Another attribute of the GEO process is that it is associated with the production of a family of **multiproducts** as a means to reach a wider audience. Such products range from preparing simple posters, dissemination tables, leaflets, CD roms, and gathering data for the GEO Cities report to preparing executive summaries.

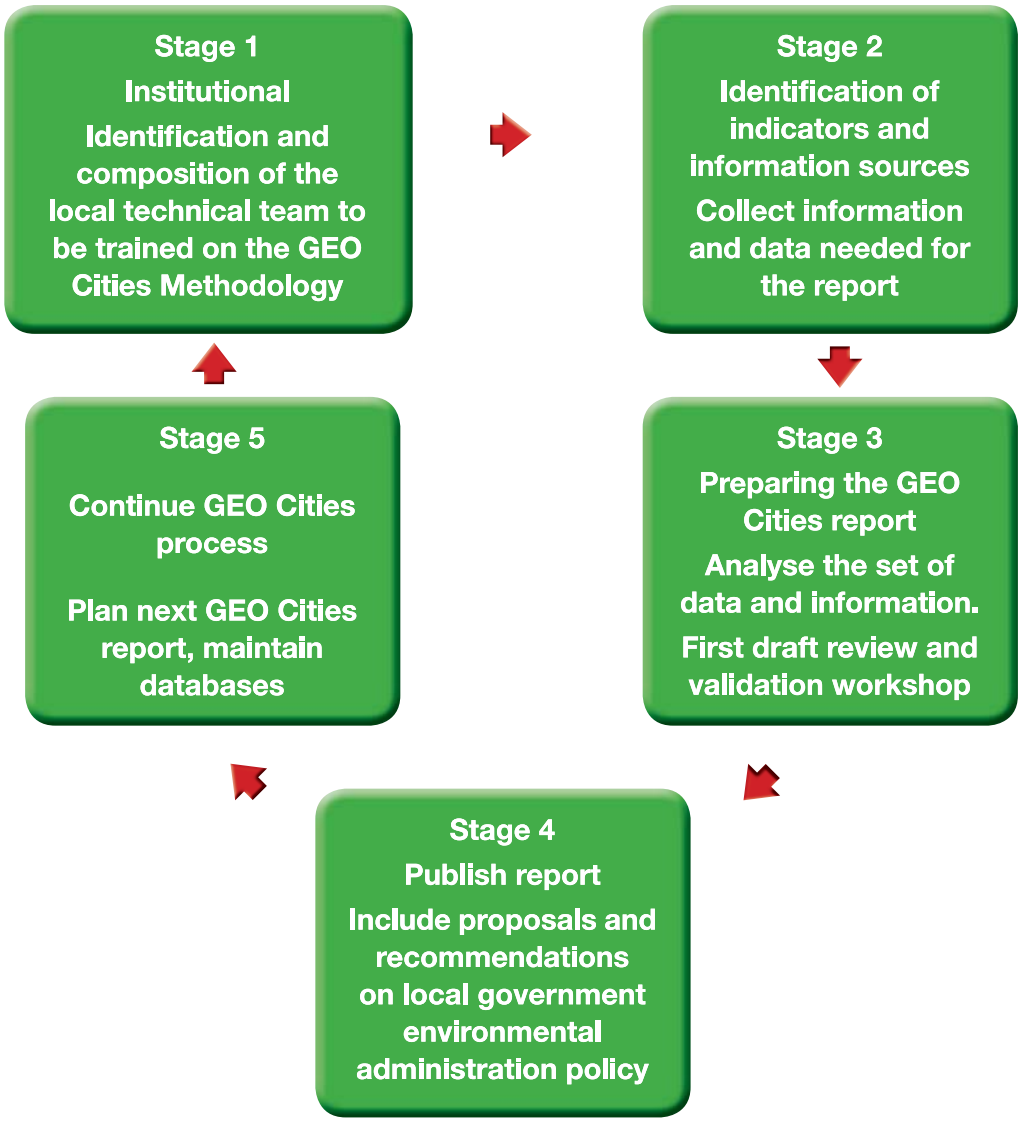
The most important conditions to ensure the success of the GEO Cities report process include the political will of the local public authority and the commitment of local civil society, in particular of those in each city who are directly involved with environmental themes. This signifies that the possibility of having a successful GEO Cities outcome depends on receiving effective support from the municipal authority, or its subordinate bodies, in making available human, technical and financial resources for the work; they should also allow access to the information needed to analyse urban-environmental questions concerning the locality. On the other hand, it is essential that civil society sectors involved with the work make a commitment to continue with it in spite of any difficulties that might crop up along the way.

For these reasons, the institutional stage of the GEO Cities process is of vital importance given that material conditions will be created to enable the entire work to develop. This stage merits special attention by all those involved, the public authority in particular.

The other components of this stage are analysed below.

Table 5 is a graphic description of the sequence of the stages foreseen for the GEO Cities process.

Table 5: GEO Cities Process



Who will administer? Who will participate?

The organizational structure should function both in the first stage that studies environmental conditions, and throughout the whole process; it is, therefore, important that all participants understand the need for a long-term commitment.

Conducting the process requires technical and/or political capacities. For this it is important to have the leadership of institutions capable of mobilizing different social stakeholders throughout the whole process. On the other hand, such institutions should have professionals trained on environmental questions to lead and to integrate the analysis into the report.

The assessment and the integrated report are tools that may be used to facilitate communication between science and politics. This is particularly important because it can leave the door open for continuous dialogue between the interested parties and society in general.

A participatory process should result in linking science and politics. However, if the report's preparation is to be handled properly, then the number of participants must be limited.

In which institutional environment?

In recent years public organizations, non-governmental organizations and institutions have published environmental assessments[34] However, so that the report and the assessment are not dominated by the outlooks or interests of local governments, social groups must be guaranteed a more important role.

Nevertheless, as this programme deals mainly with government reports that inform the public about outlooks which, while different, are also pertinent, these efforts should be considered as being synergetic rather than competitive. It is important that the report's institutional context be consistent with the broader institutional framework of the city or the country. Some cities have experience of scientific research and of systematic data gathering and planning; in these cases information on the environment may be well developed and organized. In other cities information may be scattered and the report may appear uncoordinated.

As there are no fixed rules, many variations may be found in the institutional framework. Some countries have had successful results for processes of this type with different institutional models; for example, that shown in Table 6.[35]

Local governments may:

- Use an existing government department.
- Establish an independent agency responsible for information on the environment, and for preparing assessments and reports.
- Hire a non-governmental organization or a university to prepare the GEO Cities report.

It is important to keep in mind that, while the framework or institutional environment used when preparing the GEO Cities report may be quite flexible, its form must be very clearly defined in accordance with each city's institutional conditions

[34] *UNEP, IISD and Ecologistics international, 2000, Training to prepare Integrated Environment Assessments and Reports. Training manual.*

[35] *Training manual. UNEP, IISD and Ecologistics international Ltd. Op. cit*

Table 6. Examples of institutional structures in some GEO Cities reports:

GEO Montevideo.
The city authorities, taking advantage of a team of municipal technicians responsible for preparing annual environmental reports on the city of Montevideo, and in keeping with the broader character of the GEO Cities report, expanded the original team by adding technicians from different areas; also included were representatives of environmentalist NGOs, the National Environment Directorate, and the University of Uruguay. Joining the team too were technicians from the Municipal Authorities of Canelones and San José, both within the Montevideo metropolitan area. The process was the responsibility of the Coordinator of the Environmental Education Group of the Municipality of Montevideo.
GEO Santiago
This report adopted another institutional strategy in that the Urban Studies Institute of the Pontifical Catholic University of Chile is responsible for the process. Taking part were representatives of different public and private bodies in the city including the Chilean Construction Chamber, the Ministry of Housing and Urbanism, the Latin American Botanical Network and the Transdisciplinary Centre of Environmental Studies and Development, the Ministry of Housing and Urbanism, the Latin American Botanical Network and the Transdisciplinary Centre of Environmental Studies and Development.
Both models are pertinent and allow an integrated urban-environmental report to be prepared. Choosing one or the other institutional structure will depend on the assessment made in each concrete case on institutional conditions in each city.

What is the legal mandate?

Assessment and reporting are complex tasks which, unless carried out correctly, will not produce the expected results. This requires that the legal mandate and the capacity to carry out the task are taken into account as part of the social organizations core infrastructure; this is usually a government responsibility. The legal mandate must be clearly backed by laws and regulations.

a) Legislation may include the degree of collaboration between government agencies that contribute to the report.

b) A joint working method may be established between the national or local authorities preparing the statistics, national or local follow-up programmes and the agencies presenting the reports.

c) It is recommended that legislation include a discussion on environmental reports between different sectors of government. For example, a national agency may perform a catalytic and support role to prepare the report at sub-national and local levels.

d) Legislation may promote exchange of data and harmonization of report initiatives.

e) Finally, the authority prepares the way for consultations and external participation by advisory groups.

1.1.1 Identifying and appointing the local technical team

One of the most important steps in the process is to identify the social stakeholders interested in being part of the technical team.

The interested groups (Table 7) are individuals and organizations willing to participate in planning and execution.

They can be groups of:

- Suppliers; people who control and administer services.
- Users; people who use and are directly affected by services.
- Interested people who will be indirectly affected by the impact of the service or of its system.
- Experts; people with specific knowledge about the service and its environment.
- Social movements;
- Excluded: people without access to basic urban services.

Table 7: Interested groups (stakeholders)

Governements	Religious Organizations	Indigenous groups
Enterprises and their representations	Universities	Youth groups
NGOs	Trade Unions	Unaffiliated cities
Communications media	Representatives of political parties	Associations of inhabitants of poor or marginalized areas

a) Training the work group or local technical team

This sets out the basic steps established to train the work groups in cities covered by the GEO Cities Project.

1. Determine the scope of planning and define its objectives. This should be done by whatever body (the city) starts the process with the stakeholders. It should include an educational campaign to arouse interest and gain support.
2. Create or design a General Coordination to regulate and guide the general planning effort, and integrate the results of the debates, research and drawing up the action plan or plans.
3. Establish a working group structure under the supervision of the General Coordination. These working groups will be given responsibility for setting tasks such as: establishing priorities, analysing certain questions, preparing an overall view; or they may be established to study specific questions that include such matters as garbage, health, and so on.
4. Identify the appropriate specialists to join the local team and the working groups.
5. Establish terms of reference for each group's activities that include defining the relationship between planning the stages of the process and city administrative planning; for example, the budget and freeing the needed resources.

The organization may be as described as follows

Structure of the Local Technical Team

The following is a possible composition of the group of people in charge of producing the GEO Cities report:

Local Technical Team:	It may include members of different public bodies, civil society organizations, consultants, academics or scientists who will be asked to prepare the GEO Cities report. The diversity of this technical team's members is important to ensure the presence of different points of view about urban-environmental problems in each locality. This technical team may be contracted together with a NGO or university if the locality does not have the qualified technical people required, although it is considered important that at least one member of the municipality be included in the team. This will allow technical capacitates to be installed in the institutions and will help the GEO Cities process to continue in each locality, as well as improving local urban-environmental management.
Working Groups:	They will be set up for each of the thematic sub-sets to be used when collecting relevant data and information about specific themes of significance for the report. For example, working groups may be formed on: Water, Biodiversity, Emerging Themes, and Scenarios, as well as to propose urban-environmentalist policies for the locality.
Group of Specialists or Technical Advisers:	Professionals with recognized technical or scientific competences who are capable of making a detailed diagnosis about a particular problem or theme, have no connection with the local technical team, and are given a temporary contract to make a specific contribution to the GEO Cities report.
Drafting Team:	Although the working groups and consultants may, and should, produce texts that contribute to the report's analysis, it is important that a drafting team of no more than three members be established to prepare a logically arranged document that includes the contributions of the different consultants and working groups in order to produce an integrated report. The final review of the document should be done by one person who will be responsible for editing, style correction and final drafting.
Communications Team:	Considering that the GEO Cities process should be participatory it is desirable, although not obligatory, to establish a small group of two or three people responsible for informing the different local society sectors about the process and keeping them up to date about its progress. Once the report is prepared, if society is to accept the GEO Cities report and perhaps use it as an instrument for discussion with local public authorities to improve each city's urban-environmental management, is also essential to disseminate news about the main elements of the diagnosis made on the state of the local environment according to the PSIR matrix.

Table 8: Most Common Institutional Levels

Type of agency	Possible advantages	Possible disadvantages
Existing government body	• Limits proliferation of special agencies. • Existing regional work networks. • More local government collaboration. • Access to data and information..	• •Not recognized as independent body. • Limits participation by other public stakeholders or interested groups • Tends to protect the status quo • Bureaucracy. • The process may be in danger if government changes.
Agency: independent, semi-independent	• Autonomous. • Has a distinguished public place. • Potential for innovation and more effectiveness. • Creates links between non-governmental and scientific groups of interest.	• Requires formal power to have access to information. • Lacks regional networks. • Potential uncertainty of resources. • No authorities associated with the report.

Adapted from Environment Canada, 1992 – (See Training on integrated environmental assessment and reporting. Training Manual. Op. Cit.)

Selecting GEO Cities assessment participants[36]

> **Whenever possible, try to ensure the participation of:**

1. Under-represented groups.
2. Service users.
3. Service suppliers.
4. Sectors whose interests are indirectly affected by the impact of the service or of the system.
5. Sectors with specific knowledge of the service or of the service environment.

> **The following should be considered when selecting associates:**

1. The purpose of the work to be done.
2. The inclusion of the largest possible number of organizations and individuals with the political will to act.
3. The desired degree of inclusion.
4. The abilities, knowledge and experience with which individuals and organizations may contribute.
5. The inclusion of sectors needed to implement any project.
6. The inclusion of credible individuals or organizations together with the groups they represent.

Each city will have the chance to designate the local team. If the GEO Cities Project is to succeed, it is indispensable that, throughout the process, more interested groups join the cause.

[36] *Ibid, p.20*

b) Defining the basic agenda

One way of reconciling the contributions of the different social stakeholders is to define a basic agenda which should include:

Preparing terms of reference and of commitment

Once the scope is determined, the social structures defined and identified, the next step is to use the terms of reference to define roles, responsibilities and commitments.

The terms of reference include:

- Joint activities.
- Participants' roles, including specific activities to be carried out.
- Information to be provided and the programme of contributions.
- Rules on sharing information used in the process, including confidentiality agreements.
- Decision methods, including settling conflicts.
- Resources that each participant may provide.
- Agreements on how to integrate the results of the process in the city's planning activities.

These terms of reference should be assigned by the local team members and periodically reviewed to ensure they are being complied with and are up to date.

Programme of activities

Plans the work and monitors progress. Should include all the stages and indicate the type and content of activities with their respective tasks and the time needed to carry them out.

It is very important to be as precise as possible with respect to the time required. If the estimated time is very long, for example more than a year and a half, participation will be difficult and it will add to the project's costs. Furthermore, the time required could have a negative effect on the quality of the work and cause tensions within the group.

Definition of goals (products and processes)

The goals and the programme of activities are the team's guidelines; they describe expected results and how to obtain them.

The goals may be intermediate or final; give a precise description of the type of assistance needed to reach a final result and ensure the work will continue.

An intermediate goal could be to hold technical discussions and methodology workshops for the team members and participating consultants.

The final goal is to establish a continuous city assessment process and publish a GEO Cities report to be presented at a seminar where the material will be made known to the public.

1.1.2 Training the local team

The GEO Cities report methodology requires an apprenticeship to learn what it is and how to apply it to assess the state of the local environment. There are two approaches to training in this methodology:

a) Technical training and public policy workshops

By definition, the technical team has a wide range of knowledge and experience of environmental problems and this demands a minimum of conceptual standardization.

The training workshops ensure a basic level of understanding of the factors involved in the interaction between urban development and the environment and the features and range of the GEO Cities report.

Training has four components:

- Managing the GEO Cities methodology including the use of the DPSIR matrix and the indicators.
- Managing techniques to collect and analyse data and information for the report.
- Establishing a strategy to involve different sectors in the process.
- Discussing the process of formulating, managing and following up public policies, especially on themes related to urban areas and the environment.

b) Production and distribution of publications.

To prepare the report properly, all members of the team need to have access to information on their fields of interest including: GEO reports, GEO Cities methodology and specific studies on themes relating to local environmental assessment.

Making information readily available to all members of the technical helps them to work as a unit and improves their ability to produce the report

Stage 2. Identifying indicators and information sources

2.1 Urban environmental indicators

The GEO Cities Project uses indicators as the basis for analysis. These indicators can be seen as scientific instruments that allow a description to be given of the characteristics of a phenomenon or its performance in time and space to be assessed.

The type of indicators to be selected depends on what is being assessed. The indicators used in the GEO Cities Project, and taken from the pre-established group of urban-environmental indicators, will depend on the objectives defined for each technical team.

Table 10 presents this group of indicators according to the conceptual definition of their components and the stage of the process in which they are to be used.

In there is a detailed description of each indicator, the justification for using it and the proper way to measure it.

2.1.1 Indicators: What are they? How should they be used?

There is a wide range of literature on the indicators originally created by such organizations as the United Nations Commission for Sustainable Development (UNCSD) and the Organization for Economic Cooperation and Development (OECD). The advantage these have over other indicators, like those proposed by independent researchers, is that as they are adopted by global institutions, they cover a broader range of environmental situations; they are applied regularly and systematically and, because they have a better degree of comparison, are more reliable. That is why some are proposed here as instruments to be used in preparing the GEO Cities report.

The importance of including indicators in environmental assessments was strongly backed by the recommendation in Chapter 40 of Agenda 21 on the need to create sustainable development indicators capable of measuring the advances made towards an environmentally, socially and economically fair and balanced society.

Agenda 21 functioned as the impelling force in identifying environmental themes and problems that, in turn, provided the impetus for international organizations and government agencies to produce indicators to assess the sustainability of policies, programmes, actions and processes for economic, urban and social development and that have an impact on the environment.

2.1.2 Brief definition

Indicators are essential components for assessments of a sustainable development programme. Desirable indicators are variables that summarize or simplify relevant information, point out phenomena of interest and quantify, measure and communicate important information. The main functions of indicators, as defined in the publication SCOPE, are to:

- Assess conditions and trends.
- Compare places and situations.
- Assess conditions and trends in relationto goals and objectives.
- Provide early warning information.
- Anticipate future conditions and trends.

Indicators are packets of information that help us to understand the complex interaction between different phenomena[37]. By organizing and synthesizing information, indicators perform a variety of functions that help to reach the different objectives applicable to science, to politics and to daily life. Furthermore, indicators are indispensable for well-informed decision making and for urban development planning and environmental administration.

Indicators provide society as a whole, as well as certain social sectors, with statistical, scientific and technical information; they also inform about public policy objectives and goals and the features and trends of urban, environmental, economic, and social matters. They are most useful in showing how effectively public bodies perform.

[37] *Scientific Committee on Problems of the Environment (SCOPE), 1997: Sustainability Indicators: Report of the Project on Indicators for Sustainable Development B. Moldan & S. Billharz eds., 1997, Wiley, UK*

2.1.3 Criteria to select indicators

Some principles must be observed when selecting indicators given that, although many data are available, there is little useful information[38]. The essential purpose in selecting indicators is to give decision-makers quick access to reliable information on the state of the local environment. They also serve as a reference framework for the technical teams by illustrating the main features of the interaction between urban development and the local environment.

Other criteria[39] are needed to select indicators for the GEO Cities report.

Table 9. Criteria to select urban-environmental indicators

Criteria	Should...
Polical Importance / useful to the user	• Provide a representative picture of environmental conditions, of the pressure on the environment and society's response. • Have an easy-to-understand presentation that clearly shows long-term trends. • Be sensitive to changes in the environment and related human activities. • Provide a basis for international comparisons. • Be applicable to national and/or regional environmental material of national importance.
Analytical congruence	• Correctly reflect public policy priorities. • Have scientific and technical foundations. • Be based on international models, and on an international consensus about their validity.
Measurement	• Be or become available on a reasonable cost/benefit basis. • Be duly documented and of recognized quality. • Be periodically updated according to appropriate procedures.
Easily understood	• Allow all users to have similar interpretations and perceptions. • Be transparent, that is be understood by users with different levels of comprehension and information.
Reliable	• Be technically and scientifically credible. • Be created by technically reliable institutions with recognized capacity
Transversal / universal	• Be used to learn about trends of different phenomena and, at the same time, allow comparisons to be made between different local situations.
Available	• Be or become available and, preferably, present historical territorial analyses that help to understand how phenomena behave over time

Prepared by Teixeira, I., 1998

[38] *SCOPE (Scientific Committee on Problems of the Environment), 1995: "Environmental Indicators – A Systematic Approach to Measuring and Reporting on the Environment in the context of Sustainable Development", Published in the final document of the Workshop in Ghent, Belgium, "Indicators of Sustainable Development for Decision-Making", published by the Federal Planning Office, Belgium.*

[39] *Adriaanse, Albert, 1995: "The Role of ISDs and their Potential Aggregation in the Information Hierarchy", published in the final document of the Workshop in Ghent, Belgium, "Indicators of Sustainable Development for Decision-Making", published by the Federal Planning Office, Belgium*

Table 10: Charactristics of the DPSIR matrix indicators

Pressure and driving Forces indicators	Describe what caused the problems on which the local government and society must act to preserve and improve the environment.
State indicators	Describe the conditions and quality of the local environment. Show how urban pressure on the environment affects its quality and the amount of resources available. These indicators are used to formulate public policies for the problems detected.
Impact indicators	Designed to discover how the state of the environment affects different human interests, such as quality of life, urban economy, ecosystems, urban vulnerability and the political-institutional level.
Response indicators	Allow an assessment to be made of improvement, protection, limitation and regulation measures taken by the local government, civil society bodies and enterprises or individuals to address environmental problems, especially those related to the pressure human beings place on environmental resources.

2.1.4 DPSIR matrix indicators

The matrix **Driving Forces - Pressure – State – Impact – Response (DPSIR)** is the reference for the indicators used when preparing the GEO Cities reports.

The example in table 11, applied to water, shows the logical integration between the indicators in the DPSIR matrix.

As shown in the example, once the pressure indicator is defined, the other indicators should show the same logical-causal relation that allows the report's integrated assessment to be made.

This format enables us to better understand the role of indicators in assessing the state of the environment and comprehend the dynamics of degradation, its different effects and possible solutions.

2.1.5 Indicator categories

Environmental indicators are divided into five categories according to how specific or important they are for the report (Table 12).

a) Core indicators

The indicators in the DPSIR groups are the core indicators used to assess the state of the local environment. These are related to the essential elements needed to analyse it, without which the assessment cannot be property carried out.

Most of the indicators proposed here already exist and are internationally recognized. Indicators produced by organizations such as OECD, UNCSD and ICLEI are principally related to pressure and state factors of the environment; to a lesser extent, they are related to the impact and response factors.

b) Proxy indicators

Because of the scarcity of technical and financial resources, insufficient data collection, limited exchanges with international institutes qualified to prepare and use urban-environmental

indicators, and other reasons, sufficient and reliable data are not always available to produce state of the environment indicators.

It is recommended, therefore, that a number of Proxy indicators be provided to give an approximate idea of the features and trends of the issue on which information is required to prepare the environment report for each city. The proxy indicators are used when there are no core indicators available or when they are not up to date. To use them, the technical team must be clear about their objectives.

Only the technical people responsible for preparing the report may define which proxies should be used. Table 7 presents a "basket of indicators" as a list of different sources that will allow indicators to be substituted when necessary. There are also Internet addresses where indicators may be found.

c) Local indicators

The technical teams are free to include or create indicators that reflect local ecosystems characteristics so that the report more clearly shows those that are specific to the locality. The use of such indicators should adhere to the following two general principles:

1. They should be really necessary for the report. Using a lot of indicators is not recommended as this might confuse users. Being bombarded with information will not help them to understand the phenomenon and might make it more difficult for them to adopt a practical attitude when dealing with the problem.
2. They should be clearly described. Their use has to be justified, the way they are calculated precisely defined, and an indication should be given about to which urban-development model they belong: pressure, driving forces, state, impact or response.

Table 11: Example of logical integration of the PSIR indications

Element	PSIR dimension indicators			
	Pressure	State	Impact	Response
Water	Total volume of untreated domestic sewage	Water quality index; DOB and concentration of faecal material in water	Increase in water-borne diseases	Investment in drainage, collection, treatment and water distribution systems
Air	Atmospheric emissions	Air quality	Incidence of cardiorespiratory diseases	Regulation and control of emissions from fixed and mobile sources
Land	Solid waste production	Polluted sites	Incidence of diseases caused by poisoning and contamination	Investment in solid waste management
Biodiversity	Reduced vegetal cover	Vegetal cover	Biodiversity loss	Investments in green areas

Table 12. Indicator categories

Category	Definition
Core	Indicator already exists and is considered essential to analyse the environment.
Proxy	May replace the core indicator, although its reference quality is not the same
Local	Specific and considered necessary to understand the specific characteristics of each locality.
New	Suggested for the GEO Cities methodology to help with the state of the environment assessment.
Transversal indicator	Used to assess more than one environmental resource in any of the DPSIR matrix dimensions.

d) New indicators

Urban conditions and how they interact with the environment undergo constant changes; they make it necessary to create new indicators capable of keeping pace with their rhythm and following their direction. The indicators proposed by GEO Cities include a group focussed on how local government and society respond to environmental problems.

As cities are located in different ecosystems with different environmental characteristics; there may be great variations in the environmental effects caused by urban growth, and this explains why new indicators are needed.

e) Transversal indicators

The GEO Cities methodology separates the environment into its constituent elements: water, atmosphere, soil and biodiversity, to make it easier to assess each of them. However, it must be kept in mind that they are all integrated and act in relation to one another.

For that reason, some indicators proposed here are transversal; that is to say they may be used to analyse more than one environmental resource in any of the dimensions of the DPSIR matrix. Transversal indicators reduce the total number of indexes, making it easier to assess the environment and making clear the relationship between natural resources and the effect urban development has on the environment.

2.1.6 Territorial dimension of indicators

The teams should pay much attention and give special care to the area to be covered by the assessment. This is a problem of particular interest for urban centres in metropolitan zones where urban limits are difficult to define.

In contemporary societies, urbanization usually extends beyond city limits; as peripheral and suburban zones grow, this creates confusion concerning city boundaries. In such cases it is difficult to determine to what extent the environment is the product of pressure exerted by one particular city and not by a cluster of urban centres.

It could also happen that the information available to make the assessment only refers to the most important city of the metropolitan area, or that it refers to the metropolitan region as a whole. In the latter case it is recommended that the indicators be used with a broader territorial range than in the case of only one city, and that a note be included advising of the limitations of the conclusions reached with the method employed.

It should be emphasized that it is the city and municipal authorities, together with the local technical team, that determine the territorial area to be covered by the GEO Cities assessment. This is because its territorial range may vary depending on the urban-environmental interests in question in each locality. The assessment and its report should, therefore, cover the areas necessary to support the municipal authority in its activities during the urban development process.

a) GEO Cities assessment and the rural theme

An important question to be considered is the notable urban-environmental bias in the GEO Cities assessment. This places the problem of how to prepare the report for localities with an important rural area within the framework of their socio-economic and environmental dynamics.

For many municipalities in Latin America and the Caribbean, as well as in other regions of the world, their urban areas do not necessarily coincide with what are considered, from an administrative point of view, to be the city's territorial boundaries. This is because many municipalities have a rural area significantly larger than the urban area and, therefore, this has to be considered in the GEO Cities assessment when making an analysis of the urban-environmental interaction.

When that is the case, it is suggested that the local technical team include in their analysis the corresponding themes and indicators needed to include in the GEO Cities assessment the locality's rural dynamics as they relate to its urban-environmental dynamics. In this respect, among other possible elements for analysis considered in the assessment should be themes such as: the rural population dynamics (growth and migration); the structure of land ownership (degree of concentration, size of holdings); principal products and how they are related to the natural resources (demand for water and land, their effect on vegetal cover, their impact on biodiversity, the use of agricultural inputs – fertilizers, defensives, etc.); their relationship with markets (local, national, regional or international); and social conflicts. In the absence of reliable and up-to-date quantitative information, it is suggested that the technical team at least make an analysis based on qualitative data to leave evidence of the most important questions concerning the rural theme and the effect on the locality's urban-environmental problem.

In Annex 1 a detailed description is given of the indicators suggested to prepare the integrated urban-environmental assessment within the context of the GEO Cities Project. Also included is a brief discussion on the importance of each indicator, the calculating method suggested or adopted, the urban-environmental relationship model referred to and its level.

b) Matrix of GEO Cities report basic indicators

The basic indicators to develop the GEO Cities reports are summarized in Tables 13-a, 13-b and 13-c.

Table 13 – a: Matrix of the basic indicators for the GEO Cities report – PSIR

	Water		Air		Land		Biodiversity /Fauna and Flora		Built-up Environment	
	Indicator	**Source**	**Indicator**	**Source**	**Indicator**	**Source**	**Indicator**	**Source**	**Indicator**	**Source**
Pressure	• Reduction of vegetal cover	UNSCD	• Reduction of vegetal cover	UNSCD	• Reduction of vegetal cover	UNSCD	• Reduction of vegetal cover	UNSCD	• Population growth	CEROI
	• Urban settlements area and population	UNSCD	• Legal and illegal urban settlements area and population	UNSCD	• Legal and illegal urban settlements area and population	UNSCD	• Legal and illegal urban settlements area and population	UNSCD	• Gini index (social inequality)	CEROI
	• Land change from non-urban to urban	CEROI	• Land change from non-urban to urban	CEROI	• Land change from non-urban to urban	CEROI	• Land change from non-urban to urban	CEROI	• Acid rain producing gas emissions	CEROI
	• Population growth	CEROI	• Population growth	CEROI	• Population growth	OECD	• Population growth	CEROI		
	• Gini index (social inequality)	UNSCD	• Gini index (social inequality)	UNSCD	• Gini index (social inequality)	UNSCD	• Gini index (social inequality)	CEROI		
	• Total volume of untreated sewage	CEROI	• Atmospheric emissions	CEROI	• Solid waste production	PARC21				
	• Water consumption per capita	CEROI	• Distribution	CEROI	• Solid waste disposal	PARC21				
			• Motorization index	PARC21						
			• Energy consumption per capita	CEROI						
State	• Extinct or endangered species, known species	OECD	• Extinct or endangered species, known species	OECD	• Extinct or endangered species, known species	OECD	• Extinct or endangered species, known species	OECD	• % of deteriorated areas (historic centres and buildings) in relation to the total local constructed area	OECD
	• Water shortages (frequency, extension, duration	OECD	• Air quality	CEROI	• % of geologically unstable areas at risk	PARC21	• Vegetable cover	CEROI		
	• Quality of water supply	UNSCD			• Contaminated sites	CEROI				

Table 13 – b: Public and private institutions that are potential producers of data for the report

	Water		Air		Land		Biodiversity /Fauna and Flora		Built-up Environment	
	Indicator	**Source**	**Indicator**	**Source**	**Indicator**	**Source**	**Indicator**	**Source**	**Indicator**	**Source**
Impact (Effects on each of the following aspects)	**Ecosystem** • Biodiversity loss **Urban ecosystem** • Public health cost of water-borne diseases **Political-institutional level** • Loss of urban attraction **Quality of life** • Incidence of water-borne diseases		**Ecosystem** • Biodiversity loss **Urban economy** **Political-institutional level** • Loss of urban attraction **Quality of life** • Incidence of cardio-vascular diseases		**Ecosystem** • Biodiversity loss **Urban economy** • Property depreciation. • Cost of preventing and containing environmental risks **Political-institutional level** • Loss of taxes. • Loss of urban attraction **Quality of life** • Incidence of diseases from poisoning and pollution. • Population in vulnerable urban areas. • Incidence of floods, landslides, etc.		**Ecosystem** • Biodiversity loss **Urban economy** • Public health cost **Political-institutional level** • Loss of urban attraction **Quality of life** • Micro-climate change		**Ecosystem** **Urban economy** • Property depreciation. • Cost of rehabilitating monuments and historic centres **Political-institutional level** • Loss of taxes. • Loss of urban attraction **Quality of life** • Depreciation of historic centres. • Juvenile crime rate	

Table 13 – c: context information

	Water		Air		Land		Biodiversity /Fauna and Flora		Built-up Environment	
	Indicator	**Source**	**Indicator**	**Source**	**Indicator**	**Source**	**Indicator**	**Source**	**Indicator**	**Source**
Response (existence and effectiveness of instruments)	• Environmental education • Number of environmental local level NGOs • Local Agenda 21 Activities • Investment in environmental recovery • Urban master Plan in place • Investment in green areas • Legislation to protect springs in place • Polluter/payer User/payer tax system • Investment in drainage net-works and drains • Domestic relations	• PARC21 • PARC21 • CEROI • PARC21 • PARC21 • CEROI • PARC21 • PARC21 • PARC21 • CEROI	• Environmental education • Number of environmental local level NGOs • Local Agenda 21 Activities • Investment in environmental recovery • Urban master Plan in place • Investment in green areas • Regulation and control of fixed and mobile sources emissions • Investment in public transport	• PARC21 • PARC21 • CEROI • PARC21 • PARC21 • CEROI • PARC21 • PARC21	• Environmental education • Number of environmental local level NGOs • Local Agenda 21 Activities • Investment in environmental recovery • Urban master Plan in place • Investment in green areas • Investment in solid waste management • Total areas rehabilitated in comparison to degraded • Preventive notices and fines for violating waste disposal norms	• PARC21 • PARC21 • CEROI • PARC21 • PARC21 • CEROI • CEROI • OECE • PARC21	• Environmental education • Number of environmental local level NGOs • Local Agenda 21 Activities • Investment in environmental recovery • Urban master Plan in place • Investment in green areas	• PARC21 • PARC21 • CEROI • PARC21 • PARC21 • CEROI	• Environmental education • Number of environmental local level NGOs • Local Agenda 21 Activities • Investment in environmental recovery • Urban master Plan in place • Investment in green areas	• PARC21 • PARC21 • CEROI • PARC21 • PARC21 • CEROI

2.2 Data collection and analysis

Preparing an assessment and its GEO Cities report implies managing an enormous amount of information. It is necessary, therefore, to:

- Identify sources.
- Systematize information.
- Create a database.

2.2.1 Identify primary data sources and available information

As the information needed to prepare the report is most likely dispersed among different institutions, the first task is to collect and organize it in a database so that the local technical team has a permanent source to consult.

Except in special cases, the technical team is not expected to produce primary data, that is to say, new information that was not available when the proposal was evaluated. Due to limitations of time and resources, and technical difficulties in gathering primary data, the material to be analysed will consist of secondary data that have already been prepared by institutions in each locality and/or country.

The first step to guarantee the quality of the work is to identify available information sources. These information sources may be classified according to the territorial range of the data produced or the institutional character of each of them, as set out below:

> **GEO Sao Paulo – Example of information gathering experience**
>
> Mention is made of the general difficulties in obtaining secondary data and information from government agencies as well as from private entities and non-governmental organizations; this is the case even when they are predisposed to assist and most of them collaborate. Problems were encountered when most of the data was unavailable because it was not physically accessible or had not been organized. Another point to be mentioned is that much information is available only on the area of the Sao Paulo Metropolitan Region (RMSP); that is to say, for a context where data about the municipality of Sao Paul need to be separated.
>
> The precarious and disperse manner in which a large part of information on the environment is kept, as well as the various obstacles set by some agencies' operational procedures in allowing public access to it, shows there is still a long way to go before better exchange and dissemination of information among public bodies and society in general can be achieved.
>
> In this context it is important to stress that, even though the GEO Cities report intends to use mainly secondary data, lack of information thought to be essential for the work (or even having other information that is unclassified or insufficient) requires that some primary data be obtained and produced [this allowed the Sao Paulo GEO technical team to prepare what can be considered to be a pertinent report]

Range – local, national, regional and international institutions

Information with which to formulate, manage and assess policies has become an instrument that enables local governments and society to intervene in formulating necessary urban-environmental management laws. Some institutions have experience in producing data that qualifies them as sources from which to obtain the information needed to prepare the GEO Cities report.

How the information is used depends on the specific purposes of the work to be done on the state of the local environment. Information must first of all be sought from institutions that produce data and reports on the city, for example maps and aerial photographs. This can be done in cities with a financial and technical structure to produce this type of information.

When local institutions do not have adequate and/or reliable data, the information must be sought from institutions that produce data covering a larger territory; they may be regional or state institutions depending on the territory's political division; national or, to a lesser extent, international.

Table 14: Public and private institutions that are potential producers of data for the report

Government bodies	• National statistics offices responsible for preparing the National Population Census. • Responsible for information used to formulate local-level public policies. • Responsible for formulating and administering public policies; for example, health and education agencies.
Foundations	• Public and private institutions that finance research and may establish a critical comparison with official data.
Research institutions	• Public or private, producing socio-environmental information to complement or classify official data. • Information Sources on public opinion and the local perception of the city's urban-environmental problems.
Universities	In developing countries academic institutions continue to be dedicated to producing information and to scientific research, and whose technical staff show a scientific slant; they are a prime source, although information from academics tends to circulate among a restricted university public.
Non-Governmental Organizations	NGOs are the most important social intervention stakeholders. They all produce information and other material that may contain relevant facts.
Business Associations	They have, or can produce, specific information on local economic activities that allows an analysis to be made of economic dynamics and pressure factors.
Trade Unions	They have, or can produce, specific information about the city's economic and social situation. Their information tends to complement and/or qualify that provided by other bodies representative of business (employment, wages, income).
Local and national communications media	Newspapers, magazines, television and radio may serve as a counterpart to information collected from other local sources.
International organizations and/or bilateral and multilateral agencies	They provide financial resources, prepare projects and take action on the basis of international resolutions. They supervise compliance with such resolutions and use information about the situation in each country. Although these organizations do not usually produce these data, they finance research and provide training on producing information and, therefore, are an important source for consultation.

It must be kept in mind that information from these different levels is often the result of combining it with locally-based information. In principle, this allows the information to be subdivided and making it useful in local assessments. An example is the population census which is based on data gathered at local or sub-local (household) level; the resulting dataset enables the local situation to be analysed.

There are other variables that serve as a basis for choosing sources of information. These are, in order of importance:

1. Reliability of the information. This is vital and the local team must assess the information in great detail, taking into account the report's objectivity. Reliability is never absolute, but it can be measured by the institute's tradition of producing data that are not questioned by recognized professionals in the field. This, clearly, can only be decided at local level.
2. The existence of a historic data series that allows comparisons to be made and shows how the phenomena studied evolved and, thus, to define whether that evolution was positive or negative over the long term. This is of special interest, for example, in assessing the results of public policies and the efforts of society to reverse trends that have an impact on the environment.
3. Ease of access to and availability of information is very important for the report's technical team and for possible users of the document. If the information is hard to access, is not available through the electronic media, faces bureaucratic or political obstacles, and is costly or too technical, it is better to look for another source.
4. The methodology used to produce the information greatly influences the data. It is often difficult to compare information compiled by using different methodologies; it is better, therefore, to choose sources that use the same methodologies as the GEO Cities based on the DPSIR matrix and/or a group of similar indicators, calculated in the same way.

Table 15: Context information

Information on local urban political, social and economic contexts.
Information on the political-institutional structure, the role of social organizations, the population, economy and occupation of the territory, social inequality and factors that put most pressure on the environment such as water consumption, waste production etc.
Information on principal local systems.
Information about environmental resources (water, atmosphere, soil) that indicate the territory's hydrological, geomorphologic and environmental characteristics and allow an assessment to be made of the state of the local environment.
Information on the impact of the state of the environment has on the quality of life.
Information on how the state of the environment is affecting people's health, environmental services, the ecosystem itself and human settlements.
Information on responses from the local government and society to environment problems.
This information should be identified by taking into account political-administrative, economic, technological and socio-cultural intervention instruments.
Available cartography data and information.
Well organized information with easy-to-assimilate visual information, especially on deforestation, urban expansion and the location of the territory's vulnerable points, It is suggested that, when preparing the report, a scale of, for example, 1:10,000 be used that is easily understood by the technical team and potential users.

2.2.2 Systematize information

Compiling context data

Once sources are identified, the first step is to collect the context data, or those that describe how urban areas and local ecosystems evolved.

a) Compile information related to the indicators.

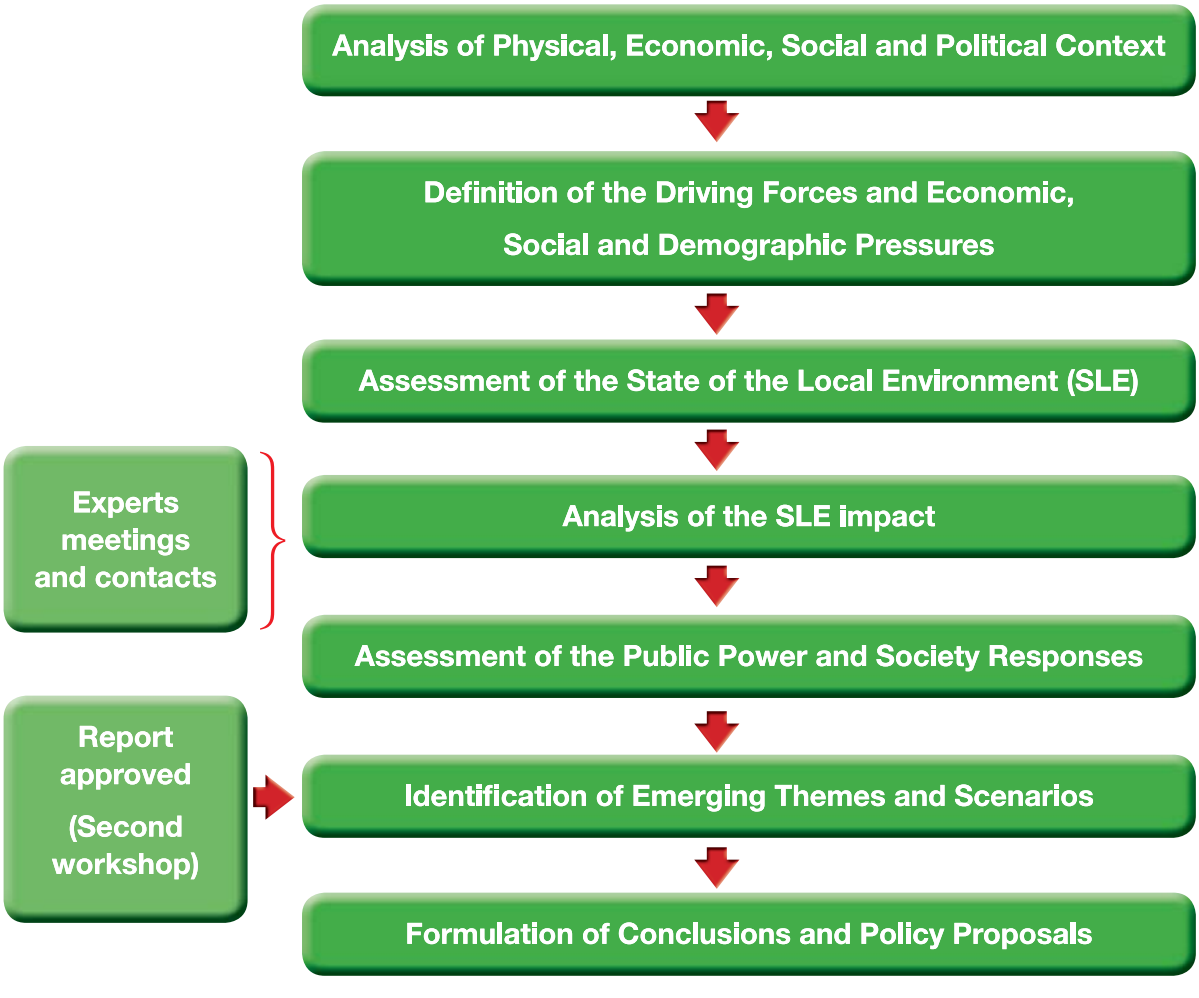
b) Present it by filling in the respective spaces in the matrix.

Collecting data from the Core Indicators matrix (first level)

The reference for collecting data is the Core Indicators matrix (Table 13) that cross-references about 50 indicators of the Driving Forces-State-Impact-Response (DSIR) structure with environmental natural resources (water, atmosphere, soil, biodiversity).

The matrix is composed of a mixture of globally-recognized indicators used in important international institutions and indicators proposed by the GEO Cities methodology.

Table 16: Diagram of GEO Cities Report



Compiling proxy indicators (second level)

The information on the GEO Cities indicators will not always be found at local level; at times the indicator will not be produced by local institutions; at others, the way it is produced will differ from that described here. In these cases the technical team will use the proxy indicators; these make it possible to arrive at a fair approximation of what is being analysed, although it is not exactly the same as the original indicators.

The proxy indicators may be produced locally; however, the local team must check the documents and electronic sites of the producing institutions to assess whether they are the most appropriate substitutes. Whatever the solution, the technical team must point out the indicators used as proxies and present the source and methodology used in the definition that results from using them. In that case, it will be necessary to specify the source of the data, the methodology used and the degree of reliability of the indicators.

Selecting and compiling local indicators (third level)

The GEO Cities report also seeks to encourage the technical teams in each city, when assessing the state of the environment, to use information and data specific to the locality. Besides the already-mentioned indicators, this will provide the opportunity to include information typical of each city, so that its particular features appear in the final document. The technical team may choose local indicators to do this

Two methods may be used to select the local indicators:

1. Consult local sources

Local institutions are to be preferred because, as they have local experience and knowledge, their information is more likely to be reliable.

2. Public consultation

Social groups may be interested in a process such as the GEO Cities. For a public consultation to be feasible it is recommended that a participatory methodology be applied that combines the use of focus groups, such as joining relevant urban-environmental groups with specialists, and holding public meetings; doing so will validate the indicator and facilitate final acceptance of the document.

Defining and compilating data relating to the new indicators

Finally, data corresponding to the indicators suggested by the technical team itself, even if not intended for publication, should be compiled. In this case, the team should be assisted by professionals with experience in producing indicators and combining data, as well as with enough relevant knowledge to generate new references.

As already mentioned, a description should be given of the source of the data, the methodology used, the possible degree of reliability of the new indicators, and the objective it is hoped to reach by including them in the state of the local environment assessment.

2.2.3 Establish a local environmental database

The database organizes information, according to the different themes, in the format proposed for the report. The data should be arranged according to the document's chapters so as to enable the technical team to follow up on collecting the information to facilitate later analyses.

With programmes such as Excel and Access, if the data identified can be quantified, the database may be transformed into a data bank, making it possible to prepare graphs and tables. This also allows an assessment to be made of the future outlook for cities, indicating the main risks and emerging themes concerning improving the state of the environment.

After this has been done, the technical team can begin drafting the report.

Stage 3. Preparing the GEO Cities Report

3.1 Data and information analysis

The analysis of the data and information compiled in the previous stage should meet five objectives:

- Identifying environmental priorities;
- Preparing the assessment on the state of the local environment and the impacts of that state;
- Assessing the responses of government and society;
- Defining emerging themes;
- Building future scenarios.

Chapter 2 contains a detailed description of the methodology of this analysis and its contents.

3.1.1 Identify environmental priorities

The report should help to identify the most significant environmental priorities in each city, as well as the opportunities most likely to be successful for short- and medium-term intervention by local government and society. It should also seek to lead environmental bodies and institutions towards creating early warning mechanisms for local government and society.

One of the expected results is to set priorities to deal with the city's environmental problems. To begin with, the proposal is to focus on the most relevant and immediate action taken by the different sectors. Defining priorities does not mean jettisoning less urgent decisions on promoting improvements to the environment. Perhaps the best strategy to follow is to keep in mind the local government's economic and human resources limits.

GEO RIO DE JANEIRO - COMMUNICATION PROBLEMS WITH THE LOCAL AUTHORITY AND CIVIL SOCIETY
Because the GEO Cities Rio de Janeiro report was the first of the series to be prepared, it faced difficulties typical of this type of document as well as others concerning the relationship with public and private stakeholders.
DATA COLLECTION LIMITATIONS
1. Difficulty of obtaining some data from public bodies: delays in supplying and collecting information. 2. Difficulty in identifying the original source of data in the public body consulted. 3. Duplication of information independently produced by public bodies in different government branches. 4. Dissimilarity of some data produced between different organizations at the same level of government, or by different authorities. 5. Discontinuance of sequential data, whether as to collection or analysis, and even as to availability. 6. Discontinuance of an organization's programmes and projects making it hard to assess the results of action taken. 7. Dissimilarity in methodologies adopted to collect information, making it impossible to analyse a historic series and compare different databases. 8. Lack of database systematization for many of the themes dealt with. 9. Lack of some historic databases, making comparisons and trend analysis impossible. 10. More information on determined themes in comparison with others.
LIMITATIONS ON PREPARING THE REPORT
1. Pilot study prepared to test a recently-conceived methodology. 2. Little participation by key stakeholders (government, NGOs, business, universities, civil society) as to making available and analysing requested data. 3. Difficulty in consulting, and even absence of, communicators in government organizations approached on some themes. 4. Differences in conceptual and technical definitions of indicators and themes to be adopted in the GEO Rio de Janeiro report.

3.1.2 Assess the state of the local environment

Assessing the state of the local environment has technical and policy elements on which to base decision making when planning urban development and city environmental management.

It is necessary to approach the technological, environmental and economic feasibility of a sustainable development plan which, if implemented, would imply profound political and social changes.

The process studies the consequences of public policy options on the state of the environment, identifying implementation strategies in accordance with interests and priorities defined for urban environmental managers and decision-makers.

The information should include data on productive potential, availability of physical space and the city's productivity goals. Analysing the resulting cost-benefit relation may also help to build scenarios that serve as environmental management tools.

3.1.3 Assess responses by government and society

The section provides a systematic description of local environmental policies and responses. It provides information on current legislation projects, identifies policy deficiencies as well as barriers to their successful implementation. In the GEO Cities report this section includes an analysis of multilateral environmental agreements, as well as an analysis of national and local legislation, economic, socio-cultural, educational, public communication instruments, and the like.

Suggested steps in policy and response analysis:

1. Identifing and listing current policies and responses about the most important environmental issues.
2. Selecting performance criteria for the policies and responses identified.
3. Assessing the effect (intended or unintended, positive or negative) of identified policies and responses on using the selected performance criteria.
4. Defining best policy options and consider how such policies need to be modified.

3.1.4 Identify emerging themes and scenarios

An important part of the GEO reports is to identify emerging themes and future scenarios. For medium and long term planning, it is important to discuss themes that may be central to defining future environmental policies. By exploring an array of possible future scenarios, decision-makers can also get a clearer picture of what tomorrow might bring and of the likely impact of their decisions. GEO scenarios are not predictions; they depict possible futures and explore different outcomes of policies and environmental changes.

3.1.5 Build scenarios: local trends (inertia, best case, worst case)

For sustainability to be feasible in cities, it is assumed that long-term processes will be prepred and scenarios projected that reflect responses, whether by civil society, a public authority and/or business, to environmental problems caused by urban development. Scenarios do not pretend to exactly foretell the future but seek to suggest a range of options to make policy options less uncertain.

With the help of the studies carried out, and with simulations serving as a basis, managers will assess the direction of urban environmental policies depending on their objectives and availability[40] .

> **Steps to build scenarios**

1. Define the environmental problem and its basis (policies and actions);
2. Diagnose the causes and consequences that result in a specific state of the environment;
3. Define the objectives and goals (policies) to achieve a given result;
4. Identify public policy options;
5. Define alternative paths that may lead to the desired objectives;
6. Identify possible results, problems and probable obstacles in reaching sustainable development objectives;
7. Define alternative obstacle management strategies;
8. Adopt a holistic approach when preparing scenarios;
9. Draw conclusions about each result in the possible scenarios.

[40] *There are different software models and tools to strategically plan and analyse scenarios. More information is available at the following Internet sites:*
Threshold 21 world model of the Millennium Institute http//:www.igc.apc.org/millenium/t21/index.html
QUEST software of Envision Sustainability Tools and the Sustainable Development Research Institute
Polestar from the Stockholm Environment Institution. http://www.sei.se/sustain/activities.html#overview

Preparing scenarios implies setting in motion possible views of the future based on present options. Building them demands the use of both qualitative and quantitative information.

The description of some trends may be less uncertain and, in this case, quantitative information is more useful.

The result will be a mixture of potential indicators, trends and goals with explanatory historic texts. To be effective in decision making, these analyses should be simple but plausible.

Information on costs and benefits is also relevant because it allows the analysis to determine how feasible is the economy, and the financial needs of each scenario.

The scenarios are built on three types of trends:

- **The inertia trend** is considered as the possibility that there will be no responses about how to confront detected environmental problems; that any such responses will not be the right ones; or that conditions to implement them will not help to reach the objectives. In this case, the future scenario will project that the environmental problems detected will become worse.
- **The best case trend** is where the responses by local government and society would be perfectly adequate for the problems and there are no obstacles to prevent them from being implemented. In this case, the scenario will project an improvement in the state of the local environment in all sectors that might suffer from intervention by social agents.
- **The worst case trend** is where there is no response to the problems confronted, or where conditions to implement the responses make no contribution or even put hard-to-overcome obstacles in the way, or where mistaken decisions by social agents worsen or increase pressure factors on the environment.

These scenarios should help decision-makers to assess the impact of the action they take, or fail to take, on the city's environmental problems.

> GEO BUENOS AIRES – PREPARING THE REPORT

Because of the need for collective reflections in preparing this report, a number of meetings and workshops were held with members of the Environment and Ecology Institute (IMAE), and with external specialists and special guests, namely:

- Eight general meetings to discuss the methodology and how to present the partial reports by speciality, supported by documents prepared by IMAE, based on the GEO methodology contained in the "Training Manual on Integrated Environmental Assessment and Reporting" (Pinter and others, 2000).
- Four interdisciplinary meetings to work on the proposal for the indicators. Environmental problems analysed at these meetings were: drinking water supply, floods, riverside vulnerability, soil and solid waste.
- Two work days to discuss the relationship between the central themes of pressure and state of the environment (air, water, soil, local ecosystems, biodiversity and built-up environment: urban patrimony).
- Three micro-workshops on the following themes: "Local ecosystems, biodiversity and forests", "Urban patrimony" and "Impacts of urban sprawl expansion". The objective of

these workshops was to agree on recommendations about how to respond to the principal problems seen in the city and revise existing environmental policies. Government technical experts and specialists from different institutions concerned with the themes dealt with were invited from: the Central Society of Architects; the University of Buenos Aires (UBA); the National Academy of Medicine of Buenos Aires; and the University of Salvador. Also invited were members of the CONICET Research degree course from the National University of Lujan.

- Two meetings to assess environmental policies related to the themes of air, water, soil, biodiversity, local ecosystems locales and the built-up environment: urban patrimony. Responses received were assessed as to achievements and/or strengths, obstacles and/or weaknesses and future priority action.
- Finally, UNEP-ROLAC, with IMAE collaboration, organized the "GEO City of Buenos Aires Workshop: Integrated Environmental Assessment of the City of Buenos Aires" to bring together experts to review and validate a draft report on which to base the final report. The workshop was attended by relevant city stakeholders, and others from governmental and non-governmental spheres who debated, made comments and presented up-to-date information. The workshop was supported by the Secretariat of the Environment and Urban Planning and the Strategic Plan of the Government of the City of Buenos Aires. It was arranged by the Fundación Cambio Democrático (The Foundation for Democratic Change), a NGO whose mission is to prevent and solve conflicts by promoting a culture of peace and participation. It also prepared the methodological document and the workshop's final report.

These workshops and meetings were a contribution to consolidate the methodology for the GEO Buenos Aires project. Considering that the documents prepared for this report are technical proposals in support of environmental management, if the undertaking is to be a success, it is essential that the community and those responsible for environmental policies participate

3.1.6 Conclusions and recommendations

Once the four objectives of information and data analysis have been met, the technical team will be ready to draft recommendations and conclusions to guide decision-makers.

The conclusions should:

- Identify the principal factors of urban pressure on environmental resources and the most significant features of the state of the local environment.
- Describe the impact of the responses, and of how they were adapted to the problems detected.
- Assess the conditions that either assisted or impeded the technical and political effectiveness of the responses given.
- Include a brief analysis of trends detected, indicating the consequences if the problems are dealt with, or if they are ignored.

The conclusions include a synthetic view of the origins and features of the city's existing environmental problems, their impact and responses and the policies proposed to deal with them. The conclusions may be organized by following the chapters of the report or of the work as a whole.

As a result of the joint consultation between interested social stakeholders, a list should be prepared of urban-environmental policy proposals designed to change conditions that affect the local environment. The proposals should establish objectives and goals; they should also describe action, instruments and institutional and financial resources needed to execute the policies described in the report.

It should be shown that the policies proposed are directly related to the report's analysis, indicating how applying them will help to change environmental conditions and the impact they will have on the quality of life, the ecosystem and the urban economy. The expected responses to pressure factors, environmental conditions and impacts should always be included.

Furthermore, recommendations should be made to facilitate or create institutional, financial, social, policy and cultural conditions suitable to apply the suggested policies.

These recommendations may include:

- The need to provide better technical training for interested social stakeholders.
- How the local government budget will be spent on socio-environmental action.
- The creation of specific urban-environmental intervention bodies.
- Ensuring civil society participation in formulating public policies.
- The need for exchanges with national or international bodies or institutions to broaden the local government's technical range and thus inform its urban-environmental efforts

3.1.7 Statistical annexes

In the section on annexes the report should include the statistical information on which the analyses are based. To this effect, while it is being drafted, because of their importance, ease of understanding or level of inclusion, data presented in the body of the report as tables or charts, should be separated from those that may make the report harder to understand. There is no need to reproduce all the information collected; the technical team should only include the most important data in the statistical information.

For ease of use and linkage, it is recommended that the statistics be presented in the same sequence as the chapters of the report. The methodology used should also be included to produce the most up-to-date data on the subject, as well as its history, if any.

3.1.8 Bibliography

The bibliography will inform the reader where to find the data and information presented; it should include the complete name of the author or the institution, the title, publisher, the city or country, the year of publication, the city or country of origin of the book in question and its edition number.

It is important to include all information sources for the data consulted to help those who wish to do further research on a theme (see Annex 2).

3.1.9 Glossary

Technical language may be an obstacle to understanding the report; therefore the inclusion of a glossary of technical terms, acronyms and concepts may make it easier for the reader to understand. A review of the document by third parties can help to identify any obstacles to understanding and to preparing the glossary.

> **Advice on improving the report:**

- End every chapter with a table summarizing the main indicators mentioned in that chapter. This may then become a tool to quickly consult data.
- Suggest a minimum basket of environmental indicators that may be systematically monitored by the municipality and/or university/NGO to show the state of the environment at a glance.
- Highlight the theme of poverty and analyse social indicators in view of the Millennium Development Goals (MDG); how the city under study should be classified according to the themes given priority in the MDG. Many international and national policies are conditioned and measured.
- Provide graphs comparing the city with other cities of similar size in the country or the region (e.g. as to indicators of human development, poverty, coverage of services, quality of air and water, etc). That is to say, to make a kind of benchmarking to help to define the city in comparative terms. This serves for purposes of communication and public awareness.
- To provide an informative and analytical basis that is sufficient to make recommendations, it is suggested that an analysis be made of environmental problems.
- Make a SWOT[41] analysis of the environmental management system.
- In view of the uncertainties associated with the quality of official information, it is suggested a section be included on the quality and availability of information, comparing official information with that from unofficial but rigorous and recognized sources.

Stage 4 Disseminating and applying policies

4.1. Dissemination strategies

The report may be a catalyst for social mobilization on the question of the environment and sustainable development. For this to be the case, strategies must be defined on how to disseminate it, stimulating its broadest possible use by citizens and public bodies not directly involved in its preparation.

A document like GEO Cities needs mechanisms to confirm the legitimacy of its analyses and proposals, and to increase the likelihood that its recommendations will be adopted.

Media to employ include: dissemination seminars, collective interviews, television and radio interviews, distributing copies to public and private bodies, to civil society organizations, universities and trade unions, the local parliament, national and international agencies, public and private schools, as well as making the report available on the Internet.

The following boxes present the structure of the GEO report communication process used by the technical team responsible for the GEO Lima and Callao report and the GEO City of Mexico team.

[41] *Strengths, Weaknesses, Opportunities, and threats*

> GEO Lima and Callao: Communication (dissemination and incidence process)

Press Release
Commitments with selected media

Land use, green areas and biodiversity
Waste
Air and transport
Water
Patrimony
Citizen Survey

National ECODIALOGUE
San Isidro ECOFORUM
Environmental fairs

Commitment with national magazine (Caretas)
TV report – Environment Day
Web, MML, MCallao, CONAM and GEA Group

> GEO Mexico City

The report continues to be disseminated several years after the process began, with very relevant impacts such as:

The GEO Mexico City report and its geotext are included in the work and apprenticeships of different Mexican groups (public and private academic institutions) at participatory workshops. Presentations have also been made at national meetings of the Local Urban Observers with support from the United Nations Human Settlements Programme (UN-HABITAT), and at national seminars on the use of urban land.

The Ministry of the Environment used GEO Mexico City as a basic input to prepare its Local Agenda 21 proposal, and the United Nations Development Programme (UNDP) also used it as a source of information to prepare its Human Development Report.

As a complement, and to make its impacts more wide reaching, in addition to putting the GEO Mexico City report on the Internet, at the beginning of 2006 the geotext was already making an important collection of maps available to the public by means of its digital maptech

As a result of all these processes, initiatives have been suggested so that, in collaboration with academic institutions and the public sector, advances may be made on research as well as on other processes that strengthen public policies, in particular extending the GEO Mexico City to cover the whole Metropolitan Zone with 20 million inhabitants and more than 50 suburban municipalities.

It is worth stressing the importance of adapting the language used in the dissemination documents to the different publics to which the GEO Cities report is addressed. Even though technical experts and scientists, as well as decision-makers, understand a more technical language, for the population in general – an important public for the document – the language must be adapted so that it can be understood and used when dealing with the public authority or other local social stakeholders

It is, therefore, particularly relevant to use the different communications media to disseminate the report, each of them with their own public in mind, thus making it a more powerful social participation instrument when it comes to local urban-environmental management

4.2. Influencing policies

The GEO Cities process ends with the inclusion of local government environmental management policies. This task is not usually the responsibility of the technical team unless its political government decides otherwise.

For that reason, the technical team should establish a collaboration strategy with those responsible for public policies and decision making about the state of the local environment. This measure can promote a fruitful exchange among decision makers and socio-environmental specialists, and thus extend the reach of the proposals; these possibilities obviously depend on each city's political and institutional circumstances

Stage 5 Continuing the GEO Cities process

UNEP's GEO Cities Project intends to use this report to define how the state of the environment is assessed, and also as a basis to prepare periodic state of the environment reports that use a harmonized methodology and a set of indicators for decision making by the public authority and other local stakeholders. This stage is also beyond the responsibility of the technical team. To follow up on how the cities are administering the environment, it is very important to recommend to decision-makers that the GEO Cities reports be prepared every two or three years.

To do so, it is recommended that, whenever possible, the revision of the GEO Cities assessment be done at the same time as decisions are made about local urban-environmental management as, for example, when a revision is made of the local Urban Master Plan, a central instrument in city management.

By doing this, the GEO Cities report could become a stimulus for a change in attitude by the government and local society on environmental questions and about the impact urban development has on ecosystems and natural resources.

Continuity will help when creating archives on environmental city assessments and, therefore, will allow an analysis to be made of sustainability, the effect of action taken and of the evolution of the link that exists between pressure factors and the local environment.

Annexes

Annex 1: Indicators

PRESSURE

- Modal transport distribution
- Motorization index
- Land Use change from non-urban to urban
- Vegetal cover reduction
- Population growth
- Area and population of legal and illegal human settlements
- The GINI Index (social inequality)
- Annual per capita energy consumption
- Total water consumption
- Total volume of untreated domestic sewage
- Atmospheric emissions
- Emission gases producing acid rain
- Solid waste production
- Solid waste disposal

STATE

- Air Quality
- Quality of water supply
- Water shortage (frecuency, extension, duration)
- Percentage of geological unstable (risk areas) areas occupied
- Polluted sites
- Extinct or endangered species/known species, measured by the number of known endangered species in the local environment. It is a transversal indicator that will help the impact and response analysis
- Vegetal Cover
- Percentage of deteriorated areas (historic centres or buildings) in relation to built-up urban areas.

IMPACT

- Biodiversity loss
- Microclimate changes
- Incidence of water-borne diseases
- Incidence of cardio respiratory diseases
- Incidence of diseases caused by poisoning and pollution
- Juvenile delinquency index
- Public health costs due to incidence of water-borne diseases
- Water collection and treatment cost
- Cost of containing and preventing environmental risks.
- Cost of rehabilitating monuments and restoring historic centres.
- Loss of urban attraction
- Property depreciation
- Incidence of floods, landslides etc
- Loss of tax revenue
- Population living in vulnerable urban areas

RESPONSES

- Urban master plan in place
- Legislation to protect springs in place
- Regulation on controlling of emissions from mobile and fixed sources in place
- Local Agenda 21 activities
- Environmental education programmes
- Number of environmental NGOs
- Tax system based on the polluter/payer or user/payer principle in place
- Preventive warnings and fines for violating waste disposal standards
- Investments in waste management
- Access to and quality of local infrastructure
- Total rehabilitated areas in relation to degraded areas
- Investment in green areas
- Investment in environmental recovery
- Investment in public transport
- Investment in water supply and drainages systems

PRESSURE INDICATORS

Definition of core indicators pressure indicators

Modal transport distribution

Resource: Biodiversity, land, atmosphere, built-up environment

Type of indicator: PRESSURE

Category: Core

Source: CEROI

Justification: What does it mean and why is it important to measure it?
Various means of transport put pressure on the environment. Collective transport provides more space, reduces traffic and saves energy. Traffic jams are associated with air pollution, accidents, reduced productivity and the population's general frustration.

How is it identified? Information needed
This indicator is measured according to transport modality: percentage of journeys in private vehicles, trains or trolleybuses, buses or microbuses, motorcycles, bicycles, on foot, other means.

This indicator should be measured every year.

Measurements and units
Percentage (%) in relation to the total daily journeys in the city by: bicycle, buses, minibuses, on foot, motorcycle, private cars, train, metro, etc.

Possible time and space formats
Trend graphs, bar charts, pie charts, (indicating participation of each modality).

Methodological resources reference
UNCHS.

http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

EF, 1998. Urban sustainability indicators for the improvement of living and working conditions. OECD, 1997. Better understanding our cities: The role of human indicators, EEA indicator set.

Objectives
Minimize the number of journeys using non-ecological transport.

Goals, reference values
None.

Other comments / context
Data on transport modalities are generally obtained from specific transport surveys. If detailed data are unobtainable, information may be collected on the number of private cars, trains and trolleybuses, buses and microbuses and non-motorized vehicles

Motorization index

Resource: Biodiversity, land, atmosphere, built-up environment
Type of indicator: PRESSURE
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The intensity of motor car use in cities is one of the main pressures on air quality due to the combustion that is the principal source of CO_2, SO_2, NO_X and other greenhouse gases. The indicator is calculated by the total number of authorized light vehicles in the city. In large cities consideration must be given to the presence of a significant number of automobiles belonging to a "floating" population or being driven to other cities.

How is it identified? Information needed
Number of cars/inhabitants in the city. Include cars from other cities being driven in the city.

Measurements and units
Number of cars per inhabitant.

Possible time and space formats
Graphs, tables and trend charts.

Methodological resources reference
Look for research studies by origin and destination, generally carried out by city or metropolitan region management agencies.

Objectives
Help to control pollution caused by motor vehicle fuels in cities, reduce air pollution and the incidence of respiratory and cardiovascular diseases.

Goals, reference values
No international reference values.

Application examples
Local sources for Bogota, Sao Paulo, Mexico City and Santiago.

Other comments / context
Although of great economic importance, and taking into account that the automobile industry drives the economy in many industrialized countries, the pressure on the environment due to the increasing use of motor cars in large cities makes it indispensable to develop mechanisms in order to be aware of its impact. The motorization index, by indicating how much use the local population makes of motor cars as a means of transport, is one of the important sources of information needed to implement the rational use of city transport systems

Land use change from non-urban to urban

Resource: All
Type of indicator: PRESSURE
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
One of the principal pressures on the environment in cities is the change in land use from non-urban to urban. This is the result of human activities, legal and illegal, on the land (dividing plots, building, constructing engineering infrastructure, etc.). It would be of interest to obtain a set of data every year on all new land occupancy showing the non-urban area (green areas, agricultural land without artificial human intervention) replaced by human occupation that tends to affect the environment's balance.

How is it identified? Information needed
Area (km^2) included in the urban area in the past year, compared to the total urban area.

Measurements and units
Area in km^2.

Possible time and space formats
Graphs, maps, aerial photos, high-resolution satellite images and trend charts.

Methodological resources reference
An approximate example of this indicator may be found in Europe's Environment "the Dobris Assessment" htt://reports.eea.europa.eu/92-826-5409-5/en

Objectives
Determine the pressure exerted on the environment and its resources due to the growth of the urban area by the addition of non-urban land.

Goals, reference values
No reference values or defined goals.

Other comments / context
This is considered as a transversal indicator, useful to analyse the pressure of urban activities on the different environmental resources considered in the GEO Cities assessment

Vegetal cover reduction

Resource: Biodiversity, land, water
Type of indicator: PRESSURE
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The land's vegetal cover has an important function in the environment because it covers a complex and varied flora and fauna biodiversity; it helps to conserve springs and the soil; filters different pollutants and influences the local temperature. Reducing the area occupied by woods and other types of natural vegetation is one of the main consequences of urban development and becomes an important indicator of the pressure cities place on the environment.

This indicator is directly related to the indicator on the state of vegetal cover.

How is it identified? Information needed
Wooded area (km^2) or other type of natural vegetation deforested in a determined period (or year or any other period).

Measurements and units
Area in km^2.

Possible time and space formats
Graphs, maps, aerial photos, high-resolution satellite imagines and trend charts.

Methodological resources reference
An approximate example of this indicator may be found in the document "Indicators of Sustainable Development, Framework and Methodologies", available for consultation at www.un.org/esa/sustdev

Objectives
Help to protect and conserve natural resources by controlling the destruction of forests and other forms of vegetation threatened by human development.

Goals, reference values
No goals or reference value for this indicator.

Other comments / context
Controlling the reduction of vegetal cover in each city is one of the main measures to reduce the pressure of urban activities on the environment. As a very broad range of environmental services is obtained from vegetal cover, it is of the utmost importance that account be taken of the degree of reduction when calculating the effects on the environment and the impacts on the quality of life in cities.

Population growth

Resource: All
Type of indicator: PRESSURE
Category: Core, transversal
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Urban population, as well as population density, is an indicator that measures pressure on the environment including the exploitation of natural resources such as water and soil, the contamination of a city and its surroundings and air pollution due to transport and industries. Over time, the increase or decrease in pressure on the urban environment accompanies the growth of population.

How is it identified? Information needed
Number of cities over a determined period (2-10 years recommended).

Measurements and units
Total number of inhabitants.

Possible time and space formats
Graphs showing trends, maps.

Methodological resources reference
UNCHS http://ww2.unhabitat.org/programmes/guo/urban_indicators.asp

WB, 1998. Sustainable Development Indicators.

OECD, 1997. Better Understanding Our Cities: The Role of Urban Indicators. EEA Indicator Set. UNEP, 2007. GEO-4: Global Environment Outlook.

Objectives
Harmonize a city's annual growth with its environment and, in general, the situation of human settlements.

Goals, reference values,
No international references.

Application examples
Prague population:

Other comments / context
A recent report mentions that the world's population continues to grow but at a slower rate than a decade ago. The average annual growth rate was 1.3% for 1997–2007 compared with 1.6% for 1987–1997. There are large regional differences in growth rates. (WHO 2009)

GEO 4 scenarios estimate that global population will continue growing, and it will reach its highest level, around 9.7 billion by 2050 in the scenario called Security first.(UNEP 2007)

Area and population of legal and illegal human settlements

Resource: All
Type of indicator: PRESSURE
Category: Core, transversal.
Source: UNCSD

Justification: What does it mean and why is it important to measure it?
Settlements characterized as illegal land possession with unauthorized buildings are generally marginalized and precarious and do not meet basic human needs. Settlements on the outskirts of cities are overcrowded and land use is inadequate and totally uncontrolled; this puts strong pressure on natural resources and the environment, deforesting wooded areas, polluting springs and occupying very vulnerable areas without such basic services as drainage, health centres and garbage collection. However, it should be made clear that not only poor and marginalized people live in these areas; there are also better-off groups in the same situation on unauthorized territories without services such as drainage.

How is it identified? Information needed
Urban residential area in km^2 occupied by legal and illegal settlements and the number of inhabitants.

Measurements and units
km^2, number of inhabitants.

Possible time and space formats
Graphs, tables, maps, trend charts.

Methodological resources reference
This indicator comes from the United Nations Human Settlements Centre (UN-HABITAT), and specifically the Urban Indicator Programme (UIP) and the Local Urban Observatory. It may be consulted at: http://ww2.unhabitat.org/programmes/guo/urban_indicators.asp

Objectives
Allows a measurement to be made of the level of marginalization of living conditions of large population groups, as well as of the pressure these settlements exert on the various local environment resources.

Goals, reference values
No reference values for this indicator.

Other comments / context
This indicator is a good example of how inequality may have perverse effects on the population and the environment, even when illegal land occupancy by the wealthiest groups is also taken into consideration. On the other hand, this is related to other important indicators such as human life and economic losses from natural disasters, the infant mortality index, the cost of local government infrastructure, and local health care, among others

The GINI Index (social inequality)

Recourse: All
Type of indicator: PRESSURE
Category: Core, transversal
Source: UNCSD

Justification: What does it mean and why is it important to measure it?
This indicator is of particular importance to assess sustainable development inequality. Since income distribution has important consequences on territorial occupation and on pressure on the environment exerted by the different social classes, population distribution in the locality must be measured. Although an automatic correlation between poverty and pressure on the environment cannot be established, as a growth of population indicator an effort must be made to prove what is undeniable or, in other words, that the poorest areas of large cities are those that exert the most pressure. Once the locality's Gini index is known, as well as how the poorest groups are distributed in the urban zone, a reliable measurement may be made of the pressure urban development places on the environment.

How is it identified? Information needed
It is an index of the difference between measuring the actual income distribution, consumption patterns or other related variables, and the hypothetical distribution in which each person receives the same.

Measurements and units
It is an index without a specific dimension, it varies from zero to one where zero represents no inequality and one represents the maximum possible degree of inequality.

Possible time and space formats
The measurement may be taken locally or nationally, depending on how income is measured. Depending on income, it may be applied to households, population groups, or consumption patterns.

Methodological resources reference
Absolutely no international reference. The World Bank provides some reference data www.worldbank.org/data

Objectives
Measure the population's income or inequality level.

Goals, reference values
Since it is a compound and relative index, the per capita income, GDP, and other economic development indicators may be considered.

Application examples
The World Bank uses the Gini index as a reference.

Other comments / context

This index is difficult to measure in poor countries. The World Bank develops a reference for all the countries in southern Africa. The OECD provides information on developed countries' incomes.

Annual per capita energy consumption

Resource: Atmosphere
Type of indicator: PRESSURE
Category: Core
Source: UNCSD, OECD, CEROI

Justification: What does it mean and why is it important to measure it?
This indicator measures the average annual consumption of electric energy per person and is related to the pattern of consumption, development, air quality and atmospheric emissions. It may be divided according to the sector: industrial, commercial, and household. It is different from transport energy consumption as it is directly linked to combustion.

How is it identified? Information needed
City population, amount of energy consumed in GWh.

Measurements and units
GWh / per capita / per annum.

Possible time and space formats
To indicate trends, numerical data may be presented in tables or charts.

Methodological resources references
OECD, 1997 Better Understanding our Cities: The Role of Urban Indicators, EEA Indicator Set.
WB, Development Data Group, 1999. World Development Indicators 1999 on CD-ROM. World Bank Publications, USA.

Objectives
Reduce the city's energy consumption.

Goals, reference values
No corresponding international patterns.

Application examples
The Regional Municipality of Hamilton-Wentworth, 1996,
http://www.iisd.org/measure/compendium/DisplayInitiative.aspx?id=1346

Other comments / context
In general, electricity is produced by burning fossil fuels, although this use has a smaller share in the energy matrix in Latin America and the Caribbean countries. Electricity generation based on fossil fuels, such as mineral carbon, natural gas and petroleum derivatives, produces greenhouse gas emissions such as carbon dioxide (CO_2). Electricity consumption is linked to productive activities that cause the emissions. Even when, as in Brazil, the matrix is based on hydroelectricity, energy consumption may reach an unsustainable level and, putting pressure on hydraulic resources.

To assess energy consumption, this information must be compared with consumption data in the transport sector, to give a more precise assessment of the cities' global contribution to air quality.

For the indicator to be effective in measuring local air pollution, the analysis must describe the energy source used.

Total water consumption

Resource: Water
Type of indicator: PRESSURE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Per capital water consumption depends on availability price, climate and uses (human consumption, hygiene, laundry, gardening, etc.). Water consumption, like other forms of consumption, is much higher in cities in high-income countries. This may be an indicator related to the quality of the city's supply system; total consumption generally includes losses of drinking water, paid for by the consumer.

How is it identified? Information needed
By relating annual domestic water consumption to the number of inhabitants connected to the supply network. The result is divided by the number of days in a year.

Measurements and units
Average water consumption (litres / day / person).

Possible time and space formats
Trend charts, graphs.

Methodological resources references
OECD, 1997. Better Understanding Our Cities: The Role of Urban Indicators, EEA Indicator Set. UNCHS, 1995. Monitoring Human Settlements: A Bridged Survey, Indicator Programme. ICLEI, http://www.iclei.org
EF, 1998. Urban Sustainability Indicators for the Improvement of Living and Working Conditions.

Objectives
Harmonize water consumption with available water resources.

Goals, reference values
Local programme goals.

Application examples
Percentage of water consumed by different sectors in Arendal (Norway).
http://www.ceroi.net
City of Targoviste, Rumania: Production and consumption patterns.
http://www.bestpractices.org/database/bp_display_best_practice.php?best_practice_id=591

Other comments / context
http://ceroi.net/ind/display.asp?indID=20

On average, people in developed countries use 272 litres of water per day; in Africa 53 litres. In North America average city use is 7 times higher than in Africa. It is estimated that lack of water and sanitation in urban areas in Brazil causes approximately 8 500 premature deaths every year

Total volume of untreated domestic sewage

Resource: Water, biodiversity
Type of indicator: PRESSURE
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Untreated sewage and rain water are generally drained off into water basins by the effects of gravity, and pollute surface, groundwater and sea water. This pollution has a serious impact on the environment and quality of life, as well as on the population's health, causing water-borne diseases, the proliferation of toxic algae, and increasing the cost of treating water for domestic consumption; therefore, the pressure on natural resources in the cities must be measured.

How is it identified? Information needed
On average, 50% of all the water consumed per capita becomes sewage. This indicator may be calculated by considering the population without sewage collection and treatment services, from information about the total consumption of water for domestic use in each city. Alternatively, account may be taken of any information available on the average annual volume of sewage per person. The indicator may be expressed as the total volume of untreated sewage and the percentage of the total volume of sewage produced in the city.

Measurements and units
Volume of sewage disposed of in a given period, by day, by month or by year: m^3/day, m^3/month, or year: m^3/day, m^3/month, m^3/year.

Percentage of total volume of drained sewage.

Possible time and space formats
Graphs, tables, maps and trend charts.

Methodological resources references
Other approximate uses of this indicator may be found in:

www.ceroi.net: Wastewater Treatment.

www.iclei.org: Volume of Sewage http://ww2.unhabitat.org/programmes/guo/guo_databases.asp Treated Sewage

Objectives
Measure the pollution in bodies of water caused by the lack of proper treatment, or not having access to the local drainage network.

Goals, reference values
No reference values for this indicator.

Other comments / context
Being aware of the degree of organic contamination is the first step in reducing pollution from sewage.

Atmospheric emissions

Resource: Atmosphere
Type of indicator: PRESSURE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Air Pollution affects human health (acutely and chronically), vegetation, buildings, construction materials, monuments and historic patrimony sites. It is caused by emissions from mobile and fixed sources directly linked to energy consumption, environmental policies, urban density, motor vehicle transport, and to the concentration of industries.

How is it identified? Information needed
Total emissions in tonnes per capita per year of a) SO_2; b) NO_x; c) CO_2. The inventory of emissions is usually divided by the main mobile and fixed sources of emissions.

Measurements and units
CO_2 (tonnes / per capita / per year). NO_x (tonnes / per capita / per year). SO_2 (tonnes / per capita / per year).

Possible time and space formats
Graphs, trend charts, column graphs.

Methodological resources references
UNCHS, http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

EC, Directorate General Environment, Working Group of the Expert Group on the Urban Environment, 2000. Towards a Local Sustainability Profile – European Common Indicators. http://www.sustainable-cities.org/ indicators/

EF, 1998. Urban Sustainability Indicators for the Improvement of Living and Working conditions.

Objectives
Reduce emissions to the minimum.

Goals, reference values
The Kyoto Protocol goals for natural emissions (no city goals have been established).

Kyoto Protocol with the United Nations Framework Convention on Climate Change.

Reduce the total of emissions caused by humans in equivalents of carbon dioxide and greenhouse gases by at least 5% below the 1990 levels, for the period 2008-2012.

Application examples
The World Bank programme "Clean Air Initiative in Latin American Cities" developed an instrument to prevent new emissions and to restore air quality in urban areas in Latin America and the Caribbean. http://www.worldbank.org/wbi/cleanair/infocenter/index.htm

Emission gases producing acid rain

Resource; Atmosphere
Type of indicator: PRESSURE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Sulphur oxides (SO_x), nitrogenous oxide (NO_x) and ammonium (NH_3), are examples of acid substances released into the atmosphere. Emissions from fixed and mobile sources put pressure on the quality of urban air. The polluting gases SO_x, NO_x and NH_3 produce acid rain and changes in the chemical composition of the soil and in surface waters, and they also affect flora and fauna.

How is it identified? Information needed
To calculate emissions per capita, the total emissions of: (a) SO_x, (b) NO_x y (c) NH_3 as well as the total population, must be known. Acid substances may be measured as an acidity equivalent; (Aeq = total acidity caused by acid components and deposited per hectare).

Measurements and units
Total emissions per capita and per hectare of NH_3 (tonnes vs. capita, Aeq, deposit of SO_2, NO_2 and NH_3 per hectare)

Total emissions per capita and per hectare of NO_x (tonnes vs. capita, Aeq, deposit of SO_2, NO_2 and NH_3 per hectare)

Total emissions per capita and per hectare of SO_x (tonnes vs. capita, Aeq, deposit of SO_2, NO_2 and NH_3 per hectare)

Possible time and space formats
Graphs, trend charts, column graphs.

Methodological resources references
UNCHS, Urban Indicators Guidelines: Better Information for Better Cities, EEA Indicator Set.

EF, 1998. Urban Sustainability Indicators for the Improvement of Living and Working Conditions.
EEA, 1998. Europeans Environment: The Second Assessment.

Objectives
Reduce emissions from fixed and mobile sources to comply with the demand for clean air quality.

Goals, reference values
Reduce to the minimum sources of pollution and improve air quality. Goals established by WHO may be taken as references.

Application examples
Arendal, Norway: http://www.ceroi.net/reports/arendal/

Solid waste production

Resource: Soil, water
Type of indicator: PRESSURE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Solid waste production increases annually due to the growing population, deficient services and unsustainable lifestyles. Solid waste is produced by economic and domestic sectors such as industry, commerce, health installations, tourism, transport, and family units.

How is it identified? Information needed
Whenever possible, this indicator should be measured by weight and volume. To calculate the amount produced per capita, the total number of inhabitants must be known. The indicator should be measured annually.

Measurements and units
Total solid waste produced (tonnes / inhabitant / year).
Solid waste produced (m^3 / inhabitant / year).

Possible time and space formats
Graphs, tables and trend charts.

Methodological resources references
OECD, 1997. Better Understanding Our Cities: The Role of Urban Indicators, EEA Indicator Set. UNCHS, 1995. Monitoring Human Settlements: A Bridged Survey, Indicator Programme.

Objectives
Reduce the amount of waste.

Goals, reference values
No reference values.

Application examples
Jacksonville, Florida, "Per Capita Tons of Solid Waste Deposited in City Landfills". http://www.jcci.org

Other comments / context
The indicator only considers solid waste.
Management of solid waste in developing countries has shown there are many social and health benefits to be had when the community participates

Solid waste disposal

Resource: Soil, water
Type of indicator: PRESSURE
Category: Core
Source: CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Solid waste disposal is one of principal urban problems. Mitigating its negative impact is directly associated with the city's capacity to properly dispose of garbage. Improper solid waste disposal puts great polluting pressure on the land; it contaminates aquifers and is harmful to humans.

How is it identified? Information needed
The indicator may be calculated from the total waste produced and disposed of (or not disposed of) in different ways divided between the total number of inhabitants. Units of weight or volume may be used and the percentage of the total of weight produced.

Measurements and units
Solid waste collected and disposed of in sanitary landfills (tonnes / inhabitant; m^3/habitante, % of total waste produced). Solid waste collected and improperly disposed of in garbage dumps and otherwise (tonnes/inhabitant; m^3/inhabitant, % of total waste produced). Solid waste collected or recycled (tonnes/inhabitant; m^3/inhabitant, % of total waste produced). Uncollected and improperly disposed of (tonnes / inhabitant; m^3 / inhabitant, % of total waste produced).

Possible time and space formats
Graphs, maps, trend charts.

Methodological resources references
OECD, 1997. Better Understanding Our Cities: The Role of Urban Indicators, EEA Indicator Set. UNCHS, 1995. Monitoring Human Settlements: A Bridged Survey, Indicator Programme. ICLEI, http://www.iclei.org
EF, 1998. Urban Sustainability Indicators for the Improvement of Living and Working Conditions.

Objectives
To prevent atmospheric, water and soil pollution by poor solid waste disposal and reduce the incidence of disease by decreasing production at source and encouraging recycling and reuse.

Goals, reference values
No reference values.

Application examples
Good practices: Waste and urban clearing in Barcelona. http://www.mediambient.bcn.es

Other comments / comments /
Even though there are strict laws about disposal of industrial waste, specifically hazardous waste, they are often ignored and a significant part of the waste is disposed of in open-air dumps or close to inhabited areas. Control and management are some of the most important instruments for reducing the pressure of urban centres on the environment.

STATE INDICATORS

3.4 Definition of core indicators: State indicators

Air Quality

Resource: Atmosphere
Type of indicator: STATE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Air quality is negatively affected by emissions from fixed and mobile sources and is directly linked to energy consumption, environmental policies, urban density, motor vehicle transport and concentration of industries. Concentrations of pollutants have series effects on human health, vegetation, constructions, monuments and cultural patrimony.

How is it identified? Information needed
Number of days in which the World Health Organization (WHO) or local standards are exceeded as to de SO_2, O_3, CO, NO_2, black smoke, suspended particles (MP) and lead (Pb). This indicator should be calculated every year.

Measurements and units
Number of days per year when the air quality standard monitored in the city does not meet each standard in the above-mentioned list (number of yearly violations of the standard).

Possible time and space and space formats
Graph and trend charts

Methodological resources references
UNCHS.http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf

WHO, 1997. Healthy Cities Indicators: Analysis of Data from Cities across Europe.

EEA, 1998. Assessment and Management of Urban Air Quality in Europe.

OECD, 1999. Advanced Air Quality Indicators and Reporting: Methodological Study and Assessment.

EC, Directorate General Environment, Working Group of the Expert Group on the Urban Environment, 2000.

Towards a Local Sustainability Profile – European Common Indicators. http://www.sustainable-cities.org/indicators/

Objectives
Reduce atmospheric pollution and its harmful effects on health, water and soil.

Goals reference values
WHO Guidelines for Europe 2005

NO_2 (200 ug/m^3, 1 hour), CO (30 mg/m^3, 1 hour, 10 mg/m^3,8 hours), SO_2 (20 ug/m^3, 24 hours mean, 500 ug/m^3 10 minutes), O^3 (100 ug/m^3 8-hour mean), lead (0.5 mg/m^3, 1 year).

More information on WHO guidelines available at:

http://www.who.int/mediacentre/factsheets/fs313/en/index.html

Quality of water supply

Resource: Water
Type of indicator: STATE
Category: Core
Source: UNCSD, CEROI

Justification: What does it mean and why is it important to measure it?
Percentage of freshwater with concentrations of faecal material bacteria above the levels recommended by the World Health Organization (WHO). The indicator assesses the quality of water supplied to communities to meet their basic needs. It identifies localities where faecal pollution in the water or the supply network signifies a health threat.

How is it identified? Information needed
Microbiological testing of water to detect Escherichia coli and streptococcus bacteria. The results are generally found in the competent authorities' laboratory records or in those kept by authorized testing agencies and institutions. The microbiological quality of water is measured as a relation between the number of water analyses made and the results of faecal material/100 ml above zero and the total number of samples analysed.

Measurements and units
Microbiological quality: (% of samples analysed with the results of faecal material). Number of days when standards are exceeded.

Possible time and space formats
Graphs, trend charts.

Methodological resources references
World Health Organization (WHO).
United Nations Centre for Human Developments for Human settlements (UN-Habitat).
Food and Health Organization of the United Nations (FAO).

Objectives
Combat drinking water pollution and damage to health (infant mortality due to diarrhoea) and the environment.

Goals, reference values
WHO; national standards.

Application examples
Quality of water supply in Prague: http://www.ceroi.net/reports/prague/issues/Water/state.htm

Other comments / context
Although reference is made to drinking water, faecal material pollution is also found in oceans and seas that are usually important sources of recreation and food supply for coastal cities. Therefore, the same indicator used to assess the state of the environment in these cities may be applied in analysing salt water quality

Water shortage (frequency, extension, duration)

Resource: Water

Type of indicator: STATE

Category: Core

Source: OECD Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?

The main concern about hydric resources in the urban environment is the inefficient use of water and its consequences: shortages, salinization in coastal areas, droughts and the impact on human health.

To guarantee sustainable administration it is essential to avoid overexploitation and degradation of water resources in cities.

How is it identified? Information needed

To assess the state of water in terms of quantity and availability, account is taken of the frequency, intensity and duration of water shortages. The indicator depends on the relation to supply sources, including those outside the urban territory, and information may be obtained from the local or regional water supply authority. It is also reflected in how authorities responsible for administration perform and users behave. Water supply policies and how they are applied over a given period show how much water is available for the city. Although quantitative, this information should be associated with pressure and response indicators that assess water quality, the population with access to water supply and treatment, intensity of use and the size of the local water supply basin. Charges for water should also be considered when analysing this resource.

Measurements and units

Index calculated on the basis of annual water shortages; duration in number of days per year and percentage of the population affected by supply measured over a given period.

Possible time and space formats

Tables and graphs to indicate changes over time, from year to year.

Methodological resources references

OECD, Key Environmental Indicators,2001.

Objectives

The objective is to guarantee sustainable management of the resource, implying reducing waste and the inefficient use of supply and treatment technology, recycling effluents and integrated water basin administration. The OECD recommends the polluter-payer principle for water use be applied.

Goals reference values

Agenda 21, chapter 18; WHO, data on water supply and consumption per capita; local reference values available from local and regional water supply agencies.

Application examples

No systematized examples for the urban environment.

Other comments / context

Water use also depends on cultural characteristics, habits and customs. The natural availability of the resource, according to geographic and climate conditions, varies greatly from region to region and from city to city. The most important reference is local, although perhaps it will be necessary to consider some global values

Percentage of geologically unstable areas (risk areas) occupied

Resource: Land, water, biodiversity, built-up environment
Type of indicator: STATE
Category: New
Source: UNCSD, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Accelerated urban growth with high levels of social inequality, is usually accompanied by occupation of risk areas, that is to say, areas that are very vulnerable to destructive natural events such as landslides and floods, putting the lives of the inhabitants at risk. The indicator, therefore, may give an idea of the existing natural and social risks in a given locality. It may also be used to asses the vulnerability risks of natural disasters in the locality.

How is it identified? Information needed
Aerial photography is an important instrument to define risk areas in each city: If this type of information is not available, geological maps of the city may also be a good sauce of information for this indicator.

Measurements and units
% of risk areas measured in km^2.

Possible time and space formats
Maps, graphs and trend charts.

Methodological resources references
UNCSD – Consult indicators that measure similar problems.

Human and economic losses caused by natural disasters.

Area and population of authorized and unauthorized urban settlements.

Objectives
Cooperate to reduce social and environmental vulnerability in the city's risk areas.

Goals, reference values
No reference values established; new indicator.

Other comments / context
Reducing social and environmental risks by lowering the occupation rate in areas vulnerable to natural disasters is an important contribution to reducing social inequality and to build sustainable development in urban centres

Polluted sites

Resource: Water
Type of indicator: STATE
Category: Core
Source: UNCSD, CEROI

Justification: What does it mean and why is it important to measure it?
The indicator shows, even though indirectly, the level of pollution in the environment. Pollution affects human health and the environment itself and causes biodiversity impoverishment.

How is it identified? Information needed
Number and area of spaces recognized as polluted (total, new and rehabilitated).

Measurements and units
Polluted spaces (total, new and rehabilitated, number of spaces, area).

Possible time and space formats
Trend charts, maps, graphs.

Methodological resources references
New South Wales Environment Protection Authority, NSW State of the Environment
http://www.environment.gov.au/soe/2001/publications/theme-reports/settlements/appendix.html

Objectives
Decontaminate spaces and improve the environment.

Goals, reference values
In Europe dispositions in force in this respect are meant to: implement an integrated and effective network of waste disposal installations (Dir. – Table, art. 5); separately dispose of batteries containing hazardous substances (Dir. 91/157, art. 6); ensure combustion is free of residual oils and, when that is not feasible, ensure their safe destruction or storage (Dir.. 75/439, art. 4); prohibit the disposal of printed circuits in any way not environmentally safe.

Other comments / context
As polluted spaces may cause serious problems they must be continuously monitored. Indicators on the number of spaces and cleaning programmes say little about the problem of soil and environmental contamination. Pressures are difficult to distinguish considering the broad range of sources and types of existing pollution; it might still be helpful to measure the use of pesticides as an indirect pollution indicator.

Extinct or endangered species/known species

Resource: Biodiversity
Type of indicator: STATE
Category: Core, transversal
Source: UNCSD, OECD, CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Number of endangered species as a percentage of known local species. Species diversity is one of the three main levels of biodiversity; the others are ecosystems diversity and genetic diversity. Birds in cities are good indicators of biological diversity.

How is it identified? Information needed
A selection must be made of all the local species whose number known (or can be estimated) and whose state is periodically monitored or assessed. For each class, a calculation has to be made of local endangered species and the information compared with the number of corresponding local species. The indicator refers to species of flora and fauna.

Calculations should be made of:
a) Percentage of endangered species of plants; total of all classes.
b) Percentage of endangered species of each class of plants.
c) Percentage of vertebrate species; total of all classes.
d) Percentage of each class of endangered vertebrate species.
Sub-indicators a) and c) provide a general view of the situation of plants and animals. Sub-indicators b) and d) show the most endangered classes.

Measurements and units
Percentage of local endangered fauna and flora species, every 5 or 10 years. Total number of local flora and fauna species.

Possible time and space formats
Graphs, tables and trend charts.

Methodological resources references
World Conservation Union (IUCN)
World Resources Institute (WRI)
OECD, 1997. Better Understanding Our Cities: The Role of Urban Indicators, EEA Indicator Set

Objectives
Reduce the danger of flora and fauna species disappearing as a result of urban environmental pressure.

Goals, reference values
No specific international goals or reference values. References are established regionally or locally.
United Nations Convention on Biodiversity (Rio, 1992) EEA, 1997. Indicators for Sustainable Urban Development: Indicators of Urban Patterns. International Institute for Urban Environment.

Other comments / context
According to the World Conservation Union definitions endangered species are understood to be those threatened with extinction and are classified as those in danger, vulnerable, rare and undetermined

Vegetal cover

Resource: Biodiversity, land, water, atmosphere
Type of indicator: STATE
Category: Core, transversal
Source: UNCSD, CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Forests with natural or planted vegetation, parks, green areas and spaces, perform a primary urban environment role. In tropical countries, green areas adjacent to or within the urban district provide an essential environmental service by making the microclimate more agreeable, filtering and retaining rainwater, placing a natural control on floods, and providing the habitat for a varied urban fauna.

How is it identified? Information needed
Surface (ha) and percentage of the total city area in each category of vegetal cover. In some cities with significant extensions of natural forest, a distinction may be made among the existing ecosystems (for example: rainforests, mangroves, savannahs).

Measurements and units
Surface (ha) and percentage of the total city area in each category of vegetal cover.

Possible time and space formats
Graphs, tables, and trend charts.

Methodological resources references
World Conservation Union (IUCN)

World Resources Institute (WRI)

OECD, 1997. Better Understanding Our Cities: The Role of Urban Indicators, EEA Indicator Set

Objectives
Provide the number and possible extension of a city's green areas.

Goals, reference values
No specific international goals or reference values.

Application examples
"The Green City of Seville", Spain: http://www.bestpractices.org

Other comments / context
Green spaces in urban areas are extremely important for recreation and, in general, to improve the inhabitants' quality of life. Pressure on biodiversity comes from different interrelated sources, mainly land use changes, pollution, and the introduction of exotic species

Percentage of deteriorated areas (historic centres or buildings) in relation to built-up urban area

Resource: Built-up environment, land
Type of indicator: STATE
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Definition of the percentage of the built-up area in poor condition because of lack of maintenance by the inhabitants and the local authorities and the type of activities in cities. It is important to be aware of the degree of deterioration of buildings and infrastructure so that action may be taken to improve conditions and the quality of life of urban centres' inhabitants.

How is it identified? Information needed
Percentage of deteriorated built-up area; if infrastructure is included it will serve as a basis to calculate land and property taxes. These data may be obtained by consulting available local urban development plans, from censuses carried out by the local administration or from research undertaken by academic or institutional sources responsible for preparing general urban socio-economic information.

Measurements and units
% of the area (km^2 deteriorated and total built-up).
% constructions (relative number and total number)

Possible time and space formats
Graphs, maps, trend charts.

Objectives
Reduce deterioration of the built-up environment and help to improve the urban population's quality of life.

Goals, reference values
No established reference values

Other comments / context

It is most important to include in the assessment on the quality of urban life the aesthetic and functional elements affected by the deterioration of buildings and infrastructure.

IMPACT INDICATORS

4.7. Definition of core indicators: Impact indicators

Biodiversity loss

Resource: Biodiversity
Sphere: Ecosystem
Type of indicator: IMPACT
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The risk to biodiversity is an excellent indicator of environmental quality. Consequently, the loss of biodiversity (number and variety of flora and fauna species in the environment) allows an assessment to be made of each ecosystem's sustainability.

How is it identified? Information needed
The indicator refers to a number of the local environment's flora and fauna species not found at the moment the assessment is made compared to earlier periods for which a record has been kept. The concept of biodiversity loss as it is used here does not only refer to the extinction of species; it is also their significant reduction or disappearance without being extinct.

To make this calculation the number and variety of the city's species of flora and fauna, both past and present must be known.

Measurements and units
Number of species of flora and fauna.

Possible time and space formats
Graphs and localization maps.

Methodological resources reference
This indicator is an approximation of the number of extinct and known species given in earlier state indicators and is commonly employed by the United Nations Sustainable Development Commission (UNSDC).

Objectives
Reduce the impact and threat of urban development to local biodiversity.

Goals, reference values
No established reference values; the indicator is new and adapts to the local environment's characteristics.

Other comments / context
This is an important instrument to assess the quality of the environment following urbanization. Although there is no experience in making this measurement at local level, it is important to begin collecting data to give the public authority and local society enough information to take measures to protect local biodiversity.

Microclimate change

Resource: Biodiversity
Sphere: Quality of life
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Public perception about the climate is important because people relate their quality of life directly to the environment. The quality of urban life, linked to a city's microclimate, is directly affected by emissions of polluting gases from industry and motor vehicles, by the lack of green areas and by soil waterproofing.

How is it identified? Information needed
By monitoring the temperature in different parts of the city differences are seen that may be associated with the quality of the local physical environment. Rainfall, temperature and relative air humidity indexes are data collected locally that should be recorded over time and may help when analysing microclimate changes.

Measurements and units
Temperature variation in °C and relative air humidity.

Possible time and space formats
Graphs and tables showing variation over time during similar periods in different years. When making an environmental quality analysis of the city, they should be associated with data on green areas, built-up and paved areas, and episodes of flooding.

Methodological resources reference
None.

Objectives
Make the public more aware of the impact the environment has on the quality of urban life. Make the authorities more sensitive to the need to improve the urban environment by, for example, planning green areas and encouraging the use of environmentally friendly building materials.

Goals, reference values
None.

Other comments / context
Although the data may be objective, such as temperature or degree of humidity, the notion of environmental comfort is subjective. The use of these indicators in analysing environmental quality in a city should be associated with other indicators, such as the motorization and air pollution index

Incidence of water-borne diseases

Resource: Water
Sphere: Quality of life
Type of indicator: IMPACT
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The state of water has immediate effects on the local population's quality of life and health. Water polluted by organic material, specifically faecal material, and used for domestic consumption, is one of the principal water-borne disease vectors with a negative impact on the quality of urban life. One of its main manifestations is infant mortality associated with diseases caused by polluted water. Therefore, it is important to follow up, at local level, the increase in borne-borne diseases so that measures may be taken to improve the quality of life and, indirectly, to improve the condition of the locality's water supply.

How is it identified? Information needed
Data provided by local public health agencies, classified by the type of disease and the affected population.

Measurements and units
Number of people affected by water-borne diseases according to disease types and dates when they appeared.

Possible time and space formats
Trend charts, tables and localization maps.

Methodological resources reference
No references to other methodological resources; new indicator.

Objectives
Improve the population's quality of life.

Goals, reference values
No reference values; in the case of infant mortality, reference is made to World Health Organization standards.

Other comments / context
Water-borne diseases reflect the socio-economic inequality between different population groups. The most marginalized groups live in unhealthy conditions with limited access to a supply of drinking water and to drainage, almost always implying pollution of alternative water sources and children coming in contact with polluted water, thus increasing the incidence of water-borne diseases. Investments in good quality water supply and drainage systems to combat these diseases would help to reduce social inequality and improve the quality of life of the poorest population groups.

Incidence of cardiorespiratory diseases

Resource: Water
Sphere: Quality of life
Type of indicator: IMPACT
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
It is now known that air pollution has repercussions on the health and quality of life of city inhabitants. Frequent exposure to elements such as carbon monoxide and carbon dioxide, nitrous oxide, ozone and others, brings with it an increase in cardiorespiratory diseases, mainly in the elderly and children.

How is it identified? Information needed
Information about the number of different cardiorespiratory diseases and their increase due to air pollution may be obtained from public health agencies.

Measurements and units
Number of people affected by cardiorespiratory diseases, indicating the type of disease, the age of those affected, and the connection with increased air pollution.

Possible time and space formats
Trend charts and tables.

Methodological resources reference
No references from other methodological resources; new indicator.

Objectives
Reduce the impact of air pollution on the local population's quality of life and health.

Goals, reference values
Consult the World Health Organization's reference values.

Other comments / context
The impact of air pollution goes beyond the immediate effect on the inhabitants' quality of life and health; climate changes caused by rising temperatures indicate the importance of controlling their causes. Nevertheless, since such changes are accumulative and only become evident after many years, their effect on human life is even greater

Incidence of diseases caused by poisoning and pollution

Resource: Land
Sphere: Quality of life
Type of indicator: IMPACT
Category: Core
Source: CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?

This indicator provides basic information on the population's health in relation to the physical environment. Cases of diseases caused by pollution and poisoning due to soil and water pollution indicate the quality of urban planning and management.

How is it identified? Information needed

Number of cases of poisonings per 100 000 identified as being due to soil pollution. This indicator may be subdivided to relate to specific types of illnesses. It is very unusual for soil pollution to cause death; however, it can occur from caesium poisoning, as has happened in the state of Goias in Brazil.

Measurements and units

Number of cases of diseases per 100 000 inhabitants in a given period.

Possible time and space formats

Trend charts.

Methodological resources reference

SEPA 2000. Environmental Indicators in Community Planning: A Presentation of the Literature.

Objectives

Reduce the risk of disease by improving living conditions by means of urban environmental planning.

Goals, reference values

No international reference values.

Application examples

None.

Other comments / context

Cases of soil pollution are generally episodic (see Bhopal, India, 1984 and the case of Love Canal in the United States in the 1960s). In Brazil, the case of caesium pollution in a garbage dump was detected because of the number of deaths it caused in the local population from cancer.

"The Global Burden of Disease" (GBD) http://www.hsph.harvard.edu/burdenofdisease/

Juvenile delinquency index

Resource: Built-up environment
Sphere: Quality of life
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The juvenile delinquency index reveals a community's state of social health and its degree of security. Poverty, drugs and environmental degradation are contributing factors to a poor quality of life which, in turn, leads to urban violence. Families without a strong structure, a lack of schools and suffering from hunger, also cause an increase in juvenile delinquency.

How is it identified? Information needed
Juvenile delinquency refers to offences committed by people less than 18 years of age. Statistical information is official and provided by local authorities and the police. Such offences may be classified as serious or minor; these data and the information on the relevant population are collected annually.

Measurements and units
Number of cases per year of juvenile delinquency over a given period (2-10 years).

Possible time and space formats
Graphs, tables y trend charts.

Methodological resources reference
Sustainable Seattle, 1998. Indicators of Sustainable Community. http://www.scn.org

Objectives
To reduce the number of juvenile delinquency cases per year in a given community.

Goals, reference values
None.

Application examples
Some international organizations like UNICEF provide comparative data on valence.
Sustainable Seattle, 1998. Indicators of Sustainable Community, page 52
http://www.scn.org

Other comments / context
Juvenile delinquency indexes also indicate future scenarios about a community's safety. Violence affects the quality of life of all the inhabitants and is identified by citizens as one of most serious urban, political and social problems. Although the quality of the environment is related to violence, this is linked to a set of social, cultural and economic factors (such as inequality, the illiteracy index, unemployment and the population in unauthorized settlements) so that the authorities must take an integrated approach to deal with the problem. To adopt violent crime as a reference may reduce the distortion margin for comparative effects

Public health costs due to incidence of water-borne diseases

Resource: Water
Sphere: Urban economy
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The state of the environment may cost municipal administrations and business significant economic losses because of the impact on the local population's health. This indicator seeks to identify, in the case of the water resource, losses from water-borne diseases that result from different types of water pollution. If the public authority is to confront this problem, measures must be taken such as increasing medical consultations or supplying medicines for sicknesses such as diarrhoea or leptospirosis, as well as providing more tests to define the type of sickness; this implies increasing health sector resources.

For their part businesses, and other economic activities in the city, also suffer losses due to days lost through sickness.

How is it identified? Information needed
The indicator is based on following how the public authority's local health costs evolve in relation to the presence or increase of the city's water-borne diseases. This means, therefore, knowing how the local budget is divided under different headings when the calculation is being made.

These data are more difficult to obtain because costs of this type are not usually reported. However, it is important to make an effort in this respect, together with associations representing business interests, to obtain these data and calculate losses due to diseases.

Measurements and units
The objective is to increase the budgets of the public authorities and of business to fight these diseases; the unit of measurement is the local currency which is converted into U.S. dollars for international comparison.

Possible time and space formats
Graphs, tables and time charts.

Methodological resources reference
No references of other methodological resources; new indicator.

Objectives
To contribute to the resources of the local economy by showing the economic weight represented by the negative impact of the state of water.

Goals, reference values
No established reference values; new indicator.

Other comments / context
This indicator, adapted for different impacts, should be used for air and water resources

Water collection and treatment costs

Resource: Water
Sphere: Urban economy
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Water pollution, its wasteful or improper use, and the constantly increasing demand for the resource, together with the growth of the urban population, shows the need to increase local availability of good quality water and to guarantee a sufficient supply. This demands large amounts of financing because, for many cities, water is not available from nearby sources but must be brought from aquifers at long distances or to which access is difficult; because water courses are generally polluted, the water must be treated for human consumption. All these factors require large investments if the quality of life and the health of the population are to be preserved, and if a large number of economic activities are to be made possible.

How is it identified? Information needed
In principle, the data needed for this indicator should be available from public water supply, control and monitoring bodies and, where the local water system is privatized, from private enterprises.

Measurements and units
Increased costs in local currency.

Possible time and space formats
Trend charts and tables; the costs are compared in 5-10 year periods.

Methodological resources reference
Other indicators that may give an approximate idea of the problem can be found in:
www.ceroi.net : Investment in water supply systems (response indicator)
www.iclei.org : Volume of water available (pressure indicator)

Objectives
Reduce the loss of resources invested in water collection and treatment by controlling leaks, rationalizing water use and improving its quality.

Goals, reference values
No reference values; new indicator.

Other comments / context
It is important to indicate, in local public finances, the impact caused by improper use, by the growth of demand and by water pollution

Cost of containing and preventing environmental risks

Resource: Biodiversity
Sphere: Urban economy
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Because of the lack of land use planning and an institutional incapacity to control illegal occupation of risk areas in cities, spending on engineering work to prevent and contain risks is only a temporary solution; these contention measures are, for example: work on gradients, channelling ravines, building landfills and dams.

How is it identified? Information needed
Budget information from competent local and regional authorities.

Measurements and units
Absolute values and percentage of costs in the budget for environmental work.

Possible time and space formats
Tables of annual spending, graphs to show long-term trends over a given time period.

Methodological resources reference
None.

Objectives
Reduce costs related to temporary solutions and report environmental, social and economic costs due to lack of planning on the use and occupation of urban land.

Goals, reference values
None.

Other comments / context
This is a local indicator to compare data with local references that depend on a follow-up the period covered by the analysis.

Cost of rehabilitating monuments and historic centres

Resource: Built-up environment
Sphere: Urban economy
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21, CEROI

Justification: What does it mean and why is it important to measure it?
Population growth worsens the impact on the built-up and natural environment. In cities, deterioration of monuments and historic centres reveals the lack of environmental quality and institutional capacity to administer land occupation and use. This indicator is related to deterioration of urban property due to corrosion caused by acid rain, or the growing disorder and urban land tremors due, for example, to the increase in the number of buses, motor cars and trucks in certain areas of the city.

How is it identified? Information needed
Number of historic buildings, annual cost of repairing monuments and restoring historic centres, local administration's budget.

Measurements and units
Variation of recovery costs in relation to the budget, in absolute values and percentages.

Possible time and space formats
Graphs, tables and maps.

Methodological resources reference
Local Government Management Board, 1994. The Sustainability Indicators Research Project: Indicators for Local Agenda 21 – A Summary. United Kingdom.

UNESCO.

Objectives
Conserve and protect monuments and historic centres to reduce the number of buildings at risk and improve environmental quality

Goals, reference values
No international goals.

Application examples
The historic centre of Salzburg: http://whc.unesco.org/en/list/784

Historic centre of Havana, Cuba;

Parati and Ouro Preto, Brazil.

Other comments / context
Cities and towns on the World Heritage List: http://www.unesco.org

Loss of urban attraction

Resource: Land
Sphere: Political-institutional
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Property supply and demand and changes in property prices may reflect the change of vocation of a given city or zone. These are qualitative indicators that measure the relation between economic activity and land use. They affect the social, environmental and economic quality of life in a given locality.

How is it identified? Information needed
Data may be found on the local property market in local and regional trade associations and through direct surveys.

Measurements and units
The number of properties for sale in relation to the number of property operations in a year over a given period.

Possible time and space formats
Tables and trend charts.

Methodological resources reference
No international references.

Objectives
Relate the change of activity and the space characteristic of a given area which, in turn, has poor environmental quality and loses economic value.

Goals, reference values
None.

Other comments / context
This indicator may be divided to assess districts or zones within an urban parameter. Its application is local and depends on national economic reference values

Property depreciation

Resource: Land
Sphere: Urban economy
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Property speculation, added to the lack of urban planning, leads to frenzied and predatory urbanization and harms the inhabitants' quality of life by overburdening the urban infrastructure and destroying work areas and resources. Property price indicators, as well as differences in price per square metre, depending to the area, may reflect the city's environmental degradation. These are qualitative indicators that measure the economic relation between land use and quality of life in a given locality.

How is it identified? Information needed
The indicator comes from an analysis over a period of time of a given area considering such matters as traffic and noise that affect the quality of city life. The information depends on the history of how prices per square metre differ in selected areas.

Measurements and units
Variation in percentages of the relative cost per square metre ($/m2) of urban plots.

Possible time and space formats
Consideration should be given to time periods of 10 years, or according to the specific situation where prices have changed significantly because of land use changes.

Methodological resources reference
No international references.

Objectives
Relate the loss of economic value to poor environmental quality.

Goals, reference values
None.

Other comments / context
This indicator may be subdivided to assess districts or regions within the urban parameter. Its application is local and depends on national economic reference values

Incidence of floods, landslides, etc.

Resource: Land
Sphere: Urban vulnerability
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Floods and landslides on gradients following heavy rains have direct, indirect and secondary impacts for the poorest people. Losses are immediate and direct, medium and long term, harmful to human health and cause indirect environmental losses. Natural phenomena generally have consequences in inverse proportion to how much planning and preparation is undertaken by the authorities.

How is it identified? Information needed
Data obtained from local authorities, civil defence and public works departments.

Measurements and units
Number of accidents in risk areas per year, measured over a given time period.

Possible time and space formats
Tables, maps and graphs.

Methodological resources reference
None.

Objectives
Reduce the number of victims and consequences of disasters whose impacts could be prevented with proper planning and administration.

Goals, reference values
None.

Other comments / context
This indicator is directly associated with the pressure indicator on the relation between authorized and unauthorized settlements and with the social inequality indicators. The state indicators on water and response linked to protecting areas with springs are also related to human vulnerability

Loss of tax revenue

Resource: Land
Sphere: Political-institutional
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The loss of tax revenue is the result of a structural deficiency in urban management, as well as of the change in the profile of activities or spatial characteristics of the given city or region. When there is much informal commercial activity, besides prejudicing public administration it also harms legal trade, resulting in bankruptcies or in owners abandoning their businesses. The lack of infrastructure, maintenance and poor environmental quality may also lead to urban degradation and consequent loss of tax revenue.

How is it identified? Information needed
Budget information provided by local authorities.

Measurements and units
Percentage of taxes from the predominant activity, tourism for example, from year to year in a given city or area.

Possible time and space formats
Trend chart.

Methodological resources reference
None.

Objectives
Revitalize degraded areas by showing the damage caused by urban deterioration.

Goals, reference values
None.

Application examples
Look for urban revitalization examples (Puerto Madero, Argentina; Harlem, USA, Havana, Cuba Pelourinho, Brazil).

Other comments / context
The objective data on the municipal budget are used in the analysis to show the existence of external environmental and urban factors.

Population living in vulnerable urban areas

Resource: Land
Sphere: Quality of life
Type of indicator: IMPACT
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Urban vulnerability is associated with the city's physical, social and economic conditions. There is a clear relationship between vulnerability and its impact and economic development. Identifying risk situations, assessing their impacts and institutional responses, may help to avoid the more serious consequences of vulnerability.

How is it identified? Information needed
Number of people living in risk localities such as on gradients and in polluted sites. These data are obtained from local authorities.

Measurements and units
Absolute number of inhabitants in risk situations in relation to the total population in a given year, and how these numbers vary over time in a given period (2-10 years).

Possible time and space formats
Graphs, maps and tables.

Methodological resources reference
World Bank, UNCHS and UNDP for national and regional data.

Objectives
Reduce urban vulnerability to natural or human-induced disasters.

Goals, reference values
None.

Application examples
None.

Other comments / context
http://www.unhabitat.org/downloads/docs/5883_19704_Cities%20and%20Climate%20Change%20Adaptation.pdf

More than half of the world's population now lives within 60 km of the sea, while three quarters of all large cities are located on the coast. Most of the world's urban population resides in vulnerable areas which are ill-equipped for adaptation, with 1 billion living in slums, and likely to become environmental refugees. It is estimated that in addition to sea level rise, 3 to 4 of every 10 non-permanent houses in cities in developing countries are located in areas prone to floods, landslides and other natural disasters – further exacerbated by climate change.

PRESSURE INDICATORS

Definition of core indicators: response indicators

Urban master plan in place

Resource: All
Type of indicator: RESPONSE
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The Urban Master Plan presupposes a concern for regulating already institutionalized land use and occupation. Meanwhile, it should be associated with other responses to specify environmental resources.

How is it identified? Information needed
Local authority and national legislation.

Measurements and units
This is a qualitative indicator to be used when diagnosing the urban environment.

Possible time and space formats
Information about the existence and date of local implementation.

Methodological resources reference
None.

Objectives
Guarantee planned urban development that includes questions about the environment

Legislation to protect springs in place

Resource: Water
Type of indicator: RESPONSE
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The existence of national and local regulations and how they are applied has a direct impact on the city's environmental and natural resources quality.

How is it identified? Information needed
Information on legislation and on competent environmental control authorities.

Measurements and units
This is a qualitative indicator in diagnosing the urban environment.

Possible time and space formats
Information about the date of national, regional and local implementation.

Maps and geographical information systems
Methodological resources reference.

Objectives
Guarantee quality of urban water supply, as well as preserving biodiversity, air and soil quality by controlling occupation in areas with springs.

Goals, reference values
The existence of standards and controls does not alone constitute a reference value.

Other comments / context
This indicator should be associated with indicators on illegal occupation and settlement, and on quality and quantity of water and how effluents are treated

Regulation on controlling emissions from mobile and fixed sources in place

Resource: Air
Type of indicator: RESPONSE
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The existence of local and national regulations and how they are applied have direct repercussions on city air quality.

How is it identified? Information needed
Information on legislation and on competent environmental control bodies and authorities.

Measurements and units
This is a qualitative indicator to diagnose the urban environment.

Possible time and space formats
Information about dates of national, regional and local implementation.

Objectives
Guarantee urban air quality by controlling industrial and transport emissions.

Goals, reference values
The existence of standards and control measures alone is not a reference value. Air quality must be measured according to national and international standards

Local Agenda 21 activities

Resource: All
Type of indicator: RESPONSE
Category: Core, transversal
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Local Agenda 21 (LA21) is an agenda for the 21st century in which the local government, the community and interested groups are involved environmentally, economically and socially to focus on a plan, programme or set of long-term sustainable activities. This long-term effort includes setting specific goals, implementing measures, following up and making assessments (such as audits, indicators and objectives).

How is it identified? Information needed
Record the city's local activities. May be defined in the LA21 table as a LA21 activity.

Measurements and units
Number of activities.

Possible time and space formats
Tables and graphs.

Methodological resources reference
ICLEI, 1998. www.iclei.org

Objectives
Implement the LA21 process in the city and its local communities.

Goals, reference values
The Rio Conference of 1992 decided that LA21 processes should be implemented globally at local level.

Application examples
A21L en Durban: http://ceroi.net/reports/durban/index.htm

Sustainable cities and local government: http://www.unchs.org

Other comments / context
In June 1992 UNCSD adopted Agenda 21 as a global sustainable development action for the 21st century. The plan includes a special mandate for authorities to act, beginning in 1996, on implementing LA21.

LA21 document: http://www.iisd.org/rio+5/agenda/agenda21.htm

Environmental education programmes

Resource: All
Type of indicator: RESPONSE
Category: New, transversal
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Environmental education is the key to good environmental management so long as the responsibility for environmental quality is shared between government and citizens. The existence of environmental education mechanisms and actions shows how the subject has been integrated into public policies and the daily life of the city's inhabitants.

How is it identified? Information needed
Local, regional and national authorities have data on legislation, standards and action on environmental education such as campaigns, movements and environmental themes included in the formal school curriculum.

Measurements and units
This is a qualitative indicator useful in making an analysis associated with other state and response indicators.

Possible time and space formats
Existing long-term activities expressed in graphs and tables.

Objectives
Stimulate environmental awareness and public participation in the city's environmental management.

Other comments / context
That the subject is institutionalized does not mean it has been included in local public policies. The subject must be associated with action, behaviour and attitudes which are, in turn, detected in the state of the environment as time passes

Number of environmental NGOs

Resource: All
Type of indicator: RESPONSE
Category: Core, transversal
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Society's participation and interest are important for local democracy and transparency in decision making, as they are also vital for successful Local Agenda 21 processes. The number of NGOs is an indicator of public participation and commitment.

How is it identified? Information needed
Number of groups, divided in groups of 10 000 people, involved in local government.

Measurements and units
NGOs / 10 000 people

Possible time and space formats
Trend chart, graphs, tables.

Methodological resources reference
ICLEI, 1998. www.iclei.org

Objectives
Increase participation in and transparency of decision making processes.

Other comments / context
Genuine participation by and interest of all social groups in the decisions are fundamental when implementing all the Agenda 21 objectives, directives and mechanisms (Agenda 21 UN, Chap. 23).

Tax system based on the polluter-payer/user-payer principle in place

Resource: Water
Type of indicator: RESPONSE
Category: Core
Source: CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The application of preventive measures includes a tax system based on the polluter-payer principle. Legislation and tax collection show the importance of applying the tax and how effective it is. It serves to internalize the environmental cost of pollution and to stimulate the use of clean processes and technologies.

How is it identified? Information needed
Data are obtained from municipalities and competent environmental control authorities.

Measurements and units
Local "green" tax system (percentage).

Possible time and space formats
Graphs and tables.

Methodological resources reference
ICLEI, 1998. Global Tomorrow Coalition, 1993. Walter Corsao: Measuring Urban Sustainability. USA.

Objectives
Increase the cost of polluting to encourage the adoption of clean technologies and processes

Preventive warnings and fines for violating the waste disposal standard

Resource: Land
Type of indicator: RESPONSE
Category: New
Source: Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
The existence of waste disposal control mechanisms implies institutionalizing them and joint responsibility.

How is it identified? Information needed
Data obtained from local environmental control authorities.

Measurements and units
Number of events per year.

Possible time and space formats
Graphs and tables.

Objectives
Reduce solid waste production, minimize and reduce risks of environmental pollution from solid waste.

Investments in waste management

Resource: Land, water and biodiversity
Type of indicator: RESPONSE
Category: Core
Source: UNCSD

Justification: What does it mean and why is it important to measure it?
Urban domestic waste management is local authorities' responsibility. The cost of managing waste is an important factor that defines the municipality's commitment to urban sustainable development; poor management causes a significant worsening of health, quality of life and the environment, adds to the loss of productivity, harms the economy and puts urban attraction at risk.

How is it identified? Information needed
In general, the cost of waste management includes the total spent on public and private services to collect and dispose of the city's garbage. This indicator does not include managing industrial hazardous waste as this is the responsibility of the sources themselves.

The indicator is calculated as the total investment in waste management services in relation to the city's income and to the total volume of waste handled.

Measurements and units
Investments in waste management (total value, unit value = total value / total volume of waste managed, percentage of municipal income).

Possible time and space formats
Graphs, tables and trend charts.

Methodological resources reference
OECD, 1997. Better understanding our cities: The Role of Urban Indicators. EEA Indicator Set.

UNCHS, 1995. Monitoring Human Settlements: A Bridged Survey.

EF, 1998. Urban Sustainability Indicators for the Improvement of Living and Working Conditions.

Objectives
Improve the municipal waste management system.

Application examples
Good practices: waste and urban street cleaning in Barcelona. http://www.mediambient.bcn.es

Other comments / context
Possible investments to improve the management system may include programmes, on different scales, on selective collection, recycling, environmental education, support for initiatives linked to recycling and other activities related to waste management innovations and training. Investments in these areas, as well as being included in the total value, should be listed separately

Access to and quality of local infrastructure services

Resource: All
Type of indicator: RESPONSE
Category: Core, transversal
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Local services quality and reliability are normally assured in industrialized countries, but in developing countries limited access or the poor quality of infrastructure services can be a serious impediment to productivity and cause frustration in national users.

How is it identified? Information needed
Percentage of services provided to households through the water supply network, drains and garbage collection.

Measurements and units
Households connected to the water supply network (total number of households). Garbage collection from households (total number and percentage of households).

Possible time and space formats
Trend charts and maps.

Objectives
Let the urban population become less frustrated.

Application examples
Household connection, in Prague, Czech Republic. http://www.ceroi.net/reports/prague/issues/housing/state.htm

Total rehabilitated areas in relation to total degraded areas

Resource: Land
Type of indicator: RESPONSE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Degraded city areas being reurbanized for other uses.

How is it identified? Information needed
Area in km^2, percentage of total urban surface.

Measurements and units
Area rehabilitated (km^2).

Area rehabilitated (percentage of total city surface).

Possible time and space formats
Maps, trend charts, graphs.

Methodological resources reference
EEA, 1997. Sustainable Urban Development Indicators: Urban Patterns Indicators. International

Institute for the Urban Environment.

Objectives
Restore affected spaces and buildings.

Goals, reference values
No reference values

Investments in green areas

Resource: All
Type of indicator: RESPONSE
Category: Core, transversal
Source: CEROI

Justification: What does it mean and why is it important to measure it?
Investments must be made to maintain and improve green areas, parks and public gardens for the city's environmental quality. These are important for recreation that has an effect on the inhabitants' quality of life.

How is it identified? Information needed
Investment made in maintaining green areas in relation to the city's GDP. It should be measured annually and a 2-10 year period should be taken into account for a long-term assessment.

Measurements and units
Percentage (%) of annual investment in relation to total municipal budget.

Possible time and space formats
Graphs, tables and trend charts.

Objectives
Improve green areas and public parks in cities.

Goals, reference values
No goals or quantitative reference values, but access to green areas is considered important for the communities' health and for urban sustainability. The WHO recommends 12m2 of green area per city inhabitant.

Other comments / context
It is important to guarantee that spaces are preserved and maintained, and to ensure they are not replaced by built-up or waterproofed areas.

Investments in environmental recuperation

Resource: All
Type of indicator: RESPONSE
Category: Core, transversal
Source: CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Investments in degraded urban areas and those being rehabilitated for sustainable use.

How is it identified? Information needed
Data obtained from the municipality and reclamation investment programmes; total values that may be compared with the city's budget. May also include private initiative investments.

Measurements and units
Value of investments in local currency or in U.S. dollars in a given year.

Possible time and space formats
Graphs, maps and tables.

Objectives
Reduce the number of degraded areas and recover the quality of environmental resources.

Goals, reference values
EEA, 1997. Sustainable Urban Development Indicators: Urban Patterns Indicators. International

Institute for the Urban Environment.

Other comments / context
The United Kingdom Brownfield programme, that basically seeks to rehabilitate commercial spaces and abandoned industries, has created more than 6 400 jobs; in addition, the pilot communities had an economic impact of more than US$2 000 million

Investments in public transport

Resource: All
Type of indicator: RESPONSE
Category: Core
Source: CEROI

Justification: What does it mean and why is it important to measure it?
The impact on the urban environment caused by traffic is directly related to air pollution and human health problems. Investments in public transport show what is being done to reduce these pressures.

How is it identified? Information needed
Investments in public transport in relation to the total spent on public roads.

Measurements and units
Investments in public transport (total value, percentage of value spent on public roads, percentage of municipal income).

Possible time and space formats
Trend charts, tables and graphs.

Methodological resources reference
Local Government Management Board, 1994. The Sustainability Indicators Research Project: Indicators for Local Agenda 21 – A Summary. United Kingdom.

Objectives
Improve users' access to public transport and the quality of the services provided.

Application examples
Strasburg tramway: http://www.eaue.de/winuwd/76.htm

Other comments / context
A recent report analyses 245 cities that are experiencing the fastest growth in the developing world. It shows very clearly that spatial influences of macroeconomic and industrial policies and related investments (or economic development), are the main drivers of city growth in 78 per cent of the cities analyzed. Investments in transport infrastructure (roads, ports, airports) were by and large the most important contributor to city growth. Forty per cent of the cities analyzed experienced high growth rates as a direct result of the diversification, expansion or improvement of regional or urban transport infrastructure (UN HABITAT 2009)

Investments in water supply and drainage systems

Resource: Water

Type of indicator: RESPONSE

Category: Core

Source: CEROI, Consorcio Parceria 21

Justification: What does it mean and why is it important to measure it?
Providing basic sanitary systems that include water supply, collection and treatment of sewage is the municipality's responsibility. Supplying drinking water with no danger of pollution from sewage is an absolute necessity for life and health. This indicator measures the importance the city places on improving its water supply and drainage systems.

How is it identified? Information needed
Investment in water supply and drainage in relation to each city's federal income. This indicator should be measured every year.

Measurements and units
Investment in water supply (total value, incremental value = total value / number of additional households served, percentage of municipal income).

Investment in drainage system (collection and treatment systems) (total value, cost of collection network increase = total value / number of households served by the network, unit cost of treatment = cost of treatment system / population served, percentage of municipal income).

Possible time and space formats
Trend charts, graphs.

Objectives
Improve municipal water supply and drainage systems.

Goals, reference values
No international references.

Application examples
Increasing access to water and sanitary services in marginalized urban areas by private investment: El Alto Project in La Paz, Bolivia http://www.bpdws.org/spanish/prj_lapaz.htm

Other comments / context
Throughout the world it is mainly the task of women to collect and handle water. They are also responsible for household chores, hygiene, the family's health and sanitary arrangements. Women should, therefore, take a full and active part in water supply and sanitation programmes

Annex 2: Guide to managing bibliographic references[42]

A. Managing bibliographic references in the body of the document

The system will be used where the reference is made with the surname and year. For example: (Schuldt 2004), (Velarde and Rodríguez 2001) or, "Schuldt (2004) maintains that..."; "Velarde and Rodríguez (2001) conclude..."

When a document has been written by three authors, the three surnames are included in the reference (Morón, Casas and Carranza 2002). If there are more than three authors (for example: Rodríguez, Seminario, Astorne and Molina), it is preferable to quote it as follows: Rodríguez and others.

When works by an author published in the same year are quoted, they should be distinguished as follows: Chacaltana 2003a and Chacaltana 2003b.

Each bibliographic reference should include at least the following information:

- Name and surname of the author or authors. If it was authored by an institution, the complete name should appear and not only the abbreviation or acronym.
- The reference title must appear in italics if it is a complete publication; between inverted commas if it is a document, report or presentation that has not been published. When the reference is to an article or chapter, the title of the publication in which it appears should be given, as well as the name of the author or editor. When the title of a work or an article is quoted, only the first word of the title appears in capital letters; for example: Ensayos sobre la economía peruana. If the work has been written in English then that language's spelling is respected; for example: A Decade of Economic Change. The Chilean Experience.
- Other information that should be included is the name of the publisher, the year and place of publication. If a newspaper article is being quoted, please include the name of the author, the date of publication and the title of the article, the name of the newspaper in italics, and the pages on which the article appears.

B. Presentation of texts in the Bibliography

Below are some examples of how to present information in the bibliography:

When it is a book:

Schuldt, Jürgen (2004). Bonanza macroeconómica y malestar microeconómico. Apuntes para el estudio del caso peruano, 1988-2004. Lima: University of the Pacific Research Centre.

When an article published in an academic magazine is quoted:

Gorton, Gary and George Pennacchi (1990). "Financial Intermediaries and Liquidity Creation", in The Journal of Finance. Vol. 45. Nº 1. Pp. 49-71.

When an article or chapter of a book written by several authors is quoted:

Bonifaz, José Luis y Luis A. Bonifaz (2004). "Servicio universal en telecomunicaciones: el caso del Fondo de Inversión en Telecomunicaciones en el Perú", in Fernández-Baca, Jorge

[42] *Guide by the Fondo Editorial of the University of the Pacific Research Centre*

(ed.). Experiencias de regulación en el Perú. Lima: University of the Pacific Research Centre.

When the quote is from an author or publisher previously quoted:

Jaramillo, Miguel (2003). "Políticas de recursos humanos para la agricultura comercial costeña", in García, Norberto (ed.). Políticas de empleo en Perú. Lima: Consorcio de Investigación Económica y Social y Red de Políticas de Empleo.

-------- (1999). El potencial de generación de empleo de la agricultura peruana. Working document. Lima: International Labour Organization.

When they are unpublished conference or seminar documents:

Domínguez, R. and P. Salinas (1992). "Las ventajas del libre comercio". Article presented at the Second International Conference on Foreign Trade, Atlanta, Georgia, United States.

When they are unedited documents:

Meller, P. and A. Solimano (1984). "Inestabilidad financiera, burbujas especulativas y tasas de interés". Santiago, Chile. Mimeo.

When the figure or table was prepared by the GEO technical team for this specific document:

Source: Prepared in house FAU-UNT, 2005.

When the figure or table was prepared on the basis of a document consulted by the GEO team:

Prepared in house FAU-UNT, 2005. Based on the Municipality of San Miguel de Tucumán, 2003. (Make reference to the title of the text or document in the final bibliography)

When the figure or table was prepared specifically for this document by a professional or expert invited by GEO Cities.

Source: Prepared by Ceballos for FAU-UNT, 2005.

When the figure or table was prepared based on a document consulted by a professional or expert invited by GEO:

Source: Prepared by Ceballos for FAU-UNT, 2005. Based on INDEC, 2001.

(In this case the title of the INDEDC document consulted must have complete reference in the final bibliography).

Annex 3: Questions guide to prepare GEO Cities report[43]

Suggested questions to be answered in the GEO Cities report

PHYSICAL CONTEXT CHAPTER

City context

Questions	Indicator
• Where is the city located? What are the city's general characteristics? Has it an urban area and a rural area? • What are the geographic characteristics, land relief, climate? • What is the relation between ecosystems in the city and geographic characteristics? • Brief account of the city's history.	• City's territorial extension and its relative importance with respect to the municipality's extension. Include map of the country by municipalities, pinpointing the city. • City's altitude ranges. • Type of climate throughout the year (temperature range). Rainy season and intensity in each period (m^3/sec average). • Identify principal natural ecosystems in the city.

SOCIO-ECONOMIC AND POLITICAL CHAPTER

Historic evolution of urbanization

Questions	Indicator
• How has land use changed? • What are the principal activities on city land? • Of each of the zones presented (industrial production, general services, tourism, housing) what percentage occupies city land? This is meant to establish the relative importance of these zones and the pressure they exert. • What are the principal forces that have changed land use?	• % of urban area and % of rural area in two extreme years. • Map of territorial occupation in the extreme years (for example, 1970 and 2008) may show the change in land use). • Extension of the urban area and its growth rate.

Demographic dynamics

Questions	Indicator
• What is the size of the population? What is its distribution, according to urban and rural area? • What is the population concentration according to municipalities or parishes? What is the evolution of population density? What is the relative importance of the arriving migrant population? • What are the principal places of origin of the migrant population? • What is the population composition by age groups?	• Population growth rate between censuses. Between 1970 and 2008, or the most convenient years. • % of urban population, % of rural population. Consider two extreme years to note differences. • Evolution of population density, city average. • Population density in principal city parishes. • Migrant population growth rate. • % of population according to age, for example: under 15 years, between 15 and 60; and over 60.

[43] *Elaborated by Rosario Gómez and Elsa Galarza*

Socio-economic dynamics

Questions	Indicator
• What is the state of the population living in poverty? Distinguish between poverty and extreme poverty and indigence. • What are the main causes of poverty in the city?	• % of population living in poverty. • % of the population in extreme poverty. • Gini index.

Provision of basic services

Questions	Indicator
• What is the coverage of the basic services of drinking water, electric light, sanitation (drains)? Is there a difference in coverage in the inner city? That is to say, in localities with more than 90% coverage and others with less than 50% of families or households covered.	• % of the population or households with drinking water supply, by principal zones. If possible, compare two extreme years to show whether it has improved, is worse, or is unchanged. • % of the population or households with sanitation service (drains) by principal zones. If possible, compare two extreme years to show whether it has improved, is worse, or is unchanged. • % of the population with electric light by principal zones. If possible, compare two extreme years to show whether it has improved, is worse, or is unchanged.
• What about health services provision? • What are the main diseases that affect the city's population? Are any of them associated with the quality of the environment?	• Number of inhabitants per doctor. • Number of inhabitants per bed. • Number of health establishments per type over time. • Growth rate of acute respiratory diseases and acute diarrheic diseases.
• What about education services? • How has the illiteracy rate evolved? • Are there contrasts? What is the rate of school dropout?	• Illiteray rate: trend. • Number of students per teacher. • Growth rate of school age children. • School dropout rate.
• Explain public transport service characteristics	• Growth rate of automobile numbers according to type of vehicle: private use or public service. • Average age of public transport vehicles. • Growth rate of emissions as to type (CO_2, total suspended particles, particulate material (PM10).

Economic dynamics

Questions	Indicator
• What are the city's main economic activities? Number of enterprises according to size: large, medium or small. The size may be defined by value of annual sales or number of workers. What percentage of the EAP is engaged in these main activities? • How do all the economic activities function in terms of using natural resources or economic impacts? What is the principal destination of the production? Home and/or foreign market.	• Growth rate of principal activities' sales values between 1990 and 2008?. Analyse trend. • % of EAP engaged in main activities identified. • Growth rate of production volume and value per year. Period 1990-2008?. • Inventory of events that caused environmental deterioration (e.g. oil spills). • In the case of a refinery details may be given of the composition of the product: diesel, LPG, etc. Between 1990 and 2008? • % of each activity's production for the home market and for foreign markets. • For forests, indicate the forest area trend.

Local environment political-administrative structure

Questions	Indicator
• What is the present city management political-institutional structure? What city institutions are involved in managing the environment? • What coordination mechanisms are there between institutions identified? What are the main competences and attributions of such institutions?	• Make a flowgram of all the institutions involved in managing the environment and how they interrelate. • Make a flowgram of the environment management unit in the city's municipality and its coordination with other institutions.

STATE OF THE ENVIRONMENT CHAPTER

Water

Questions	Indicator
• What are the sources of the zone's water supply? What water basins supply the city? Is underground water used? What has been the average flow volume in recent years? Is it a permanent flow? • What is the water used for? What is the order of importance between domestic, industrial, energy, agricultural and other uses? • Concerning domestic use, what access does the population have to drinking water? How is water supplied to those who do not have access? Where is water supplied inside the city? What is the price per cubic metre? Has this price gone up?	• Water basins that supply the city; annual average flow. • Demand for water according to type of use. Balance between drinking water and sewer system • Coverage. • Price of domestic drinking water. • Volume of sewage according to type of use. • Content of pollutants in sewage (DBO, heavy metals, coliforms, among others). • Volume of water treated.

Questions	Indicator
• Concerning the domestic drainage system, rain and industrial: how much is generated? What types of waste does it contain? What is the sewage treatment capacity? How many effluents are dumped directly into the sea or into rivers? Are beaches polluted by sewage?	

Air

Questions	Indicator
• What are the air pollution sources -- mobile or fixed? Does industry get energy by burning fossil fuels? Is gas used? • Concerning pollution by motor vehicles, is the vehicle fleet an old one? Does it use gasoline or petroleum or public or private transport? Are some city zones particularly polluted by vehicular congestion? • Concerning industrial pollution, what type is it? • Does it affect a particular city zone?	• Air pollution indicators in recent years compared to standards. • Number of vehicles (private or public service); age. • Air pollution indicators by type of industry.

Biodiversity

Questions	Indicator
• What is the vegetal cover surface within the city area? What types of fauna inhabit each area? • How many public parks are they and how big are they? What type of services do they offer? What is their state of conservation? • How many city gardens are there, and how big are they? How much green area is there per inhabitant?	• % of urban land covered by green areas, forests, wetlands, etc. • Number and size of public parks. • Number and size of public gardens. Density per locality (district) within the city. M^2/inhabitant.

Land

Questions	Indicator
• What is the land used for? • What are the most frequent urban land risks? Landslides caused by rain, earthquakes, floods, others? In what season do they happen? Are they recurrent and are they becoming more intense? • Number of housing units and inhabitants in risk areas. • City zones with well-built constructions compared to poor zones.	• Changes in land use in hectares. • Map of zones at risk. • List of earthquakes or floods in recent years and their intensity. • Number of earlier disasters and damages. • Number of informal or poor settlements. Number of inhabitants.

Marine coastal resources

Questions	Indicator
• Have economic activities caused the marine coastal zone to deteriorate? How have hydrobiological species and fishing been affected?	• Number and volume of fish species for consumption.

Solid waste

Questions	Indicator
• What volume of solid waste does the city produce per year? What type of waste: domestic, industrial, hazardous, etc.? Which type produces the most volume? • Is all the city garbage collected? Are there alternative systems to dispose of waste: barrows, or direct dumping? Are there recycling systems? What price is charged for garbage collection? • What is the disposal system; its storage capacity: landfills, dumps, etc.? Are all types of waste included? How much does the system cost the municipality?	• Volume of each type of waste produced. • Waste production compared to collection. • Number of controlled sanitary landfills, dumps, others.

Built-up environment

Questions	Indicator
• City zones with well-built constructions compared to poor zones. Model urbanizations. Degree of urban infrastructure deterioration. Historic centre. How are the city's buildings preserved?	• Number of informal or poor settlements. Number of inhabitants. • % of total city area with buildings in good condition. Number of deteriorated buildings compared to total buildings.

RESPONSES CHAPTER

Questions	Indicator
• What policies are in place to respond to the city's environmental deterioration?	• Principal standards and the problem they cover.
• What strategies have been developed by the local authority to respond to the city's environmental deterioration? How have they been implemented? To what degree have they advanced? Who benefits from the programmes and action? Principal results.	• Principal instruments used, types of incentives offered. Success factors.
• What strategies have been developed by business and NGOs to respond to the city's environmental deterioration? How have they been implemented? To what degree have they advanced? Who benefits from the programmes and action? Principal results.	• Principal instruments used, types of incentives offered. Success factors.
• What is the extent of citizen participation and response to the city's environmental problems? What proposals have been made? If they have been acted on, how effective have such proposals been?	• Number of public environmental hearings. • Number of neighbourhood committees to care for the environment.
• What are the principal instruments used in local environmental management? (Land occupation master plans, licences, area concessions, setting pollution standards).	• Inventory of proposals by citizens on improving the environment.
• What are the main sources of financing for the city's urban environmental management? How much financing by type of activity, over time.	• Identifying the principal instruments: date first applied, lessons learned. • Growth rate of global financing for municipal urban environmental management.
• Identify the principal mechanisms developed by the municipality to promote effective citizen participation.	• Financing structure of urban environmental management, according to type of activity.
• Explain the role of environmentalist NGOs, their number and sphere of action (air quality, water quality, green areas, among others).	• Number of NGOs, according to their main environmental theme of interest.

Annex 4: Work guide for the GEO Cities report workshop[44]

Assessment of the environmental indicators proposal

1- The proposal on indicators for GEO reports

The distinctive characteristic of the IEA/GEO (Global Environment Outlook) reports is that they go beyond a traditional state of the environment report and, as an integral part of decision making on sustainable development, they include an assessment of policies and emerging themes.

The objective of the IEA/GEO report is to promote effective action to achieve sustainable development. This report is produced as a participatory effort involving the principal stakeholders as well as experts in different disciplines related to development. The aim is to build a consensus about priority actions and questions resulting from a dialogue between stakeholders, politicians and scientists.

GEO is an integrated report because not only does it observe the links between socio-economic, environmental and policy questions, it also attempts to imagine future options and policy priorities based on past and present experiences. GEO uses a scenarios approach by examining a series of potential future results of possible policy decisions that may be taken today. Environmental questions in GEO are analysed by using a systemic approach and a conceptual pressure-state-response framework.

What is an integrated environmental assessment?

Traditional reports on the state of the environment have been very useful in indicating environmental conditions. However, these reports need to include an assessment of policies that have an influence on the environment. It is important to include this assessment because the consequences of policies, whether intentional or unintentional, may be dispersed over time and could also be the causes of environmental problems.

GEO Cities reports are based on the GEO Cities methodology and respond to six basic questions, according to the Methodology for the Preparation of GEO Cities Reports manual. Given that the GEO methodology is constantly being applied on its different levels (global, regional, national, local), it is continuously being enriched and improved. Its dynamics and constant improvement have resulted in additions being made to the conceptual framework and these are being applied nationally and globally.

Below an outline of the new conceptual framework is presented with a brief explanation of the elements that are defined in most detail (see outline). These are, basically, driving forces and the pressures that interact with the other elements.

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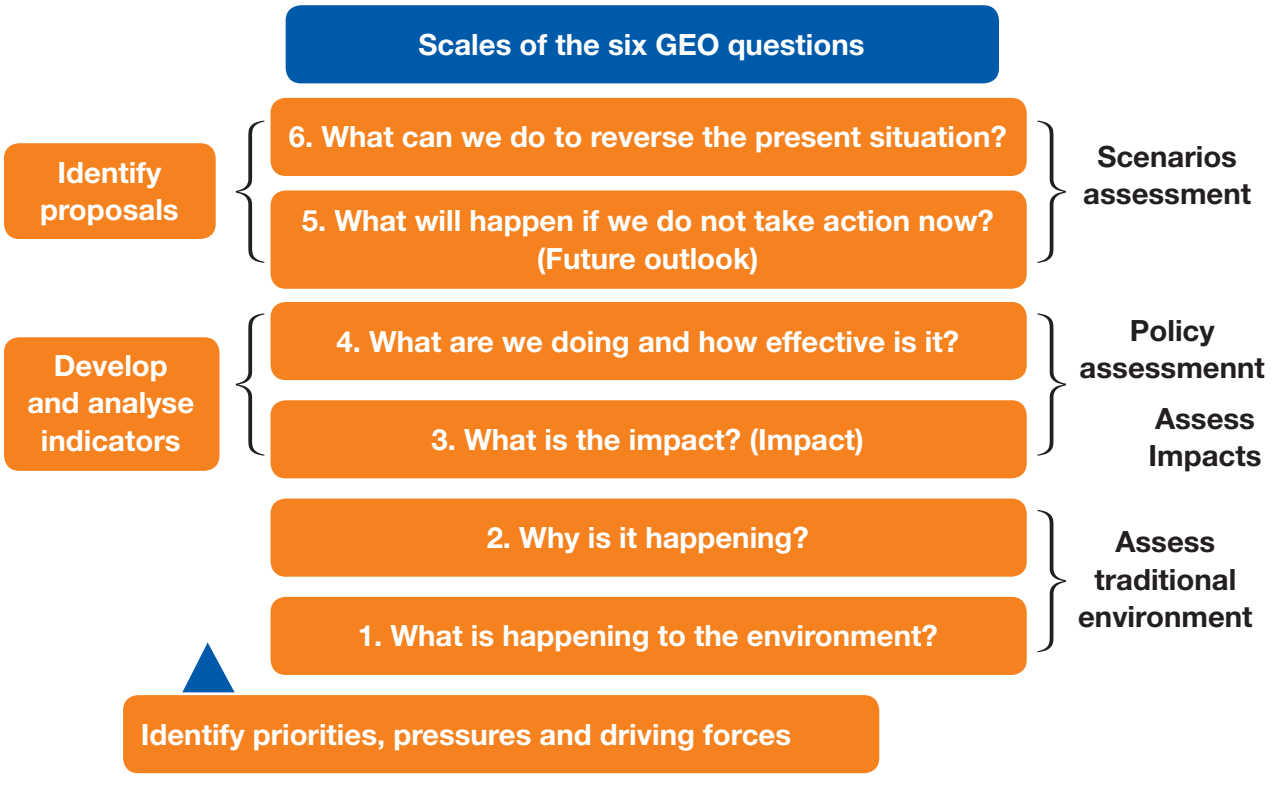
[44] *Prepared on the basis of Pinter, L., Zahedi, K., and Cressman, D (2000): Training Manual on Integrated Environmental Assessment and Reporting.*

The integrated environment report askes the six questions summarized in the following figure:



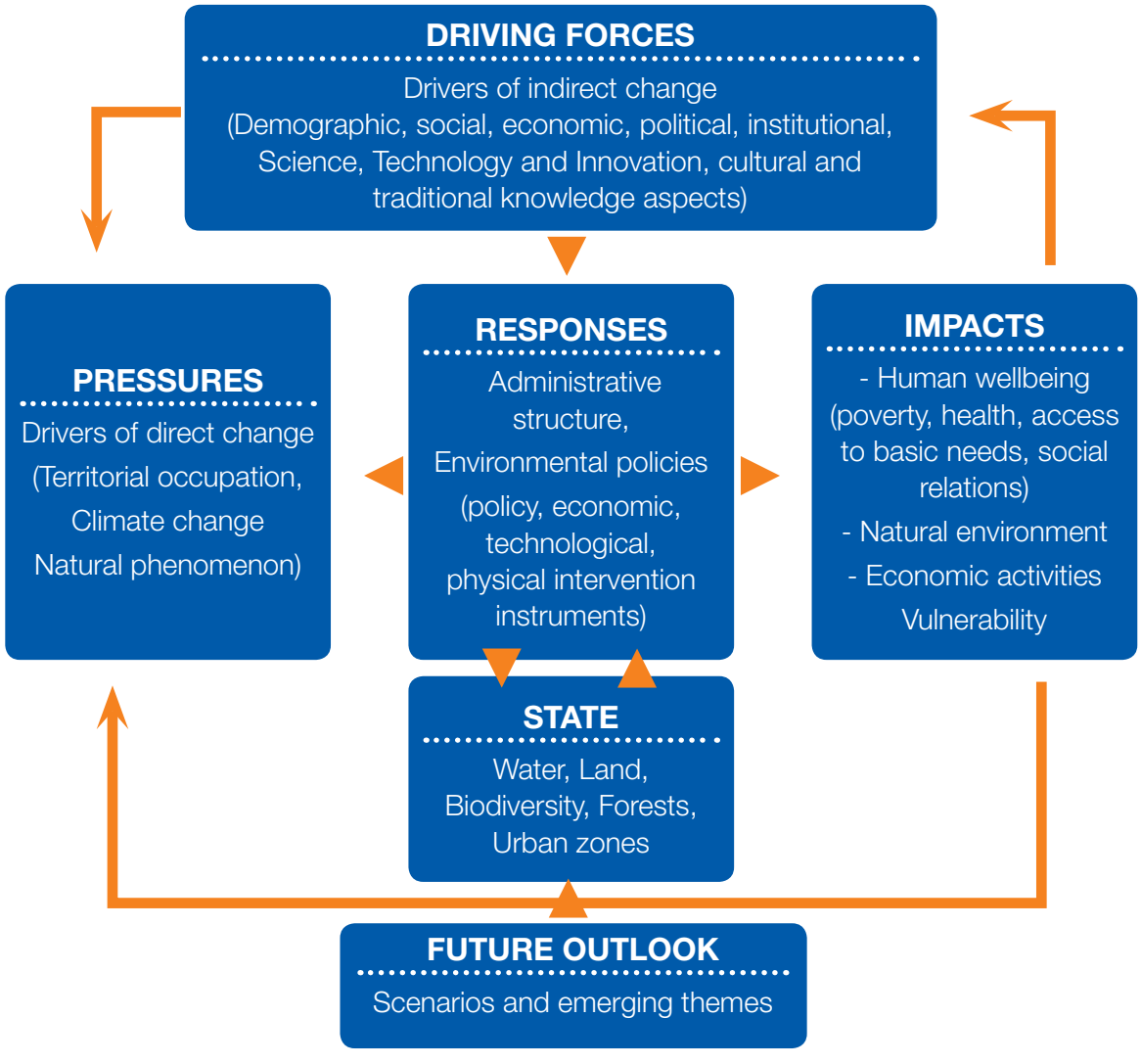
Scales of the six GEO questions

An integrated state of the environment assessment is a process to produce and communicate relevant policy information on key interactions between environment and society. These interactions may be categorized as:

- Driving forces and the pressures human beings place on the environment
- The resulting state or condition of the environment
- Impacts on the quality of life, the economy and ecosystems
- Society's responses to these results.

These categories are the basic components of the DPSIR framework[45] that underlies an integrated environment assessment. The following is a diagram of this framework:

[45] *Driving forces, Pressure State Impact Response (DPSIR) was developed as a more detailed alternative to the Pressure State Response (PSR) model.*



To design interventions that increase positive and minimize negative impacts, it is essential to identify and understand the drivers or forces that cause changes in ecosystems and the services they provide. In this respect, two elements are identified that influence changes to the environment: driving forces and pressures. From the political point of view, each is a starting point when dealing with environmental problems.

It should be made clear that, according to the terminology of the GEO methodology, driving forces refer to different types of processes that propel indirect changes in the environment (economic and social forces and the political-institutional forces that underlie them) such as population growth, consumption and production patterns, among others; Pressures, however, refer to propellers of direct change, that is to say, mainly physical, chemical or biological such as land use change, climate change and natural phenomena.

Both elements are considered to be causes that explain environmental changes and, therefore, it is very important to clearly identify them given that it is on them that the responses will have a bearing.

The chapter on driving forces describes five principal components on which responses are sought to the following questions:

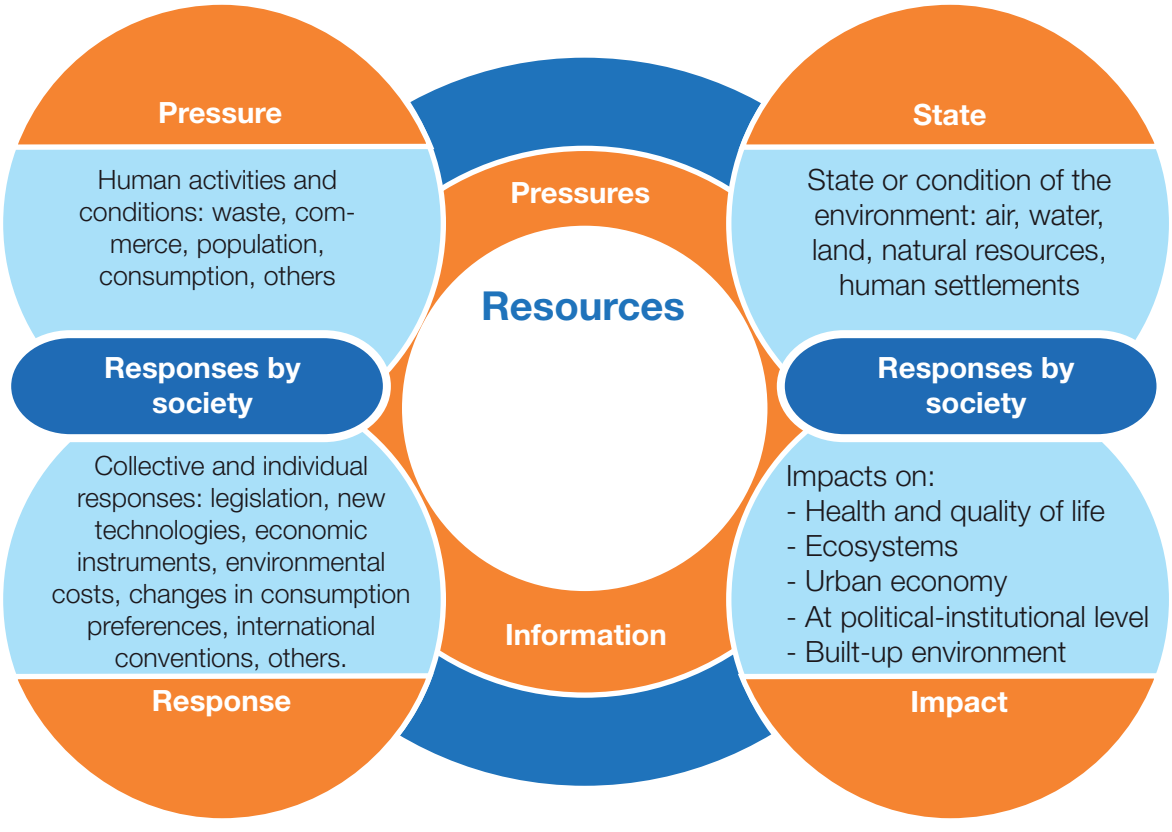
Components and basic questions to develop the driving forces

Components	Basic questions
a. Demographic aspects	• What is the city population's structure and growth trend? How does this trend change the environment?
b. Social aspects	• How does the population's poverty encourage behaviour that affects the environment? • Do the population's consumption patterns (energy and water) affect the quality and quantity of natural resources? • Is environmental education an ongoing process in general education?
c. Economic aspects	• What is the city's economic growth model? • Do the leading productive sectors have sustainable growth plans? • Do the city's developing industrial sectors have a clean technologies growth strategy?
d. Policy-environmental aspects	• Do the sectorial and local environmental policies applied have an integrated approach? Do they take account of economic, social and environmental aspects? • Is there an effective and efficient local environmental policy that provides incentives to take action? • What are the most used regulatory frameworks? What incentives do they provide? • What influence does public participation have on local environmental action? • What policy-institutional factors condition the use of ecosystems and their services? • What are the criteria for allocating and spending funds budgeted to conserve ecosystems and their services?
e. Science, technology and innovation (STI)	• ¿What is the trend? • What are the coordination mechanisms between the city's STI generators and users? • How is STI articulated in national education programmes?

As to pressures, the following components and basic questions have been established:

Components and basic questions to develop the pressures:

Components	Basic questions
a. Change in land use	• What has been the territorial occupation process? • What are the principal factors that condition occupation of the territory in the region? • How has the territorial occupation pattern conditioned the change in the environment?
b. Climate change	• How does climate change affect urban ecosystems? • Who have been mostly affected?
c. Natural phenomena events	• What are the city's principal natural phenomena? • How has the incidence of such phenomena led to behaviour that affects the amount of natural resources and the quality of the environment?



Driving forces and pressures are generally underlying forces such as population growth, consumption and poverty. Pressures on the environment are considered from a policy outlook as starting points to approach environmental questions.

State refers to the condition of the environment resulting from the pressures mentioned above, for example the level of air and water pollution, soil degradation and deforestation. The state of the environment will affect human health, wellbeing and quality of life, ecosystems and socio-economic conditions. In the DPSIR (Driving Forces-Pressure-State-Impact-Response) model these effects are part of the **"impact"**. It is important that decision-makers and the public know about the state of the environment and its indirect effects.

Response corresponds to society's collective or individual action to reduce or prevent negative environmental impacts, correct environmental damage or conserve natural resources. Responses may be: regulatory action, spending on the environment or on research, public opinion, consumers' preferences, change in management strategies and environmental information.

2- Analysis of the State of the environment

Until now, different working groups have made an earlier survey of the state of the environment in the city of San José in Costa Rica with respect to the following themes:

- Air
- Water:
  - Access to and water supply
  - Sewage and sanitation
- Solid waste

- Soil
- Coastal resources
- Biodiversity
- Forests
- Built-up environment

Annex 4 contains a list of basic indicators (pressure, state, impact, response) prepared by different institutions (UNCSD, ICLEI, OECD, and others) for an integrated environmental assessment.

3- Do the following exercises to propose indicators by themes

Exercise Nº 1

Identify your city's main environmental problems by sub-system and causes. Then prioritize the problems as shown in the following example:

Identify the principal environmental problems in Lima and Callao		
Natural sub-system	**Principal environmental problems and their priorities**	**Pressures /Causes**
WATER	Quality of water from groundwater and surface sources	• Availability of water • Dumping untreated sewage • Population concentration • Demographic growth • Poor water management • Overexploitation of groundwater sources
AIR	• High concentration of particulate material and carbon monoxide • High concentration of lead in the air (Callao) • High noise levels • Bad smells in the city	• Badly maintained motor vehicles • Poor transport management Environmental liability of mineral warehouses • Noise from industries, commerce, airplanes, etc. Industrial fish production Gases and effluents emissions
SOIL	• Soil pollution from solid waste • High concentrations of pesticides in the soil • Lead in the soil (Callao)	• Poor solid waste management Use of pesticides in agriculture • Environmental liabilities of mineral warehouses

Exercise Nº 2

Now take the first priority theme and its cause and identify the impact and responses. Once you have identified the state of the problem, pressures, impact and responses, then identify the indicators for each one of them as shown in the following example. This list is a guide and you may amplify its spectrum of indicators.

Indicators of DPSIR dimension						
Element	**Priority problem**	**Driving Forces**	**Pressure**	**State**	**Impact**	**Response**
Water	Quality of water from surface and ground sources	Demogra-phafic growth rate	Total volume of untreated domestic sewage per year	Index of water quality: DBO, DBQ, pH, nitrites, faecal matter in water	Incidence of water-borne diseases	Investment in drainage networks, collection, treatment plants ($/year)
Air	Air pollution	Country's economic situation	Atmospheric emissions from mobile and fixed sources	Concentra-tion of pollutants (PM10, PM2.5, CO, Pb, SO_2, CO_2, NO_x)	Incidence of cardio-respiratory diseases	Regulation and control of emissions from mobile and fixed sources
Soil	Soil pollution	Population growth	Solid waste production	Polluted sites	Incidence of diseases from poisoning and pollution.	Investment in integrated waste management ($/year): collec- tion and final disposal.

Exercise Nº 3

Assessing environmental policies helps to answer two questions:

What is happening? That is, how do policies affect the state of the environment?

What are we doing about it? That is, which of the policies now in force attempt to deal with environmental questions?

1- What is a policy?

According to the manual used to prepare the GEO reports, a policy is a set of inter-related decisions taken by a political stakeholder or a group of stakeholders on selecting objectives and the means to to be used to achieve them.

The policy context

Ways in which policies may be developed:

- **urgent, reactive policies:** for example policies taken quickly in response to environmental emergences;
- **habitual decisions:** most policies are the result of routine decisions made according to established and understood frameworks;

- **undefined areas:** those midway between exceptional and habitual; these are rare policies that have a high political profile and do not always follow the conventional decision making process.

Policy attributes:

- general or specific
- explicit or implicit
- reactive or proactive
- evolutionary or revolutionary
- independent or integrated with other policies

Policies may be at any point between these extremes. Examples of explicit policies are those clearly announced in ministerial speeches, legislative declarations, regulations, press conferences, laws, among other media. In contrast, implicit policies are not clearly explained.

Relations between the policies

There are different policy levels:

Transnational Example: Agreement on Climate Change
National Example: Reduce emission of greenhouses gases
Provincial - Regional Example: Require pollution certificates for private vehicles
Local Example: Subsidize vehicular fleet modernization

Since the driving forces-pressure-state-impact-response model was developed no policy exists in isolation; it is important, therefore, to consider the relations between various environmental policies and between environmental and other types of policies.

2- Steps in analysing and assessing policies

Because environmental conditions and socio-economic priorities evolve, policies must be continuously assessed and modified. The following is one method of making an assessment and an analysis:

Step1: Identify and list present policies and legislation with significant effects on the environment.

Step2: Identify performance criteria for selected policies.

Step3: Assess selected policies.

Step 1: Identify and list present policies and legislation with significant effects on the environment:

What types of policies are there and which of them should be analysed?

Diagnosing the state of the environment is the basis for assessing policies currently in place and, at this stage, the purpose is to identify and assess the main present environmental, economic and social policies that seek to respond to the most critical environmental problems. Many policies that appear to be unrelated to the theme of the environment have the potential to create adverse environmental effects, while others might have unexpected but beneficial effects. It is important, therefore, to be aware of policy implications.

In this analysis, to be practical, we should select a relatively small number of policies. Different categories of policies are:

a) International mechanisms: bilateral or multilateral agreements; commercial agreements; regional environmental and sustainable development groups or organizations; international environmental laws.

b) National sustainable development policies: may be government decisions obliging departments to provide reports on how sustainable development strategies are executed; the establishment of national advisory groups dedicated to implementing sustainable development and giving them support; and helping to prepare a set of national sustainable development indicators.

c) National fiscal and Treasury Department policies: allocating budget and other government resources for the environment, green taxes.

d) Legal instruments: environmental legislation, the obligation to assess environmental impact, standards, prohibitions, limits, licences (for example, control and leadership or extreme measures).

e) Economic instruments: taxes, subsidies, tariffs (for example, user tariffs) and fines, systems to assign responsibilities, financial instruments (for example, loans to environmental funds), systems to guarantee deposits and their later return, price structure, ecological labelling.

f) Raising awareness about education policies: public consultations, measures directed at vulnerable groups (for example: women, youth or indigenous groups), environmental journalism, conferences and seminars, environmental curricula, information and database networks (national and regional).

g) Standards and voluntary instruments: local Agenda 21, ISO 14 000, responsible care, better administrative practices.

h) Social policies: labour laws, sanitary and work safety regulations, support for public participation, rules and regulations related to gender equality.

Criteria to select policies for inclusion in the analysis

- Relevance for the public and for decision-makers;
- Link with environmental priorities identified in the diagnosis;
- Affecting the health, income and wellbeing of a large number of people;

- Responding to a physically severe environmental situation that change rapidly and/or are irreversible;
- Are related to the country's international obligations;
- Have the potential to cause disorder or conflict;
- Provide easy and feasible solutions;
- Originality of the policy initiative.

Step 2: Identify performance criteria for selected policies.

Once a number of high priority policies are identified, the next step is to determine the criteria that help to assess the results from an environmental and sustainable development point of view. Policies are generally designed without precise objectives or with criteria unrelated to the variables.

Criteria (of performance) may range from "general and descriptive" (for example if the policy complies with general principles) to "specific and quantitative" (for example when the objectives relate to specific indicators or defined periods). In essence, these criteria provide a basis for comparison between the planned or desired achievement and the actual achievement. Some examples of criteria categories are:

Benchmark: Comparison of a variable in my jurisdiction, with the best performance documented for the same variable in another jurisdiction. Example: the highest percentage of households connected to the sanitary system in sub-section X, compared to the variable in another sub-section.

Limits: bear in mind the value of a key variable that causes a fundamental and irreversible change in how a system behaves. A policy is assessed according to its capacity to bring a system to the limit or beyond. Example: a fishery's maximum sustainable performance. A rule defined in a general way and often formally accepted. If the definition of the principle does not include a specific performance measurement, the assessor should obtain a mandate to identify this relevant performance measurement as part of the assessment. Example: the policy should help to raise the level of knowledge about the environment.

Standards: Properties and regulations, accepted nationally and/or internationally, concerning environmental procedures or characteristics. A policy is successful if it helps to keep the performance within certain established limits. Example: quality standards for different uses.

Goals related to policies that include those stipulated in legal agreements: Determined by a policy and/or technical process that takes account of past performance and desired results. Example: official development assistance will be 0.4 per cent of GDP.

Step 3: Assess selected policies

The final objective of assessing policies is to influence decision making and initiate policy changes where and whenever needed. It is easier to adopt a recommendation for political changes if those who are to implement them are involved in preparing the analysis, from identifying crucial environmental themes, selecting the indicators and criteria and creating the link with specific policies.

Assessing policies centres on comparing the actual performance and what is expected of a given policy based on relevant performance criteria. Neither environmental themes nor policies can exist in isolation; any environmental trend will be the result of the combination of how policies and natural factors interact, some of which cannot be controlled by human beings. A policy may be good with a particular environmental impact or criterion but not with another.

3- Do the following exercises to identify and assess environmental policies in your thematic area:

Exercise Nº 1

Identify three policies being developed locally or regionally (Metropolitan Area) that seek to respond to the problem you are investigating. List other policies that may affect the result of those mentioned.

Exercise Nº 2

Identify the factors that facilitate and those that hinder the implementation of the policies mentioned above.

Exercise Nº 3

Propose three alternative local or regional policies (Metropolitan Area) to respond to the problem you are investigating.

Exercise Nº 4

Complete the action impact matrix based on the example in Annex 2 that relates to your area of study. To do this, you should chose three pressures that are affecting the environment, and three policies that have affected the state of the environment or that are suggested as responses to that state. Determine the original intention of these policies, identify their impact on three other key environmental conditions, and assess the impacts (Beneficial (+) or Harmful (-); High intensity (H) or Moderate intensity (M).

Exercise Nº 5

In relation to the policies selected in the above exercise, identify their main successes and failures.

Based on the response to the previous exercise, what priority action would you recommend?

In the specific area you are working on, do you think the responses to the present state of the environment can be treated independently?

With what other aspects (social, economic, environmental) would you relate these responses?

In the specific case of services, with what other regions of the country is their supply linked? Can the impacts be limited to the city?

Concerning the specific theme you are working on, what stakeholders would be involved in the DPSIR Driving Force-Pressure–State–Impact-Response model (government, private sector, NGOs, communications media, religious organizations, universities, trade unions, youth groups, indigenous groups, political parties).

Other questions to complement the exercise

Institutional

Have local public institutions created new environmental management units?

Is there coordination between these units? What mechanisms are used?

Are public personnel trained to manage these units?

How does the local government establish strategies to improve urban-environmental management? How are they implemented?

Local urban-environmental regulations

Identify the normative gaps that prevent efficient environment management.

Which existing standards have actively encouraged urban environment management?

Do the norms concentrate on control instruments (supervision and fines) or economic instruments (tax incentives)?

Is there harmony between national and local urban environment norms?

Citizen participation

Are there norms that encourage citizen participation? What are the principal mechanisms (public hearings), principal contributions?

Are there coordination mechanisms with the private business sector? What are they? Are they effective? Which are the principal contributions?

Information

Is there an urban environment information system? How is information organized?

How is information disseminated? Who uses it and for what?

Identify and assess the city's environment policies.

Business social responsibility

Principal activities (link with the locality to mitigate damage to the environment) Develop and apply innovations

Relation between private and public sectors. Coordination mechanisms.

Investment in environmental management

Principal programmes and projects, and amounts allocated.

Use of clean technologies.

Origin of investment funds.

Environmental education

Educational programmes

Awareness campaigns (solid waste, water quality)

Annex 5: Example of indicators used in GEO Cities reports

GEO Lima and Callao

Table 1 Indicators used in GEO Lima and Callao

Demographic Dynamics	
Demography	**(P)** Total metropolitan population (Number of people) **(P)** Evolution of population in Lima and Callao: national level (%) **(P)** Population growth rate (%) **(P)** Population growth rate between censuses (%) **(P)** New inhabitants per year **(P)** Population density – inhab/km^2 **(P)** Global fertility rate (children/woman) **(P)** Composition of population: men-women (%) **(P)** Population under 15 years (%) **(P)** Population between 15 and 29 years (%) **(P)** Population between 30 and 65 years (%) **(P)** Population over 65 years (%) **(P)** Population born outside Lima (%) **(P)** Native language of metropolitan population (% by type of language) **(P)** Population in human settlements (%) **(P)** Incorporation of districts (number of new districts)
	Total indicators: 16
Socio-economic dynamics	
Economy and poverty	**P)** GDP ($) **(P)** GDP share of primary sector (%) **(P)** GDP share of secondary sector (%) **(P)** GDP share of tertiary sector (%) **(P)** EAP in SMEs **(P)** Sector where the head of household is employed (%) **(P)** Unemployment rate (%) **(P)** Informal employment **(P)** Poverty (%) **(P)** Disparities in socio-economic levels (%) **(P)** Monthly income ($) **(P)** Distribution of socio-economic levels by cones
	Total indicators: 12
Infrastructure and access to urban services	**(P)** Degree of housing units consolidation (% and type) **(P)** Improvised housing (%) **(P)** Length of stay in provisional housing (years) **(P)** Metropolitan road network (Km and type) **(P)** Metropolitan journeys (Number of journeys/day/inhabitant) **(P)** Purpose of journeys (% and type) **(P)** Cycling paths network (Km) **(P)** Drinking water and drainage network coverage (%) **(P)** Water and drainage network (Km) **(P)** Maintenance and replacement of pipes (type and %) **(P)** Population receiving intermittent service (%) **(P)** Continuity of drinking water service (hours/day)

(P) Pressure **(S) State** **(I) Impact** **(R) Response**

Infrastructure and access to urban services	**(P)** Population with water service less than 6 hours/day (%) **(P)** Price of water from the network **(R)** Norms, plans, etc. **(R)** Investments in housing programmes (type, $ and beneficiaries) **(R)** Formalizing property (number of plots formalized) **(R)** Educational instruments (type and $)
	Total indicators: 18
Socio-economic dynamics	
Education, information and citizenship	**(P)** Students enrolled (number) **(P)** School centres (number, type and %) **(P)** Population attending school (type and %) **(P)** Average years of study (years) **(P)** Illiteracy rate (/100 inhabitants) **(P)** Illiterate women (/100 inhabitants) **(P)** Illiterate men (/100 inhabitants) **(R)** Environmental education programmes and projects (type and %) **(R)** Citizen awareness programmes and projects (type and %) **(R)** Environmental information programmes and projects (type and %) **(R)** Initiatives by NGOs (type and %) **(R)** Private enterprise initiatives (type and %) **(R)** Local government initiatives (type and %)
	Total indicators: 13
Health	**(P)** Health sector establishments (number and type) **(P)** Medical attention (number of inhabitants per doctor) **(P)** Medical services (number of beds/inhabitant)
	Total indicators: 3
Vulnerability	**(I)** History of earthquakes (magnitude and intensity) **(I)** Housing units at risk (number) **(I)** Number of vulnerable people at risk **(I)** Damage caused/phenomena ($ material losses and deaths) **(I)** Incidence of phenomena of technological origin (% and type) **(I)** Cost of natural disaster incidents ($)
	Total indicators: 6
Local management	**(R)** Policy and administrative instruments (type) **(R)** Capacity formation instruments (type and number) **(R)** Environmental management control instruments (type and $)
	Total indicators: 3
Natural sub-system	
Water and drainage	**(P)** Surface water resources storage capacity (millions of m^3) **(P)** Treatment plants nominal production capacity (m^3/sec) **(P)** Volume of water produced and aquifer exploitation (m^3/sec) **(P)** Operating wells (number) **(P)** Unitary water production (litres/inhab/day) **(P)** Volume of water consumed (litres/inhab/day) **(P)** Differences in consumption levels between districts (litres/socio-economic sector) **(P)** Total demand for water (m^3/sec) **(P)** Water not counted (%)

(P) Pressure **(S) State** **(I) Impact** **(R) Response**

Water and drainage	**(P)** Domestic sewage production (m^3/sec) **(P)** Treated sewage (% and volume) **(P)** Treatment plants operating (number) **(P)** Collectors (number) **(P)** Industrial establishments discharging into the drainage network (number) **(P)** Industries that comply with industrial drainage regulations (%) **(P)** Total volume of treated sewage (m^3/month) **(P)** Population with access to drinking water and drainage network (%) **(S)** Concentration of DBO5 (mg/L), thermotolerant coliforms (NMP/100 ml), toxic metals (mg/L) **(S)** Chlorine samples in cistern trucks **(S)** Evolution of groundwater exploitation (m^3/years) **(S)** Drinking water quality in distribution system (% of acceptable samples) **(S)** Drinking water quality from groundwater sources (% of acceptable samples) **(S)** Sanitary quality of beaches (NMP thermotolerant coliforms/100 ml) **(S)** Levels of aquifer exploitation (m^3/sec) **(S)** Water deficit: production versus demand **(I)** Children affected by ADDs (number) **(I)** Incidence of water-borne diseases (number and type) **(I)** Incidence of gastro-intestinal diseases (number) **(I)** Incidence of diseases caused by polluted sea water (number) **(I)** Incidence of diseases transmitted by food (number) **(I)** Quality of groundwater samples (% of acceptable samples) **(I)** Persons at risk from drinking water from wells with unacceptable bacteriological quality (%) **(I)** Persons at risk from water from cistern trucks with unacceptable bacteriological quality (%) **(I)** Economic cost of treating water and drains ($) **(I)** Cost of depolluting water ($) **(I)** Economic cost of monitoring water ($) **(R)** Policy and administrative instruments (type) **(R)** Technological physical intervention instruments (type and $) **(R)** Drinking water coverage projections ($) **(R)Sewage** treatment projections ($) **(R)Education** and information instruments (type and $)
	Total indicators: 41
Air	**(P)** Concentration of national industrial production (%) **(P)** Concentration of national vehicle fleet (%) **(P)** Growth rate of automotive fleet **(P)** Evolution of automotive fleet (type of vehicles) **(P)** Total number of vehicles **(P)** Number of public transport vehicles **(P)** Number of informal vehicles **(P)** Age of vehicle fleet (years) **(P)** City's most important industrial sectors (%) **(S)** Emissions by type of industrial vehicles (%) **(S)** Emissions of total suspended particles (ug/ m^3/) **(S)** Emissions of sulphur dioxide (ug/ m^3/)

(P) Pressure **(S) State** **(I) Impact** **(R) Response**

Air	**(S)** Emissions of nitrogen dioxide (ug/ m^3/) **(S)** Carbon monoxide emissions of (ug/ m^3/) **(S)** Concentration of sedimentable solid pollutants (tonnes/km^2/month) **(S)** Inventory of vehicle emissions (tonnes/year) **(S)** Vehicle and industrial emissions (%) **(S)** Contribution to producing pollutants by types of mobile and fixed sources (%) **(S)** Noise levels on main avenues in metropolitan Lima (decibels) **(S)** Noise levels at Jorge Chavez international airport and surrounding areas (decibels) **(I)** Asthma incidence (%) **(I)** Incidence of ARIs (%) **(I)** People who die from air pollution (number) **(I)** People who die from ARIs (number) **(I)** Deaths caused by air pollution registered in Lima and Callao (number) **(I)** Children affected by ARIs **(I)** Economic cost of air pollution: monitoring ($) **(I)** Economic cost of air pollution: operational costs ($) **(I)** Economic cost of air pollution: effects on public health ($) **(I)** Policy and administrative instruments (types) **(I)** Economic instruments (types and $) **(I)** Physical intervention instruments (types and $) **(I)** Information and education instruments (types and $)
	Total indicators: 33
Land	**P)** Size of city (km^2) **(P)** Urban area growth (hectares) **(P)** Extension of urban land (hectares) **(P)** Extension of agricultural land (hectares) **(P)** Urban area occupied by industries (%) **(P)** Factories in industrial zones (%) **(S)** Total urban land area (hectares) **(S)** General land use classification (types and %) **(S)** Plots formalized in risk, archaeological and natural reserves zones (number) **(S,** I) Reduction of agricultural area (% and hectares) **(I)** Reduction of wetlands area (hectares) **(R)** Policy and administrative instruments (types) **(R)** Physical intervention and technological instruments (types and $) **(R)** Information, education and citizenship instruments (types and $)
	Total indicators: 14
Biodiversity and green areas	(S) Number and area of natural ecosystems (hectares) (S) Identified land species: fauna and flora (number and type) (S) Identified marine-coastal species: fauna and flora (number and type) (S) Vegetal cover (hectares)
	Total indicators 4
Built-up Sub-system	
Patrimony	(S) Condition of patrimony (I) Affecting factors and their impact on patrimony (types) (I) Economic cost of patrimony recovery ($)

(P) Pressure **(S) State** **(I) Impact** **(R) Response**

Patrimony	**(R)** Policy, administrative instruments (types) **(R)** Physical intervention instruments (types and $) **(R)** Information, awareness and education instruments (types and $)
	Total indicators: 6
Energy	**(P)** Principal energy sources (% and types) **(P)** Energy reserves and consumption (% and types) **(P)** Energy consumption in the city compared to national production (%) **(P)** Electricity consumption (kWh/inhabitant/day) **(P)** Number and capacity of hydroelectric power stations **(P)** Efficiency in energy use (types and %)
	Total indicators: 6
	Total indicators 175

(P) Pressure **(S) State** **(I) Impact** **(R) Response**

2. GEO Sao Paulo

Description of the 83 environmental indicators proposed for the city of Sao Paulo

Pressure

1. Population growth and density
2. Income inequality index (Gini)
3. Social inclusion/exclusion index
4. Municipal human development index (HDI-M)
5. Authorized and unauthorized settlements
6. Expansion of urbanized area
7. High-rise buildings favoured
8. Reduction in vegetal cover
9. Water consumption
10. Sewage and rain water destination
11. Solid waste production
12. Solid waste disposal
13. Atmospheric emissions
14. Modal transport distribution
15. Motorization
16. Consumption of fuels
17. Electric energy transmission
18. Electric energy consumption
19. Radio transmissions
20. Mobile telephone use
21. Potentially polluting activities
22. Agrochemicals use
23. Occurrences harmful to fauna

State

1. Air quality
2. Acid rain
3. Surface and underground water quality
4. Quality of water supply
5. Water shortage
6. Areas at risk of flooding and landslides
7. Erosion and blockage areas
8. Polluted areas
9. Earthquakes and tremors
10. Noise pollution
11. Electromagnetic pollution
12. Visual pollution
13. Historic, environmental and archaeological patrimony conservation
14. Vegetal cover
15. Urban arborisation
16. Urban species diversity
17. Conservation units and related areas
18. Recreation areas accessibility
19. Synanthropic fauna and untamed domestic animals.

Response

1. Municipal master plan
2. Legislation to protect springs
3. Local Agenda 21
4. Environmental education
5. Environmental non-governmental organizations
6. Environmental taxation
7. Atmospheric emissions control
8. Control of emissions from noise sources
9. Control of dangerous cargo circulation
10. Control of vectors, synanthropic fauna and untamed animals
11. Household harmony
12. Recovering areas at risk of flooding and blockages
13. Recovering erosion and landslides areas
14. Rehabilitating degraded areas
15. Investment in water and drainage
16. Investment in solid waste management
17. Recovering recyclable materials from solid waste
18. Investment in public transport
19. Increasing vegetal cover
20. Creating and managing conservation units
21. Rehabilitating and freeing wild animals
22. Fines for infringing environmental norms

Impact

1. Incidence of diseases associated with air pollution
2. Deaths from diseases associated with air pollution
3. Incidence of water-borne diseases
4. Deaths from diseases associated with water pollution
5. Incidence of diseases transmitted by animals
6. Deaths from diseases transmitted by animals
7. Occurrences of floods and landslides
8. Health risks from polluted areas
9. Microclimate changes
10. Cost of water collection, piping and treatment
11. Groundwater level overflow
12. Public health costs of air pollution diseases
13. Public health costs of water-borne diseases
14. Public health costs due to diseases transmitted by animals
15. Costs of conserving and restoring historic, environment and archaeological patrimony
16. Property depreciation
17. Loss of urban attraction
18. Juvenile vulnerability index
19. Loss of biodiversity

Annex 6: List of participants at workshops on preparing GEO Cities methodology, version 3

Mexico City, 27-29 November 2001.
List of participants

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Annex 7: Impact strategy and communication activities

What is an impact strategy?

An impact strategy consists of steps taken to ensure the work done will result in real progress being made on key aspects or concerns. By definition it is proactive with respect to public policies where government or citizen priorities may change or undergo modifications. It is a dynamic process that identifies and anticipates desired changes in the IEA/GEO process, for example in GEO Cities.

Why?

In many cities/countries, IEA/GEO reports are a constitutional mandate; in others they are a voluntary government initiative and, in some cases, part of a broader central government monitoring and assessment programme.

In each of these cases it is important to know about any previous initiatives of the same type that may have failed, learn from the errors made and make suggestions for the report being prepared. Then the following questions must be kept in mind:

Why was the assessment made?

What happened to earlier assessments?

Who is participating in the assessment?

What relevant events are happening in the city/country?

When?

The impact strategy should be applied from the beginning of the IEA process (institutional arrangement) and undergo constant monitoring and assessment. The local coordinator, together with the local team, will be responsible for applying this impact strategy.

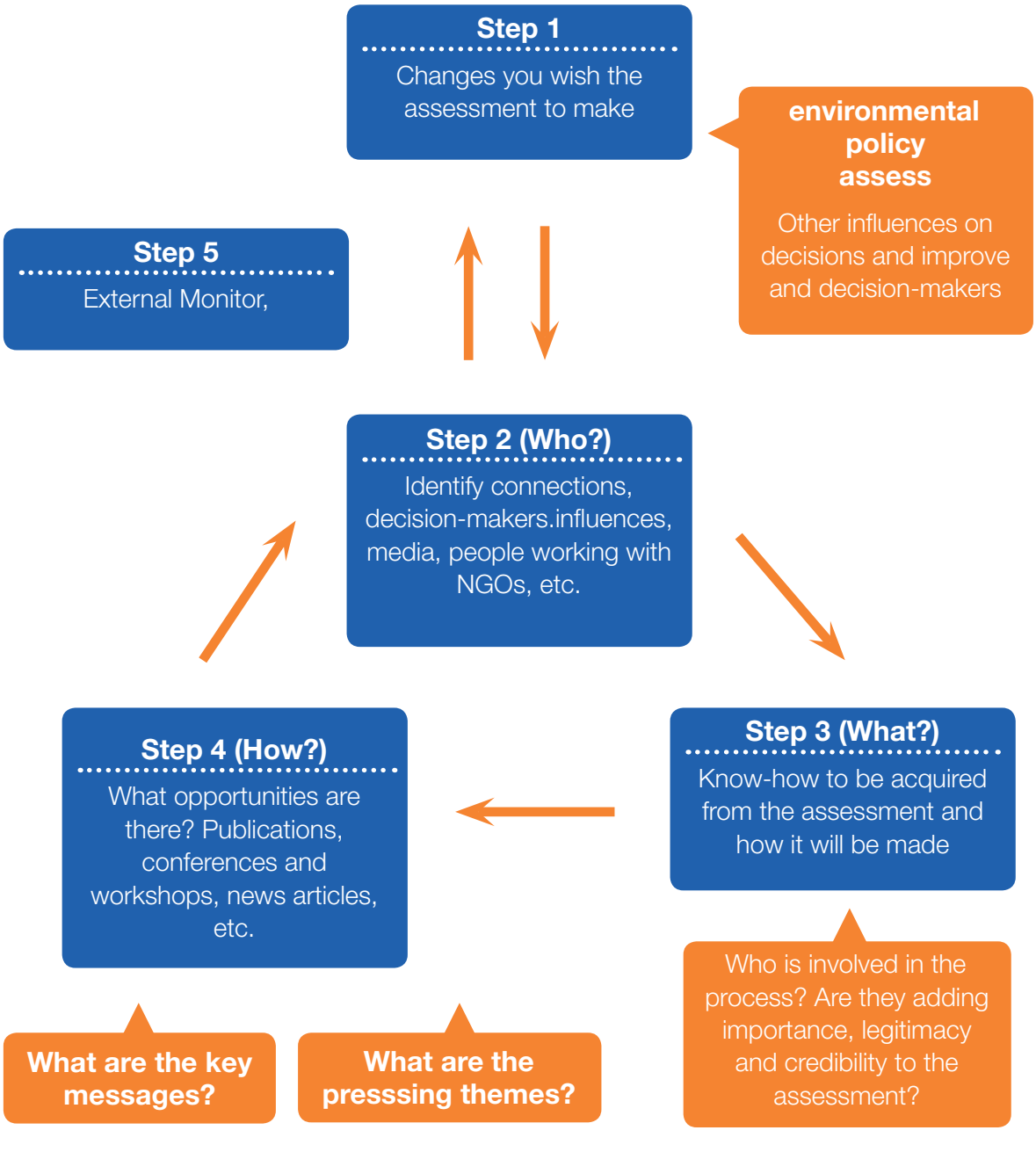
Difference between impact strategy and communication activities

	Impact strategy	Communication activities
Purpose	It is meant to cause change and identify its role as an agent for change	To ensure people understand the findings and recommendations
Audience	Small group of key stakeholders and those who have access to other stakeholders	Mass audiences
Period	Developed at the beginning of the assessment process, and then monitored and adjusted as it progresses	As it is part of an impact strategy, it is usually implemented almost at the end of the strategy when findings and recommendations are known

Steps in an impact strategy

There are five main steps in preparing an impact strategy, as can be seen in the following figure:

1. Creating a premise for change. What should be the assessment's impact?
2. Managing relationships. Identify key stakeholders you wish to influence and look for opportunities to contact them.
3. Managing knowledge. Collect and analyse information for the assessment.
4. Managing opportunities. Make this knowledge available to those who need to be influenced.
5. Monitoring and improving. Determine whether the impact strategy is working and adjust if necessary.



Target groups

As a part of communication activities target groups must be defined, key stakeholders who have to be influenced and who receive key messages from the GEO process. In this respect, it is suggested that you:

- Differentiate between users of information and those who transmit it
- Prepare specific messages for each group
- Analyse the audience's characteristics
- Consider its reach and credibility. Those who transmit messages should also be considered in this analysis. Are you the person best suited to reach a certain target group?
- Consider spokespersons

Examples of other more common target groups:

- Government planners
- Politicians
- Researchers and analysts
- Non-governmental organizations (NGOs)
- General Public
- Schools and universities
- Industry and business
- Indigenous groups
- Media

Communication effectiveness and efficiency

In this respect, in the communication and subsequent impact process, a difference must be made between the concepts of effectiveness and efficiency.

Effectiveness of communication: The messages should be received by the target audience, correctly interpreted, remembered for a long time, and should trigger appropriate action.

Efficiency of communication: This obeys the concept of reaching the maximum number of people per unit cost.

In short:

Communication = Significance + Number

Communication activities

The following activities are suggested:

Printed:	Electronic/digital products
• Report • Executive summary • Periodic reports n key themes • Bulletins • Newspapers • Posters • Calendars • Atlas	• Internet • CD-ROM • Web site **Presentations** • Visual and verbal (graphs, videos, music)

Attention cycles

When preparing and implementing the impact strategy and communication activities, it is important to be aware of the attention cycles of the most pressing themes and, of course, touched upon in the GEO report. The levels of attention will encourage stakeholders to take part in the initiatives proposed. Knowing that the process is under the public radar will also help to pinpoint where the report will be useful by providing new information and recommendations on action.

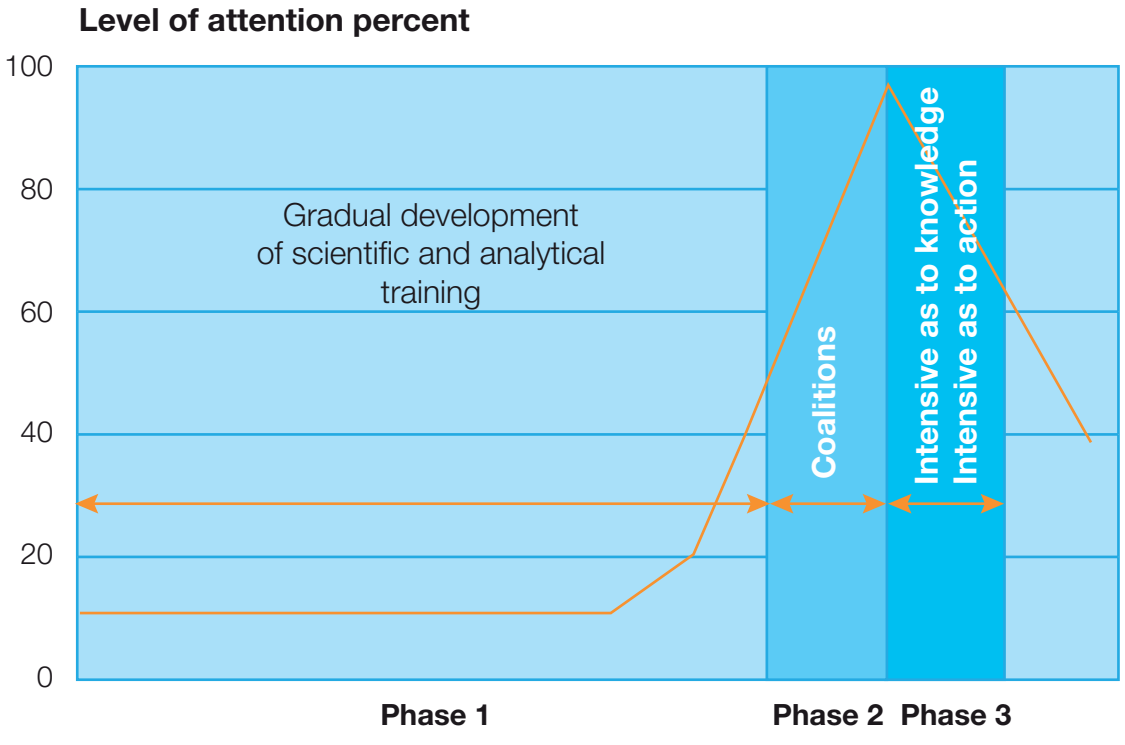
The bibliography shows there are three important phases of public attention paid to different themes, and the environment is no exception:

Phase 1. During the first phase, before the theme attracts much public attention, the principal functional change is the gradual increase in scientific and analytical capacity through research, monitoring and making assessments. After an extended period, characterized by relatively low public attention, there is a gradual increase in some institutions in society's capacity to confront new themes, mostly because of historic circumstances and as to how the theme is perceived. During this period of low attention, it is improbable that new institutions will become involved and participate.

Phase 2. The following period, marking the second phase, is a rapid increase in public attention. During this time of public and political attention, there will be a new definition of leadership in the institutions already part of the movement and new institutions will need to be added. Iin this phase of a particular theme's evolution, it is important to recognize the need to form coalitions and, by working together, to provide an impetus. These coalitions are the basis on which a common understanding of the problem can be reached, as well as how it might be solved. Effective management of emerging themes will be an incentive to form coalitions instead of simply promoting participation by individuals or isolated groups of stakeholders.

Phase 3. A third phase of interactions is associated with the period when public attention is at its peak and continues through the consequent decline in attention. During this period, connections between "awareness intensive" and "action intensive" management functions become more frequent and often go in the two directions of: knowledge causes action; and action leads to knowledge.

The following figure summarizes the attention cycle:



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