

11/4/2011



THE
DEPARTMENT OF
ENVIRONMENTAL
AFFAIRS

ENVIRONMENTAL IMPACT
ASSESSMENT AND MANAGEMENT
STRATEGY

SUBTHEME 2: Knowledge and information:

DEA: Madeleine Oosthuizen, Chantal Matthys, Wayne Hector

SSI: Gillian Maree



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

TABLE OF CONTENTS

1	SUBTHEME 2: KNOWLEDGE AND INFORMATION	1
1.1	PROBLEM STATEMENT	1
1.2	OBJECTIVE OF SUBTHEME 2	1
1.3	GOALS	1
2	BACKGROUND	2
3	PROJECT METHODOLOGY	3
3.1	LEGISLATION	6
3.2	WHAT IS KNOWLEDGE AND INFORMATION FOR INTEGRATED ENVIRONMENTAL MANAGEMENT?	7
3.3	KNOWLEDGE SHARING	9
4	STATUS QUO	11
4.1	INFORMATION MANAGEMENT AND AGENDA 21	11
4.2	WHAT IS THE INFORMATION NEEDED FOR?	17
4.3	UNDERSTANDING HOW INFORMATION IS CURRENTLY USED AND DEPLOYED	18
4.4	DECISION SUPPORT SYSTEMS FOR EIA AUTHORITIES	19
4.5	THE DIFFERENCE BETWEEN PRIMARY AND SECONDARY DATA	20
5	ACCESS TO INFORMATION	22
6	GEOGRAPHIC INFORMATION SYSTEMS (GIS)	26
6.1	BACKGROUND	26
6.2	THE SPATIAL DATA INFRASTRUCTURE (SDI) ACT	27
6.3	THE FUNCTION OF GIS IN DEA	29
6.4	GIS DATA CAPTURE AND STANDARDS	30
6.5	GIS SYSTEMS	30
7	SUMMARY OF SPATIAL DATA TYPES	33
7.1	NATIONAL DATA SETS	33
7.2	PROVINCIAL DATA SETS	35
7.3	INTERNATIONAL DATA SETS	36
7.4	DATA DISSEMINATION	37
7.5	CASE STUDY: BIODIVERSITY GEOGRAPHIC INFORMATION SYSTEM (BGIS)	37
7.6	GIS ISSUES	40
8	ANALYSIS	41
8.1	PROBLEM IDENTIFICATION	41
8.2	PROBLEMS EXPERIENCED WITHIN THE EIA PROCESS	44
8.3	ISSUES ARISING FROM STRATEGIC PLANNING TOOLS	48

9	SYNTHESIS	49
9.1	STRATEGY STATEMENTS/ PRINCIPLES	51
10	PROPOSALS	53
11	RISKS	62
11.1	LIMITED COLLABORATION FOR INFORMATION AND DATA SHARING	62
11.2	WITHOUT A FORMAL INFORMATION SHARING NETWORK IT MAY BE IMPOSSIBLE TO FUNCTION	63
11.3	DIFFICULTY IN ACCESSING DATA AND INFORMATION	63
12	REFERENCES	65

List of Figures

Figure 1:	The Mandate and scope for information management as set out in NEMA	6
Figure 2:	Relationship between knowledge and information (from Ackoff, 1989)	8
Figure 3:	Simplified process for using information in Decision making (after Hari Srinivas, http://www.gdrc.org/decision/info-decision.html)	18
Figure 4:	EIA process for South Africa	19
Figure 5:	The four states of information possession (after Hari Srinivas, http://www.gdrc.org/decision/info-decision.html)	42
Figure 6:	Integrated Environmental Management Concept	53

List of Tables

Table 1:	Focus areas for Subtheme 2	5
Table 2:	Overview of nationally available data sets	33
Table 3:	Typical types of information requested at a provincial and project scale	35
Table 4:	Examples of International data sets	36

Appendices

Appendix A: Available Core Data sets

List of acronyms

DEA	Department Of Environmental Affairs
EAPS	Environmental Assessment Practitioners
ECA	Environmental Conservation Act
EIA	Environmental Impact Assessment
EIAMS	Environmental Impact Assessment Management Strategy
EMF	Environmental Management Framework
GIS	Geographic Information System
GPS	Global Positioning System
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
NEAS	National Environmental Assessment System
NEM:BA	National Environmental Management: Biodiversity Act
NEMA	National Environmental Management Act
NGO	Non Governmental Organisation
RoD	Record of Decision
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SDI	Spatial Data Infrastructure

SEA Strategic Environmental Assessment

SUBTHEME 2: KNOWLEDGE AND INFORMATION

1 SUBTHEME 2: KNOWLEDGE AND INFORMATION

1.1 PROBLEM STATEMENT

The problem statement on Subtheme 2: Knowledge and Information was compiled by the Project Steering Committee as:

Ineffective/insufficient knowledge and information management/ dissemination. The competent authorities are also not adequately capacitated in terms of resources e.g. systems, operational procedures, finances, hardware, knowledge management (institutional memory)

1.2 OBJECTIVE OF SUBTHEME 2

The objective of Subtheme 2 is to ensure that information is effectively managed and disseminated, that data is efficiently stored and is readily accessible, and that knowledge is advanced. Secondly, to ensure that Competent Authorities are adequately capacitated in terms of resources, skills and competence for effective information and knowledge management.

The Strategy will be developed within the context of existing legislation, policies, NEMA, plans including National, Provincial, and Local Integrated Development plans. The Strategy will need to respond to the current legislative context but should also influence it.

1.3 GOALS

The project has four goals:

Goal 1: To ensure that knowledge and information are effectively managed and stored

Goal 2: To ensure that knowledge and information are effectively disseminated

Goal 3: To ensure that authorities are adequately capacitated in terms of resources in this process

Goal 4: To ensure that authorities are adequately capacitated in terms of skills and competence in this process

2 BACKGROUND

At the “Ten Years of EIA in South Africa Conference” (2008) it was agreed that an Environmental Impact Assessment and Management Strategy (EIAMS) should be formulated for SA. The strategy should facilitate a participatory process that, in the context of the objectives of integrated environmental management contained in Section 23 of NEMA and the principles of sustainable development of Section 2 of NEMA, revises the environmental management scheme in a systematic and rigorous manner. The sub- directorate: Environmental Impact Management Strategy at the Department of Environmental Affairs (DEA) has been tasked with the development and promotion of this comprehensive strategy to manage the environmental impacts of development in South Africa

The DEA therefore conceived a project that has to look at the desired future state for the EIAMS and path the way to achieve it within the mandate provided by Chapter 5 of NEMA and within a strategic policy context. The desired future includes an environmental impact assessment and management system, that consists of voluntary and regulated instruments in the next 5 years, where –

- the inefficiencies and ineffectiveness of the current system have been corrected and the efficiencies and effectiveness optimized;
- regulated EIA is used only when it is the most appropriate tool;
- Integrated Environmental Management (IEM) is given effect through a variety of other instruments that would, depending on the nature of activities and/or the receiving environment supplement, compliment or replace EIA;
- EIAM takes place within a strategic context of environmentally informed spatial instruments, sector strategies and policies;
- authorities are sufficiently capacitated with skilled and experienced officials;
- other stakeholders are capacitated and empowered to ensure maximum impact on the effectiveness and efficiency of the strategy;

- government regulatory processes have been as far as possible integrated, or at least aligned; and
- all stakeholders are equally committed to make it work: Government, EAPs, developers, community etc.

The project was conceived as a conglomerate of smaller tasks and studies, arranged around specific themes. Within this context, the DEA appointed SSI Engineers & Environmental Consultants to assist the Department with specialist studies in relation to the development of the national EIAMS. This specific specialist report relates to the compilation of a specialist report on EIMS Specialist Report: Subtheme 2 - Knowledge and Information under the Theme: Governance and Administration.

Timely availability of reliable geo-referenced land, climate, plant nutrients, production and water information, integrated with infrastructural- and socio-economic factors, are essential for stakeholders, policy makers and land users to exercise the best choices among options in using these resources to achieve sustainable levels of food production and development in an increasingly complex environment.

The need for and access to spatial information in South Africa for use in decision making and development planning is a topical issue and inevitably leads to discussions on uncoordinated effort, a lack of funding and expertise and the unavailability of good quality, standardised data.

3 PROJECT METHODOLOGY

The research for the Subtheme 2 report addresses 10 distinct steps or issues, as detailed in

Table 1 below. During the course of the investigations, cross-referencing with other sub-theme specialist investigations will take place.

TABLE 1: FOCUS AREAS FOR SUBTHEME 2

Key Focus	Description
1 Goals & Objectives	Compile goals and objectives.
2 Existing information management	Investigate and report on existing information management and - dissemination procedures, as they apply to each stakeholder (including decision makers, I&APs, commenting authorities, EAPs, EMIs and Environmental Practitioners) within existing organisational structures and procedures identified in Subtheme 1.
3 Problems	Identify existing problem areas with availability of information to decision makers, I&APs, commenting authorities, EMIs and Environmental Practitioners by amongst other interviewing/e-mail/internet based mechanisms on how information is made available to I&AP's, EAP's and officials. Report on the accuracy of information, the delivery mechanisms concentrating on where the process fails to make information readably available to parties.
4 Inefficiencies	Assess the availability of information at decision maker's offices in order to assist in identifying points of ineffective information dissemination.
5 Alternatives	Investigate alternative methods of making information available to decision makers, commenting authorities, I&AP, EMIs, Environmental Practitioners and EAP's.
6 Alignment	Propose alignment of Knowledge and Information Management Systems, procedures and locations within proposed structures and procedures as proposed in subtheme 1.
7 Capacity audit	Assess capacity of EIA decision makers in terms of financial resources and hardware, software and skill to ensure appropriate and effective knowledge management. Include an assessment of the resources available through technical services – intranet, servers, database administrators, etc.
8 Recommendations	Propose solutions to problems identified.
9 Mechanisms	Propose a platform for knowledge management and dissemination considering data collating projects such as GBIF and SABIF under SANBI and how processes integrate and data sharing occurs. Propose mechanisms to ensure greater integration of data and verification of data. Identify mechanism to provide information about post-decision follow-up, auditing and compliance monitoring.
10 Obstacles	Identify problem areas which may prevent implementation and propose solutions to problems identified

3.1 LEGISLATION

The Department of Environmental Affairs (DEA) mandate for information lies within NEMA Chapter 5. The need for information and the types of questions to be answered are directed by Chapter 5 of NEMA.

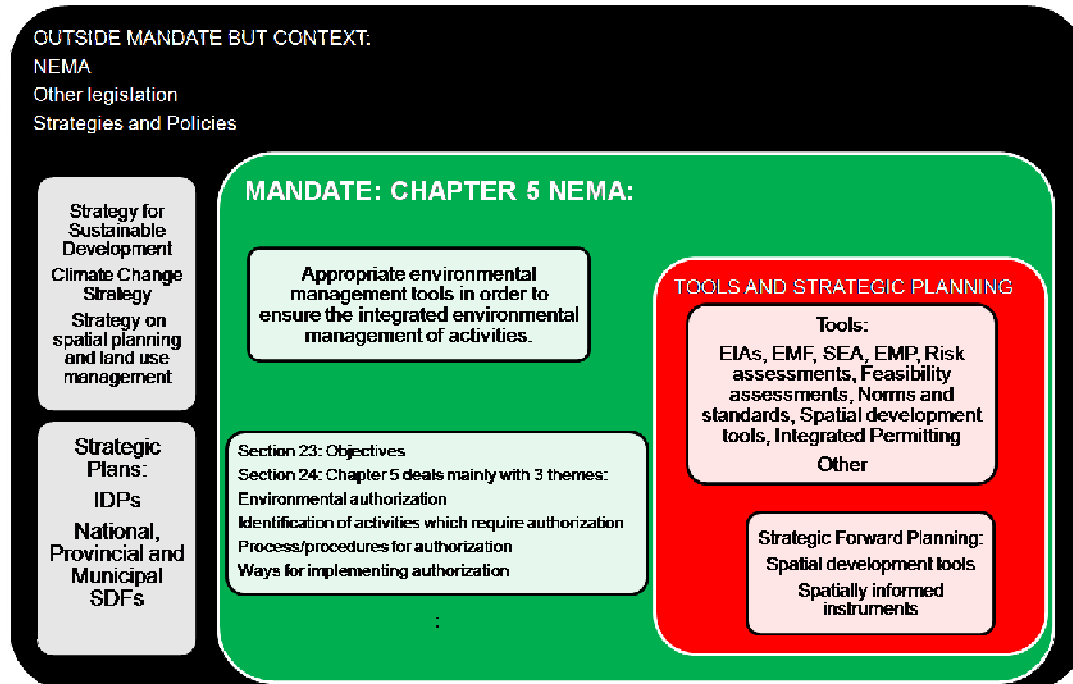


FIGURE 1: THE MANDATE AND SCOPE FOR INFORMATION MANAGEMENT AS SET OUT IN NEMA

The DEA information systems to consult and consider include the NEAS, EIA GIS and DEA GIS.

Chapter 5 of NEMA clearly articulates that DEA's responsibility for information management (linked to the environmental tools) is broad and covers the spectrum of environmental tools. In this regard, DEA is likely to become custodian of a range of data sets, including managing information on environmental decisions made within the scope of the EIA process. Spatially explicit decision support systems are becoming increasingly important as it allows users to understand the connections and cumulative effects between projects, as well as gather a deeper understanding of activities and environmental impacts within ecological units.

Decisions around data custodianship become more involved and should be linked to departmental requirements (in terms of legislation) and policy directives. Only when a departmental vision and objectives for information management are set can decisions be taken on who is responsible for what data. This requires both vertical and horizontal coordination across government departments to ensure alignment of resources and data collection and management.

3.2 WHAT IS KNOWLEDGE AND INFORMATION FOR INTEGRATED ENVIRONMENTAL MANAGEMENT?

The underlying assumption in decision making is that access to good information will lead to better decisions and management practices, which will eventually lead to a more sustainable management and use of natural resources as well as improved quality of life of people.

The management of environment information involves a number of processes and outputs. The processes include collection, organisation, analysis and communication of data and statistics, including spatial information. The production of new or extrapolated environmental information entails the collection and analysis of raw data, and interpretation into forms that can be used for decision making. Outputs are packaged in a number of formats including the legislated looks like environmental impact assessments (EIAs), and the production of state of the environment reports, environmental outlook reports, statistical reports, environmental atlases and policy statements. These are produced by a large range of stakeholders and role players including government, parastatals, research organisations and the private stakeholders.

Decision makers use the information generated, along with their own learning and experience to assess the condition and trends in the environment (knowledge), to determine and adjust policy directions and to decide where best to invest resources for the management of the environment. Environmental information management is essential for decision makers to access appropriate information, analyse cause and effect, develop strategies for action, manage natural resources, prevent and control pollution, and evaluate progress towards environmental goals and targets.

The critical link between environmental information management and good decision making was recognized and formalized internationally in 1992 under Principle 10 of the Rio Declaration on Environment and Development which in part states:

“Environmental issues are best handled with the participation of all concerned citizens [...]. At the national level, each individual shall have appropriate access to information concerning the environment [...] and the opportunity to participate in decision making processes [...] Effective access to judicial and administrative proceedings [...] shall be provided.” (UNEP 1992).

It is important to define what is meant by knowledge and information, and what the role and relationship of each is to IEM. In general, the definitions of information tend to be more uniform and less complex than the definitions of knowledge, where information is commonly defined as: organized data; data endowed with relevance and purpose; interpreted data (e.g. Drucker, 2001). Knowledge is the application of data and information and seeks to answer the "how" questions.

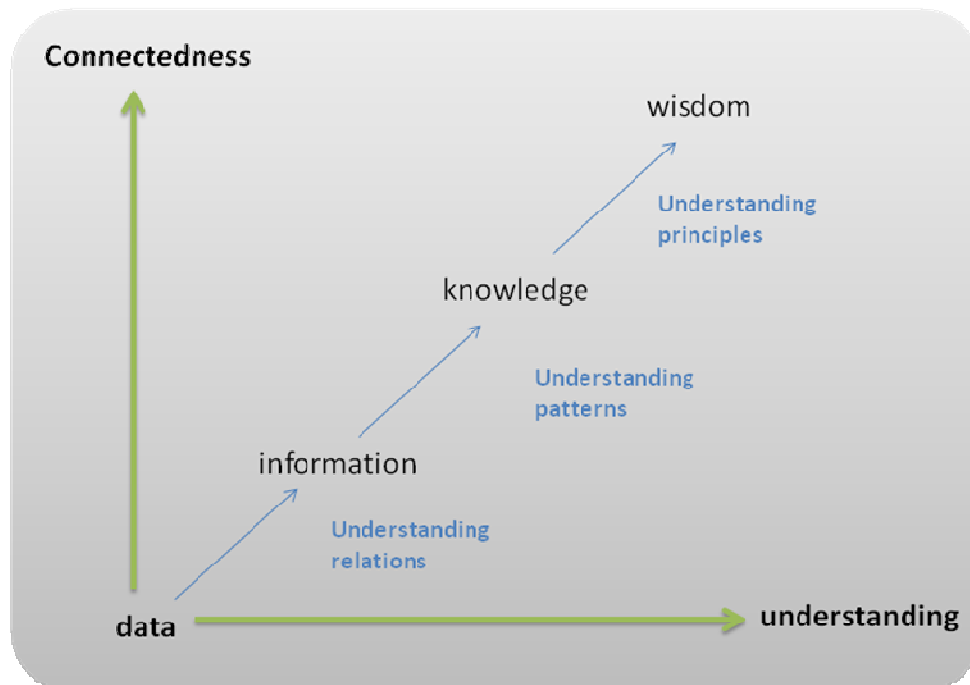


FIGURE 2: RELATIONSHIP BETWEEN KNOWLEDGE AND INFORMATION (FROM ACKOFF, 1989)

Figure 2 shows that we don't always incorporate all the information we have into decision making. The context in which information is generated, cultural differences or communication difficulties can mean that the information may not be used, or misinterpreted by decision makers. This lack of a shared understanding can create gap between information and how the knowledge is interpreted and applied to environmental problems.

Decision makers are often criticized for the decisions that they make; whether they seem to misinterpret the information, ignore information available to them or not consider what is seen to be vital information. However, it can be difficult to make a decision when faced with information overload, they may distrust the information sources, not be able to effectively articulate their information needs (due to different scales of work) or even be faced by contradictory information (van Wyk, Drackner and Roux, 2008). This is often true of the Environmental Impact Assessment Process where government officials within the Competent Authorities are often faced with having to decide on whether a development may proceed, what conditions to place with the Record of Decision and often with political pressure as well. This can make decision making difficult, particularly when faced with thick volumes of reports of information.

For Integrated Environmental Management it is also useful to differentiate between two dimensions of knowledge, depth and breadth of knowledge (Roux et al, 2006). Depth of knowledge refers to the in-depth knowledge and learning that an expert would have of their particular field of study, for example, a PhD in inorganic chemistry would be one indicator of a great depth of knowledge of a particular field. Breadth of knowledge refers to knowledge across a broad range and diversity of areas and includes the ability to relate different specialist areas to each other. Often, breadth of knowledge within the environmental field comes with experience and learning on the job. A good breadth of knowledge will enable an organisation to respond effectively to a variety of situations and changing circumstances (Roux et al, 2006). Knowledge within IEM requires skills that relate to both depth and breadth of knowledge.

3.3 KNOWLEDGE SHARING

Knowledge sharing refers to the behaviour of a person who *voluntarily* provides other people or organisations with access to their unique knowledge and/or experience (Hansen and Avital, 2005). *Knowledge hoarding* is the opposite of knowledge sharing and refers to the behaviour by which a person or organisation limits or prohibits access to knowledge. Two main drives for knowledge hoarding have been identified and are strongly influenced by organisational culture and structures:

1. Individuals hoard information out of fear that sharing it might reduce their personal value or influence (knowledge is power). This is true for organisations as well.
2. Knowledge is hoarded to avoid the costs (time and effort) of sharing.

Here it is also important to distinguish between sharing of tacit and explicit forms of knowledge. Explicit knowledge refers to knowledge that can be written down or physically recorded (e.g. record of best practice). Tacit knowledge refers to knowledge that is transferred by interactions between people (e.g. through mentoring).

In situations where knowledge is withheld in order to retain control and power over information or knowledge it can negatively affect integrated decision making. Dynamics between people and personality dynamics can affect sharing or hoarding processes as well as the culture within an organisation. People play an important role in the ability and willingness to share information, experiences (both good and bad) and can enable, or disable effective environmental decision making.

It is equally difficult to know or evaluate if the correct or best decision has been made if all available and relevant information is not shared or made available. The EIA process is one example of where there may be a tendency of only wanting to make information available that is favourable to the decision.

It is acknowledged that in a small number of situations public access to information can result in environmental loss or risk. In these cases availability of information may need to be controlled, however the balance must remain in favour of the responsible release of information and any restrictions should be fully justified and defensible.

4 STATUS QUO

4.1 INFORMATION MANAGEMENT AND AGENDA 21

Agenda 21 recognizes that "*there already exists a wealth of data information that could be used for the management of sustainable development. Finding the appropriate information at the required time and at the relevant scale is a difficult task.*"

Agenda 21: Chapter 40

Information for Decision making

INFORMATION FOR DECISION-MAKING

40.1. In sustainable development, everyone is a user and provider of information considered in the broad sense. That includes data, information, appropriately packaged experience and knowledge. The need for information arises at all levels, from that of senior decision makers at the national and international levels to the grass-roots and individual levels. The following two programme areas need to be implemented to ensure that decisions are based increasingly on sound information:

- Bridging the data gap;
- Improving information availability.

PROGRAMME AREAS

A. Bridging the data gap

Basis for action

40.2. While considerable data already exist, as the various sectoral chapters of Agenda 21 indicate, more and different types of data need to be collected, at the local, provincial, national and international levels, indicating the status and trends of the planet's ecosystem, natural resource, pollution and socio-economic variables. The gap in the availability, quality, coherence, standardization and accessibility of data between the developed and the developing world has been increasing, seriously impairing the capacities of countries to make informed decisions concerning environment and development.

40.3. There is a general lack of capacity, particularly in developing countries, and in many areas at the international level, for the collection and assessment of data, for their transformation into useful information and for their dissemination. There is also need for improved coordination among environmental, demographic, social and developmental data and information activities.

40.4. Commonly used indicators such as the gross national product (GNP) and measurements of individual resource or pollution flows do not provide adequate indications of sustainability. Methods for assessing interactions between

different sectoral environmental, demographic, social and developmental parameters are not sufficiently developed or applied. Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems.

Objectives

40.5. The following objectives are important:

To achieve more cost-effective and relevant data collection and assessment by better identification of users, in both the public and private sectors, and of their information needs at the local, provincial, national and international levels;

To strengthen local, provincial, national and international capacity to collect and use multisectoral information in decision-making processes and to enhance capacities to collect and analyse data and information for decision-making, particularly in developing countries;

To develop or strengthen local, provincial, national and international means of ensuring that planning for sustainable development in all sectors is based on timely, reliable and usable information;

To make relevant information accessible in the form and at the time required to facilitate its use. Activities

Development of indicators of sustainable development

40.6. Countries at the national level and international governmental and non-governmental organizations at the international level should develop the concept of indicators of sustainable development in order to identify such indicators. In order to promote the increasing use of some of those indicators in satellite accounts, and eventually in national accounts, the development of indicators needs to be pursued by the Statistical Office of the United Nations Secretariat, as it draws upon evolving experience in this regard.

Promotion of global use of indicators of sustainable development

40.7. Relevant organs and organizations of the United Nations system, in cooperation with other international governmental, intergovernmental and non-governmental organizations, should use a suitable set of sustainable development indicators and indicators related to areas outside of national jurisdiction, such as the high seas, the upper atmosphere and outer space. The organs and organizations of the United Nations system, in coordination with other relevant international organizations, could provide recommendations for harmonized development of indicators at the national, regional and global levels, and for incorporation of a suitable set of these indicators in common, regularly updated, and widely accessible reports and databases, for use at the international level, subject to national sovereignty considerations.

Improvement of data collection and use

40.8. Countries and, upon request, international organizations should carry out inventories of environmental, resource and developmental data, based on national/global priorities for the management of sustainable development. They should determine the gaps and organize activities to fill those gaps. Within the organs and organizations of the United Nations system and relevant international organizations, data-collection activities, including those of Earthwatch and World Weather Watch, need to be strengthened, especially in the areas of urban air, freshwater, land resources

(including forests and rangelands), desertification, other habitats, soil degradation, biodiversity, the high seas and the upper atmosphere. Countries and international organizations should make use of new techniques of data collection, including satellite-based remote sensing. In addition to the strengthening of existing development-related data collection, special attention needs to be paid to such areas as demographic factors, urbanization, poverty, health and rights of access to resources, as well as special groups, including women, indigenous peoples, youth, children and the disabled, and their relationships with environment issues.

Improvement of methods of data assessment and analysis

40.9. Relevant international organizations should develop practical recommendations for coordinated, harmonized collection and assessment of data at the national and international levels. National and international data and information centres should set up continuous and accurate data-collection systems and make use of geographic information systems, expert systems, models and a variety of other techniques for the assessment and analysis of data. These steps will be particularly relevant, as large quantities of data from satellite sources will need to be processed in the future. Developed countries and international organizations, as well as the private sector, should cooperate, in particular with developing countries, upon request, to facilitate their acquiring these technologies and this know-how.

Establishment of a comprehensive information framework

40.10. Governments should consider undertaking the necessary institutional changes at the national level to achieve the integration of environmental and developmental information. At the international level, environmental assessment activities need to be strengthened and coordinated with efforts to assess development trends.

Strengthening of the capacity for traditional information

40.11. Countries, with the cooperation of international organizations, should establish supporting mechanisms to provide local communities and resource users with the information and know-how they need to manage their environment and resources sustainably, applying traditional and indigenous knowledge and approaches when appropriate. This is particularly relevant for rural and urban populations and indigenous, women's and youth groups.

Means of implementation

Financing and cost evaluation

40.12. The secretariat of the Conference has estimated the average total annual cost (1993-2000) of implementing the activities of this programme to be about \$1.9 billion from the international community on grant or concessional terms. These are indicative and order-of-magnitude estimates only and have not been reviewed by Governments. Actual costs and financial terms, including any that are non-concessional, will depend upon, inter alia, the specific strategies and programmes Governments decide upon for implementation.

(b) Institutional means

40.13. Institutional capacity to integrate environment and development and to develop relevant indicators is lacking at both the national and international levels. Existing institutions and programmes such as the Global Environmental

Monitoring System (GEMS) and the Global Resource Information Database (GRID) within UNEP and different entities within the systemwide Earthwatch will need to be considerably strengthened. Earthwatch has been an essential element for environment-related data. While programmes related to development data exist in a number of agencies, there is insufficient coordination between them. The activities related to development data of agencies and institutions of the United Nations system should be more effectively coordinated, perhaps through an equivalent and complementary "Development Watch", which with the existing Earthwatch should be coordinated through an appropriate office within the United Nations to ensure the full integration of environment and development concerns.

Scientific and technological means

40.14. Regarding transfer of technology, with the rapid evolution of data-collection and information technologies it is necessary to develop guidelines and mechanisms for the rapid and continuous transfer of those technologies, particularly to developing countries, in conformity with chapter 34 (Transfer of environmentally sound technology, cooperation and capacity-building), and for the training of personnel in their utilization.

Human resource development

40.15. International cooperation for training in all areas and at all levels will be required, particularly in developing countries. That training will have to include technical training of those involved in data collection, assessment and transformation, as well as assistance to decision makers concerning how to use such information.

Capacity-building

40.16. All countries, particularly developing countries, with the support of international cooperation, should strengthen their capacity to collect, store, organize, assess and use data in decision-making more effectively.

B. Improving availability of information

Basis for action

40.17. There already exists a wealth of data and information that could be used for the management of sustainable development. Finding the appropriate information at the required time and at the relevant scale of aggregation is a difficult task.

40.18. Information within many countries is not adequately managed, because of shortages of financial resources and trained manpower, lack of awareness of the value and availability of such information and other immediate or pressing problems, especially in developing countries. Even where information is available, it may not be easily accessible, either because of the lack of technology for effective access or because of associated costs, especially for information held outside the country and available commercially.

Objectives

40.19. Existing national and international mechanisms of information processing and exchange, and of related technical assistance, should be strengthened to ensure effective and equitable availability of information generated at the local, provincial, national and international levels, subject to national sovereignty and relevant intellectual property

rights.

40.20. National capacities should be strengthened, as should capacities within Governments, non-governmental organizations and the private sector, in information handling and communication, particularly within developing countries.

40.21. Full participation of, in particular, developing countries should be ensured in any international scheme under the organs and organizations of the United Nations system for the collection, analysis and use of data and information.

Activities

Production of information usable for decision-making

40.22. Countries and international organizations should review and strengthen information systems and services in sectors related to sustainable development, at the local, provincial, national and international levels. Special emphasis should be placed on the transformation of existing information into forms more useful for decision-making and on targeting information at different user groups. Mechanisms should be strengthened or established for transforming scientific and socio-economic assessments into information suitable for both planning and public information. Electronic and non-electronic formats should be used.

Establishment of standards and methods for handling information

40.23. Governments should consider supporting the efforts of governmental as well as non-governmental organizations to develop mechanisms for efficient and harmonized exchange of information at the local, national, provincial and international levels, including revision and establishment of data, access and dissemination formats, and communication interfaces.

Development of documentation about information

40.24. The organs and organizations of the United Nations system, as well as other governmental and non-governmental organizations, should document and share information about the sources of available information in their respective organizations. Existing programmes, such as those of the Advisory Committee for the Coordination of Information Systems (ACCIS) and the International Environmental Information System (INFOTERRA), should be reviewed and strengthened as required. Networking and coordinating mechanisms should be encouraged between the wide variety of other actors, including arrangements with non-governmental organizations for information sharing and donor activities for sharing information on sustainable development projects. The private sector should be encouraged to strengthen the mechanisms of sharing its experience and information on sustainable development.

Establishment and strengthening of electronic networking capabilities

40.25. Countries, international organizations, including organs and organizations of the United Nations system, and non-governmental organizations should exploit various initiatives for electronic links to support information sharing, to provide access to databases and other information sources, to facilitate communication for meeting broader objectives, such as the implementation of Agenda 21, to facilitate intergovernmental negotiations, to monitor conventions and efforts for sustainable development to transmit environmental alerts, and to transfer technical data. These

organizations should also facilitate the linkage of different electronic networks and the use of appropriate standards and communication protocols for the transparent interchange of electronic communications. Where necessary, new technology should be developed and its use encouraged to permit participation of those not served at present by existing infrastructure and methods. Mechanisms should also be established to carry out the necessary transfer of information to and from non-electronic systems to ensure the involvement of those not able to participate in this way.

Making use of commercial information sources

40.26. Countries and international organizations should consider undertaking surveys of information available in the private sector on sustainable development and of present dissemination arrangements to determine gaps and how those gaps could be filled by commercial or quasi-commercial activity, particularly activities in and/or involving developing countries where feasible. Whenever economic or other constraints on supplying and accessing information arise, particularly in developing countries, innovative schemes for subsidizing such information-related access or removing the non-economic constraints should be considered.

Means of implementation

Financing and cost evaluation

40.27. The secretariat of the Conference has estimated the average total annual cost (1993-2000) of implementing the activities of this programme to be about \$165 million from the international community on grant or concessional terms. These are indicative and order-of-magnitude estimates only and have not been reviewed by Governments. Actual costs and financial terms, including any that are non-concessional, will depend upon, inter alia, the specific strategies and programmes Governments decide upon for implementation.

Institutional means

40.28. The institutional implications of this programme concern mostly the strengthening of already existing institutions, as well as the strengthening of cooperation with non-governmental organizations, and need to be consistent with the overall decisions on institutions made by the United Nations Conference on Environment and Development.

Capacity-building

40.29. Developed countries and relevant international organizations should cooperate, in particular with developing countries, to expand their capacity to receive, store and retrieve, contribute, disseminate, use and provide appropriate public access to relevant environmental and developmental information, by providing technology and training to establish local information services and by supporting partnership and cooperative arrangements between countries and on the regional or subregional level.

Scientific and technological means

40.30. Developed countries and relevant international organizations should support research and development in hardware, software and other aspects of information technology, in particular in developing countries, appropriate to their operations, national needs and environmental contexts.

4.2 WHAT IS THE INFORMATION NEEDED FOR?

Within the IEM field there are a number of role players who need access to information to fulfil a number of purposes. Primarily though, it is to improve the quality of the outputs and decisions from environmental tools and policies.

Decision makers need to ensure that all relevant information has been considered, correctly interpreted and understood within the local context so that the best and most informed decisions can be made. There needs to be a level of assurance that recommendations to proceed or halt a project are adequately understood, within the ambit of the law and that local communities and stakeholders are informed.

Developers and land users need certainty around investments they may want to make and what the forward planning visions are for a particular area. They need to understand whether or not their developments and ambitions will fit within the development framework of the area. Equally, they need to know what the environmental impacts of their development may be, how this may be influenced by options and what the legislative requirements from them will be.

Environmental Assessment Practitioners (EAPs) need access to detailed information on projects undertaken for clients, or need to generate specialist information about the site in order to fully understand the implications and impacts of the project. Information used by EAPs within a EIA context often covers numerous specialist fields and in a great deal of detail. Information around local development plans, local government forward planning and other current projects also inform the outputs of EAPs work.

NGOs need to know that awareness was raised within local communities and that the impacts and consequences of the project are fully realised and planned for. NGOs often require access to detailed information that would assist with feedback on specific issues or concerns. For monitoring purposes, information on mitigation measures and time frames should be available.

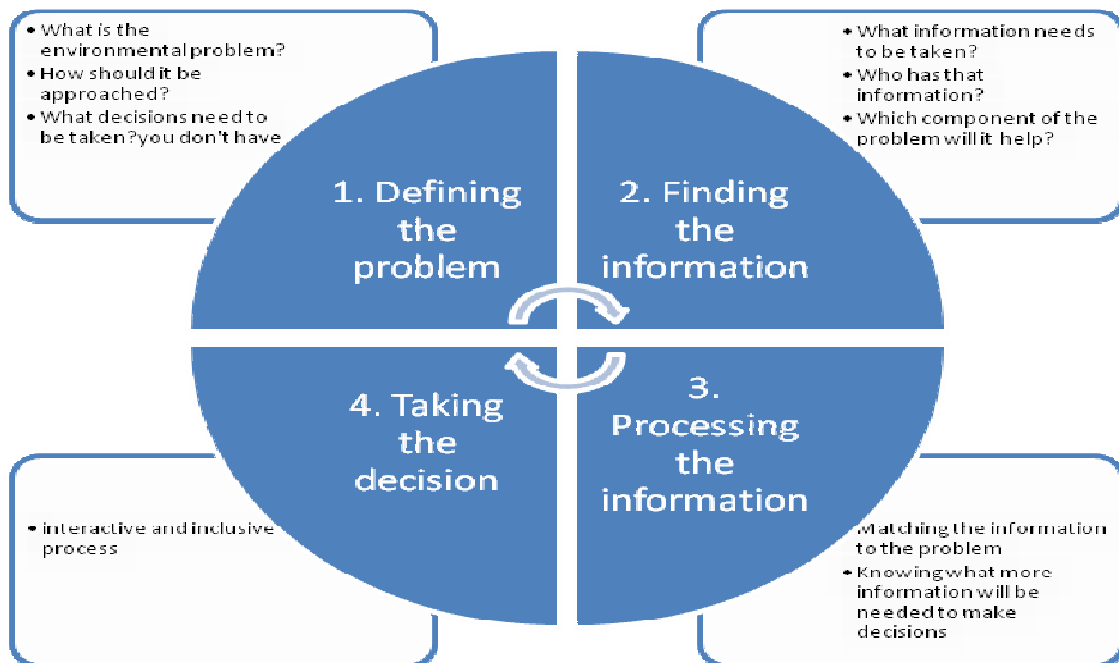


FIGURE 3: SIMPLIFIED PROCESS FOR USING INFORMATION IN DECISION MAKING (AFTER HARI SRINIVAS, [HTTP://WWW.GDRC.ORG/DECISION/INFO-DECISION.HTML](http://www.gdrc.org/decision/info-decision.html))

4.3 UNDERSTANDING HOW INFORMATION IS CURRENTLY USED AND DEPLOYED

The existing South African Procedure for an EIA serves as a basis to develop and understand how information and knowledge management flows work within this decision making process. The current EIA procedure is a good starting point as it is a comprehensive environmental assessment procedure and many other environmental management and/or licensing procedures follow similar processes.

Many of the current problems experienced with the EIA process cut across other environmental tools and the analysis in section 0 captures the cross cutting issues.

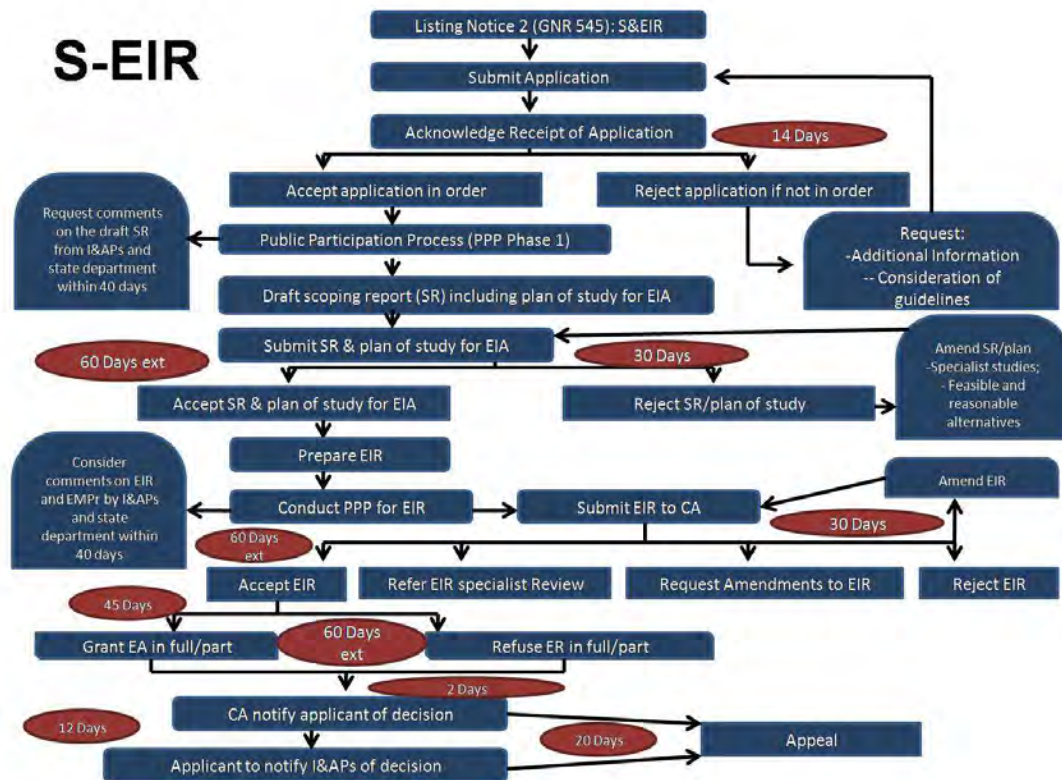


FIGURE 4: EIA PROCESS FOR SOUTH AFRICA

4.4 DECISION SUPPORT SYSTEMS FOR EIA AUTHORITIES

These are key elements in the whole EIA decision-making process. It has been proven over the years that any change to the biophysical, socio-economic or cultural- historic environment often triggers amendments to the legislation and in particular, environmental legislation. This necessitates the need to amend existing regulations, policies, guidelines, strategies and plans. South African environmental legislation has gone through a constant process of law reform, ever since it came into effect.

In light of the above, environmental authorities have no choice, but to develop new or re-design its existing decision support tools to be able to still effectively respond to these changes. However, although some tools may still be useful, its applicability might have changed.

The capacity audit and needs analysis survey revealed that some provincial EIA administrators are still operating in a vacuum of decision support systems and tools. This does not only impact significantly on the EIA regulatory timeframes, but also poses a serious threat to the quality of EIA

decisions. In many instances where decision support tools are absent, administrators are unable to timeously respond to submissions and the processing of applications is being delayed. EIA administrators are also unable to challenge certain submissions with factual data or information at its disposal, if there is no decision support system or tool that can be used to verify information submitted.

Following the workshop discussions, it is evident that the EIA administrator needs to expedite the development of an electronic tracking and database system, which will serve as a reporting tool for EIA administrators, but simultaneously also provide access to the applicant, EAP or public in general to monitor/follow the progress and status of applications submitted. The National Environmental Authorisation System ("NEAS"), which is currently in the process of being re-developed aims to do exactly that. Currently it serves as an electronic database, but other functionalities, such as application tracking, status and progress reporting, public portal and decision support (GIS) applications still needs to be finalised.

4.5 THE DIFFERENCE BETWEEN PRIMARY AND SECONDARY DATA

Data or information may be derived from many different sources and can be classified as primary or secondary data. Essentially, primary data is data gathered for the first time by the researcher; secondary data is data taken by the researcher from other or secondary sources, internal or external. Normally the cost of gathering secondary data is lower than the cost of primary data. A primary source is raw field data that has been collected or set of archival records. A secondary source is a summary of a book or set of records.

The first step before deciding whether primary data collection is necessary is to thoroughly search available secondary data sources before any primary data collection. In some cases, the secondary data may be sufficient to solve the problem. The value of secondary data is that it has several supplementary or other uses. The Internet is an example of a source of external secondary data. Many published, statistics and figures are available on the internet, although their accuracy or value is often debateable. In many cases, secondary data is collecting and possibly processing data by people other than the researcher in question.

In South African, the funds available for primary data collection are often limited, as is primary data collection. This makes our reliance on secondary data for IEMS high.

5 ACCESS TO INFORMATION

The right to access information is challenging particularly given the number of different user groups and needs. These include:

- Specialists who need detailed data. In addition, there are increasing reporting requirements on specialists which is making reporting more complex.
- Decision makers (government) needs support by selectively searching and finding trends in up to date data
- Other departments and users who need access to environmental data on an ad hoc basis
- The public has the right to up to date, accurate and trust worthy processed environmental information.

5.1.1 The South African Constitution

At the highest level the Constitution of South Africa (1996) within the bill of rights clearly states the right to access information:

32. Access to information

1. Everyone has the right of access to

- a) any information held by the state; and*
- b) any information that is held by another person and that is required for the exercise or protection of any rights.*

This duty to disclose information is important to protect the constitutional right to a safe environment. Access to information about the environment and the duty to disclose certain information about the environment are recognised tools for environmental protection both within NMEA and principal 10 of the Rio Declaration.

5.1.2 National Environmental Management Act and access to information

NEMA provides access to government held information about the environment and risks to the environment and gives powers to government to obtain environmental information. It allows the Minister of Environmental Affairs to draft regulations allowing for access to privately held information.

Section 31 of NEMA makes the following provisions for access to information:

- a) *every person is entitled to have access to information held by the State and organs of state which relates to the implementation of this Act and any other law affecting the environment, and to the state of the environment and actual and future threats to the environment, including any emissions to water, air or soil and the production, handling, transportation, treatment, storage and disposal of hazardous waste and substances;*
- b) *organs of state are entitled to have access to information relating to the state of the environment and actual and future threats to the environment, including any emissions to water, air or soil and the production, handling, transportation, treatment, storage and disposal of hazardous waste held by any person where that information is necessary to enable such organs of state to carry out their duties in terms of the provisions of this Act or any other law concerned with the protection of the environment or the use of natural resources;*
- c) *a request for information contemplated in paragraph (a) can be refused only:*
 - i) *if the request is manifestly unreasonable or formulated in too general a manner;*
 - ii) *if the public order or national security would be negatively affected by the supply of the information; or*
 - iii) *for the reasonable protection of commercially confidential information;*
 - iv) *if the granting of information endangers or further endangers the protection of the environment; and*
 - v) *for the reasonable protection of personal privacy.*

What the regulations do not do is define what is meant by *environmental information* or provide mechanisms for sharing and disclosure of the information. Ideally mechanisms are needed to respond to requests for information as well as making public information about the environment available. For example reports on the state of the environment, information about policies, plans and programmes that affect the environment, and information about environmental dangers or risks.

5.1.3 The Environmental Impact Assessment Regulations of 2010

The Environmental Impact Assessment Regulations of 2010 (Government Gazette No. 33306) clearly establishes the Competent Authorities right to access information (Section 7).

7. (1) A competent authority is entitled to all information that reasonably has or may have the potential of influencing any decision with regard to an application unless access to that information is protected by law.

(2) Unless access to the information contemplated in subregulation (1) is protected by law, an applicant or EAP or other person in possession of that information must, on request by the competent authority, disclose that information to the competent authority, whether or not such information is favourable to the applicant.

In addition withholding information to the competent authority is listed as an offence (section 71):

71, (1) In addition to section 24F of the Act, a person is guilty of an offence if that person --

(a) provides incorrect or misleading information in any document submitted in terms of these Regulations to a competent authority;

(b) fails to comply with regulation 7(2);

(c) fails to comply with a request in terms of regulation 69(2); or

(d) commences or continues with an activity where the environmental authorisation was suspended in terms of regulation 49.

(2) A person convicted of an offence in terms of subregulation (1) is liable to a fine not exceeding R1 million or to imprisonment for a period not exceeding one year, or to both such fine and such imprisonment.

Unfortunately, these regulations do not extend to the responsibility of government departments to supply information to other government departments, NGOs or EAPs. This can be particularly problematic where a government department maintains information databases critical to decision making but does not share it. In addition, the regulations do not deal with the rights of civil society

to access the information. In other words, the regulations are clear that EAPs are must supply information to government, but does not extend that responsibility to release all information to interested and affected parties (IAPS).

6 GEOGRAPHIC INFORMATION SYSTEMS (GIS)

6.1 BACKGROUND

The development and use of maps has changed a great deal over the last few decades and limited to a few generators of data and map makers. The rise of GIS (Geographical Information System) technology has changed how maps and data are generated, used and stored.

In the past, the collection and distribution of geographic information was highly centralised. The technical merit of the data was rarely challenged due to the heavy costs and technology associated with traditional mapping and to the long time-scales of mapping projects that often extended over several decades. Maps were not necessarily a consumer product, but were considered part of the national assets; data mainly used by the government, for defence, taxes, planning and development.

GIS technology has changed the way maps are generated, particularly with the development of desktop GIS. Usage and type of applications is now incredibly diverse. Nearly anyone can create their own maps, thanks to the use of desktop mapping, GIS, GPS surveying, satellite imagery, scanning and intelligent software.

However, the overall cost of developing geospatial data required to support GIS applications remains relatively high compared with the hardware and software required for GIS. This has an impact on the type and quality of data that is available, and importantly, on how, and to whom, that data is distributed.

Unfortunately, geospatial data sets have been poorly documented and there have been duplicate efforts in geospatial data development, which hinders dissemination of GIS applications in local, national, regional and global circumstances.

Today GIS is characterised by:

- many actors involved in data collection and distribution
- a proliferation of GI applications, product types, and formats (Google Earth is an example of a well used application)

- duplication as a consequence of the difficulties to access the existing data, and the highly specific quality of the data collected (e.g. data collected at a local project scale can be incompatible with nationally generated data layers)
- increasing difficulty in the exchange and use of data that comes from different organisations

6.2 THE SPATIAL DATA INFRASTRUCTURE (SDI) ACT

To address some of the above issues in South Africa the SDI Act (Act 58 of 2003) was published in 2004. The Act establishes the South African Spatial Data Infrastructure (SDI), the Committee for Spatial information, an electronic metadata catalogue, determines standards for capturing and sharing of spatial information and provides for other matters. The SDI act is applicable to organs of state which hold spatial information and to users of spatial information. The Act aims to ensure that that spatial information can be shared more easily, avoid efforts in duplicating data, setting standards for data capture, allow data to be kept in a central and accessible storage area.

The Objectives of the SDI Act are to:

- Facilitate the capture of spatial information through co-operation among organs of state
- Promote effective management and maintenance of spatial information
- Promote the use and sharing of spatial information in support of spatial planning, socio-economic development and related activities
- Create an environment which facilitates co-ordination and co-operation among all stakeholders regarding access to spatial information
- Eliminate duplication in the capturing of spatial information
- Promote universal access to such information: and
- Facilitate the protection of the copyright of the state in work relating to spatial information.

The Act makes provision for the identification of data custodians. Data custodians **are organs of state** which captures, maintains, integrates, distributes or uses spatial information.

- A data custodian must capture and maintain metadata for any spatial information held by it
- A data custodian must ensure that metadata is available to users by making its metadata available for inclusion in the electronic metadata catalogue: and including it in a manual on

functions as described in section 14 of the Promotion of Access to Information Act, 2000 (Act No. 2 of 2000).

There are 3 key issues when it comes to GIS:

1. GIS data and capture standards
2. GIS systems
3. Data dissemination

6.3 THE FUNCTION OF GIS IN DEA

The DEA has a number of responsibilities for geographic information in South Africa. This includes providing, maintaining and managing the departmental GIS infrastructure (hardware and software) and general GIS support to DEA staff, including basic GIS training.

1. A vital function is the capturing and maintenance of geographic data, especially those data sets for which DEA is custodian (Protected Areas). Other data sets captured or being captured include:
 - Waste facilities (medical, hazardous/general waste, permitted/non-permitted)
 - Botanical gardens
 - Ramsar sites
 - Air quality priority areas
 - Tourism facilities
 - EMF's completed
 - Marine areas (territorial & inland waters)
 - Marine Protected Area
 - GMO's – experimental farms, and so on
 - SA Coastline
2. The Department also facilitates the capturing, purchasing and acquiring of geographic data to support DEA's strategic business areas. These include the:
 - SANBI Municipal Biodiversity Summaries
 - Satellite Imagery for the country SPOT5
 - National Land Cover
 - Vegetation of South Africa, Lesotho and Swaziland
 - Protea Atlas

- Bird Atlas
 - Sensitive Coastal Areas
3. The Department has a strong role to play in geographic data analysis and the production of maps for dissemination to the public (for example, State of the Environment mapping).
 4. Provide access to a range of spatial data sets for spatial analysis to DEA staff and external stakeholders through Internet and Intranet GIS portals.
 - Spatial datasets on tourism facilities and tourism infrastructure for rural nodes (interactive maps server),
 - State of the environment (interactive map server),
 - Paper maps for download (ENPAT maps)
 - Data sets on protected areas for download (shapefile) and data sets on CD/DVD

6.4 GIS DATA CAPTURE AND STANDARDS

Currently the means of GIS capture and the standards set vary across government departments. The implications are that when a project cuts across administrative boundaries (e.g. 2 provinces) the data sets may not be compatible. In these cases it may be necessary to recapture data or even model new data. This is particularly concerning when it comes to base data sets (e.g. landcover).

At an international level standards for data capture and sharing do exist, for example the Global Biodiversity Information Facility (GBIF) implement and promote biodiversity information standards and protocols, to facilitate information sharing in the global environment. At a national level the SDI Act guides standards for metadata management.

6.5 GIS SYSTEMS

Current DEA GIS systems in use or under development include: EIA GIS and NEAS.

6.5.1 EIA GIS

The EIA GIS system is currently under development by DEA and its purpose is:

- An expansion of the RSA – Norway agreement project: National Sensitive Areas project
- Identify of geographical areas of national importance (particularly focusing on those for the current EIA regulations contained in Listing Notice 3);

- Collation and visual display of useful information; and
- Development of an EIA decision support system

The development of the site will focus collecting and displaying spatial information on the applicant's proposal; the site of the proposed activity; and other relevant and available environmental data. So for any query done within the system the follow sets of information will be available:

- A list of activities for which application is necessary
- Any environmental attributes of the site
- The type of assessment
- The competent authority
- Any available environmental information
- Other applications from the NEAS system underway
- Any policies and guidelines that may apply

Current issues that the decision system still needs to resolve include are:

- Environmental attributes are consistently defined and captured;
- The list of activities is populated accordingly;
- The GIS Viewer is populated;
- The legal notice as an update of Listing Notice 3 is published; and
- the GIS system is linked to NEAS for EIA applications received.

In addition, the system would need to solve a number of technical issues relating to the data that is used to populate the system. It is worth noting that these issues are common across the country for GIS.

Problems include:

- Data ground truthing as many data layers are modelled from existing information or at a courser scale than necessary.
- Determination of high water mark of the sea
- Estuary to be changed to estuarine functional zone
- Delineation of the Urban edge
- Delineation of rivers/wetlands

- Decisions around what gets included and what is excluded, e.g. wetland overlapping to a built-up area

6.5.2 National Environmental Assessment system (NEAS)

NEAS is an electronic system used to capture and process EIA applications, generate environmental reports and record decisions (RoDs) and serve as an E-government solution for tracking environmental applications.

NEAS has undergone a number of iterations for capturing EIA information. NEAS I focused on the Environmental Conservation Act (ECA) Regulations, NEAS II on the 2006 Regulations of the National Environmental Management Act (NEMA). The latest version, NEAS III captures EIAs for the NEMA 2010 Regulations.

The objectives of the current system are to:

- improve processing of EIA applications
- track the status of an application
- have a database storage
- identify bottlenecks in the process
- be a decision support system
- provide national reports on applications
- integrate with other systems
- be flexible and adaptable to the changes

7 SUMMARY OF SPATIAL DATA TYPES

The type and quality of data available differs greatly across provinces, and seems to be dependant on the strength and investment in data at a provincial level. At a national level, national government departments are custodians of many of the national data layers, some of which are too coarse to be used at provincial or lower scale. This section provides an overview of some of the data available.

7.1 NATIONAL DATA SETS

AT A NATIONAL LEVEL, MANY NATIONAL GOVERNMENT DEPARTMENTS ARE ACTIVELY INVOLVED IN MAINTAINING CERTAIN DATA SETS, OFTEN WHICH ARE USED FOR THEIR OWN PLANNING AND REPORTING NEEDS. THESE DATA LAYERS ARE OFTEN FREELY AVAILABLE TO OTHER USERS, BOTH IN THE PUBLIC AND PRIVATE SECTORS.

Table 2 provides an overview of the nationally available data sets.

TABLE 2: OVERVIEW OF NATIONALLY AVAILABLE DATA SETS

Data	Responsible Department	Web Address
Protected Areas, State of the environment (SOER)	DEA	http://soer.deat.gov.za
		http://gis.deat.gov.za
Biodiversity, vegetation, threatened ecosystems, municipal biodiversity summaries	SAN BI	http://www.bgis.sanbi.org/
		http://www.bgis.sanbi.org/mapsearch.asp
Satellite images	CSIR	http://catalogue.sac.co.za/
Land Cover – Rural	National (2001) –	http://www.ngi.gov.za/

Data	Responsible Department	Web Address
Development	CSIR, Provinces	
Topographic maps (paper and in electronic format)	Department of Rural Development and Land Reform: National Geo-spatial Information	http://www.ngi.gov.za/
Aerial photography	Department of Rural Development and Land Reform: National Geo-spatial Information	http://www.ngi.gov.za/
Cadastre, farm boundaries	Surveyor General, distributed at a provincial level	http://csg.dla.gov.za/data.htm
Rivers/Water Resources	Department of Water Affairs	http://www.dwa.gov.za/projects.aspx
Agricultural information	Department of Agriculture: AGIS	http://www.agis.agric.za/agisweb/agis.html
Earth observation	South African Earth Observation Network (SAEON)	http://www.saeon.ac.za/ http://data.saeon.ac.za/spatial_search
Municipal and other boundaries	Demarcation Board	http://www.demarcation.org.za
Infrastructure	Eskom – Power lines/stations	On request

Data	Responsible Department	Web Address
Social/ population	StatsSA	http://www.statssa.gov.za/
Soils and Geology	Council for Geosciences	http://www.statssa.gov.za/
Climate data	South African Weather Service	http://www.weathersa.co.za/web/

7.2 PROVINCIAL DATA SETS

The quality, type and level of data available at a provincial level differ between the provinces. Provincial data sets are often more difficult to access than national data, and provincial departments often only give specific use of the data to provincially funded projects by means of a data exchange agreement.

TABLE 3: TYPICAL TYPES OF INFORMATION REQUESTED AT A PROVINCIAL AND PROJECT SCALE

Theme	Specific information
Geographic location	Geographic reference system, geographical names etc
Administrative units	Administrative units, census units etc
Properties, buildings and addresses	Addresses (National Address Database) etc.
Elevation	Coastline, elevation, DEM etc.
Geo Physical environment	Soil, geology etc.
Land Surface	Land cover, orthophoto images, satellite imagery etc.
Transport	Transport networks etc.
Utilities and facilities	Transmission lines, pipelines, etc.
Society and population	Urban and rural settlement, cultural heritage, population distribution etc.
Planning	IDPs, SDFs
Area regulation	Land use plans, protected sites, regulation zones etc.
Air and climate	Climate zones, air and atmospheric conditions etc.

Theme	Specific information
Water bodies and hydrology	Surface water bodies, water catchments, groundwater bodies etc. Water quality and water use
Oceans and seas	Sea regions, oceanographic spatial features etc.
Biota/biodiversity	Biodiversity priority areas, sensitive feature, Bio-geographical regions, vegetation, habitats, species distribution, etc.
Natural resource	Ecosystem resources, water resources, forest resources, fishery resources, renewable energy resources etc.
Natural and technological risks	Vulnerability zones, technological risks vulnerability zones, natural disasters etc. Climate change
Areas under anthropogenic stress	Polluted areas, noise and radiation zones, areas of intense exploitation etc.

7.3 INTERNATIONAL DATA SETS

International data sets are becoming increasingly important, particular when one considers that many ecological boundaries, like catchments, cross administrative and national boundaries. This is also linked to a shift in focus for IEM to understanding cumulative effects and integrated resource management. For South Africa, the SADC countries and shared catchment boundaries are particularly important considerations.

There is an extensive range of international data, norms and policies available internationally, often which are specific to sectors and areas. The table below provides an outline of some of these, however, a comprehensive list would be difficult to put together and would be very large.

TABLE 4: EXAMPLES OF INTERNATIONAL DATA SETS

Theme	Specific information
Administrative units	UNEP
Elevation	Africa-wide satellite imagery. E.g. NASA SRTM and ASTER data
Biodiversity	IUCN (International Union for the Conservation of Nature) for Red listing of species GBIF (Global Biodiversity Information Facility) for

Theme	Specific information
	data records World Wildlife Fund for Nature (WWF)
Land Surface	Land cover, orthophoto images, satellite imagery etc.
Society and population	UNEP – particularly for links to environmental goods and services
Planning	SADC Resources and policy briefs
Agriculture	UN FAO
Air and climate	UN Greenhouse Gas Inventory Data International Panel on Climate Change
Water bodies and hydrology	UN FAO Global Water Partnership WWF – HydroSHEDS Stockholm International Water Institute (SIWI) UN Water

7.4 DATA DISSEMINATION

Access to accurate, timeous and relevant data is critical for integrated environmental management. In many cases access to base data sets is difficult, and in some cases even denied, which has impacts on the quality of information used to derive findings. This is particularly true for tools like EIAs and EMFs where up to date and accurate information is necessary to make informed decisions on the impacts of projects.

Mechanisms to access, use and update datasets requires attention and there are few working examples of this in South Africa. A widely used web portal is the BGIS site.

7.5 CASE STUDY: BIODIVERSITY GEOGRAPHIC INFORMATION SYSTEM (BGIS)

7.5.1 Introduction to BGIS

Biodiversity Geographic Information System (BGIS) was developed to bridge the gap between science, policy and decision making.

BGIS has eight years of experience in information sharing and is regarded as an international pilot in this area. India is one of the first countries which intends on utilizing the South African processes and methodology for information sharing as a guide to develop their own, and extend it to East Asia.

7.5.2 Methodology for information sharing

A number of core components are responsible for the functioning of the BGIS and would be essential for any information portal. These can briefly be classified and explained as follows (based on the experience and functioning of BGIS):

- The method of information sharing must be user friendly. When the process of gathering information and/or analyzing the information becomes too cumbersome the value of the information tends to be lost and many users lose interest.
- Dedicated team of skilled scientists, managers and IT specialists
- Substantial budget
- Network capacity and functionality
- An understanding of how users interact with the website, and how the information is being utilized. Only once this is understood can a website be built that meets the needs of its users by presenting information in a manner which is easily accessible, understandable and functional; and make information available in formats which can be utilized by the website users.

7.5.3 New BGIS Tools

Over and above the mapping capabilities that BGIS provides the public and private sector access to, there are a number of tools which have been developed or are in the process of being developed, to further assist information sharing and decision making.

7.5.3.1 BGIS Advisor

This tool can be useful in a number of ways with regard to the Environmental Assessment process for individuals in all schools of thought, from the public and private sector.

The BGIS Advisor provides information on what an Environmental Impact Assessment (EIA) is, the process and how to go about undertaking an EIA. This tool also currently holds 11 million biodiversity records which can be used in the environmental impact assessment process by channeling the user to information that is relevant to the particular study and the use of this information in a comprehensive and effective manner.

More information can be found at <http://biodiversityadvisor.sanbi.org/>

7.5.3.2 Species Distribution Modeling

The Species Distribution Modeling, which forms part of the BGIS Advisor is specifically aimed at Environmental Assessment Practitioners (EAPs) and Biodiversity Specialists, aims to assist with information sharing of biodiversity records and improve the quality of data available on biodiversity records. The Biodiversity EIA System allows EAPs to upload Biodiversity Studies undertaken for Environmental Assessments and identify the relevant location associated with the data set. In so doing this system not only facilitates information sharing and collaboration of biodiversity datasets to produce a comprehensive set of data over South Africa, but it also allows for patterns and processes to be identified, it highlights where Environmental Assessments are being undertaken, and facilitates in identifying and measuring cumulative impacts.

To ensure quality of information is maintained, BGIS has decided to make all information that is loaded onto the system to be peer review by other users.

This tool will be announced at the IAIA Conference in Mexico in June, and shortly after this it will be launched in South Africa.

7.5.3.3 Land Use Decision Support

Similarly to the BGIS Advisor, the BGIS can be used in land use development plans, climate change studies, and general research.

More information can be found at <http://bgis.sanbi.org/LUDS.asp>

7.5.4 Workshops & Training sessions

7.5.4.1 Training

BGIS runs a number of training sessions every year for the public and private sector. The intention of these training sessions is to inform individuals about the abundance of information available to them, and guide them on how to utilise the information in a responsible and accountable manner. These workshops are free to ensure that accessibility to this resource is open to everyone.

7.5.4.2 Workshops

BGIS has held a number of workshops to gain understanding of the types of information that users require, the format for this information, how this information could best be presented and to discuss to improve information sharing and social networking.

7.6 GIS ISSUES

The majority of GIS users and practitioners are in government departments and the private sector. Many of the systems in use in government institutions were acquired through separate processes and consequently, each institution tends to have its own GIS system independently of other departments. In most cases there is very poor coordination among departments, however, coordination is continually improving as data custodian's link with one another. The independent and isolated development of GIS applications result in duplication of data collection and data coverage, the use of various scales for base maps and in a lack of standards for spatial data quality.

Other issues here:

1. Bandwidth issues
2. Standards
3. Metadata
4. Copyrights and end user agreements

8 ANALYSIS

8.1 PROBLEM IDENTIFICATION

8.1.1 Data issues

Despite efforts to organise and systematise the environmental data by a number of government department and role players there still exist data gaps and challenges. A lack of inconsistent collection of data on key natural resources and their processes leads to information gaps and makes it difficult to make accurate predictions. For instance, despite increasing attention by a number of sectors, there is still limited information of the impact of water quality issues in South Africa.

Standardization and harmonization of data are issues that lead to unreliability, incompatibility, inconsistency, non-uniformity and conflicting data sets (Gowa, 2009). Although a number of public institutions are now providing data, at a cost, there are still limited incentives to do so other than their own internal reporting processes. Data collection happens for specific projects or needs and can be incompatible with other uses or users. Data generated through the EIA process is a good example of this. Large amounts of specialist data is often collected in the EIA process, but is not assimilated into a regional or national data set or understanding of that particular specialist area. For example, species data lists will be greatly improved if data from EIA studies can be assimilated into a national data set. A further issue here is the use of different methodologies by specialists, or different levels of accuracy of that data.

Despite the importance of data dissemination, there is still limited data dissemination outside of government departments (Gowa, 2009). Access to information is often limited to those who already know where to go, or more importantly, know whom to ask. Information is unfortunately seen as a currency to be traded or not shared. In many cases the lack of sharing seems to be out of fear of errors being found or uncertainty around what the data will be used for.

Other reasons that have contributed data problems are the high costs of data collection (specifically for primary data collection), costs of data storage, maintenance and dissemination; difficulty of quantifying some of the environmental variables; and a lack of appropriate indicators to measure these variables. Encouraging private sector involvement would be one way of reducing the high costs associated with data collection. However there is limited incentive for them to do so.

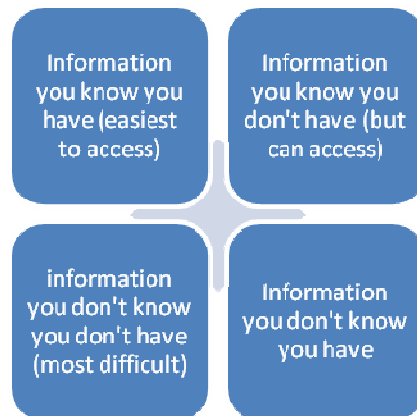


FIGURE 5: THE FOUR STATES OF INFORMATION POSSESSION (AFTER HARI SRINIVAS, [HTTP://WWW.GDRC.ORG/DECISION/INFO-DECISION.HTML](http://www.gdrc.org/decision/info-decision.html))

8.1.2 Capacity, expertise and equipment

The technical expertise and specialized equipment (hardware and software) required to capture or manipulate data is limited to certain specialised people and expensive (often tightly licensed) equipment. There are staff and skill constraints, especially at a provincial and local government levels, and staff turnover is also an issue. If the skills gap is not promptly filled after a staff member leave it can lead to a shortage of appropriate technical skill. In addition, new technical advances are being made on an almost daily basis and this requires regular training, re-training and strategic planning. Training is also critical in determining the sophistication of the analysis and outputs that can be generated. This issue is important especially when it comes to translating the outputs from environmental information and tools into planning guidelines or policy statements.

Even where equipment is available, in some cases it is not effectively nor efficiently utilised and maintained. Maintenance costs account for a substantial proportion of budgets required for environmental information systems and are a major concern for organisations. Some research has suggested that maintenance costs can range between 70–80 per cent of a budget for information systems (Gowa, 2009).

Other challenges experienced include inadequate network infrastructure (high Internet connection fees, low bandwidth, and weak links), general infrastructure problems (unreliable power), poor information retrieval skills among users and inadequate linkages with partner organizations (Gowa,

2009). Another issue is who has access to the information systems, hardware and software. Where access is limited to a few technical users who select what, and in which format, information gets feed to decision maker's critical data and knowledge can be missed.

8.1.3 Networking issues

Currently, a big issue in South Africa is that data collection and information management infrastructure in the country is still very weak in some areas. Networking and mechanisms to serve data between data producers and users are weak (e.g. getting necessary government data sets to EAPS). Unfortunately, technical issues can never be completely removed from politics and it is extremely important to have commitment of high-level decision makers in institutions and political support to enable data sharing (Gowa, 2009). Low awareness about the availability of environmental information leads to low demand for it, as users are often simply not aware the data exists. The implications of this can be far reaching, as decisions on environmental assets can be made without access to critical information that can sway a decision. In South Africa, another concern is the political sensitivity of the data, where data sets may not be made available due to the picture they may present.

8.1.4 Communication issues

A commonly experienced issue is the means that the environmental information is shared. Different users and interest groups have greatly differing needs when it comes to information access. For example, a specialist will need access to detailed scientific information in the lowest resolution possible. Local community members, who are sometimes uneducated or illiterate, will need the information interpreted and packaged in an easy to understand format. State of Environment Reporting and River Health Reports are two examples of where detailed scientific environmental monitoring data is interpreted for decision makers.

Access to information covers a broad range of users and levels of access to that information which can be a challenge to the custodian. Interpreting and packaging of scientific information in a range of formats can be a time consuming and expensive exercise, yet still does not negate the need to access the detailed information.

8.2 PROBLEMS EXPERIENCED WITHIN THE EIA PROCESS

The following section covers information issues that have been raised in the Project Steering Committee meetings and workshops of the EIAS Project, the Review the Effectiveness and Efficiency of the Environmental Impact Assessment (Eia) System In South Africa report (2008) and outcomes of EIAMS workshops.

- Despite a large amount of policies, guidelines and information documents across authorities in the environmental and development fields, the biggest issue that affects the effectiveness of EIA negatively in South Africa is that it is often executed without taking sufficient account of the broader context within which the application occurs (for example consideration of the SDF or EMF). This means that while EIA processes may meet the quality criteria, it often fails to make a real contribution to the quality of the decision that is made in the context of the specific area or sector within which it is made. The reasons for this, amongst others, include:
 - A lack of adequate sector specific environmental policies, targets and goals;
 - A lack of spatial environmental sensitivity delineation, especially at detailed local levels in areas that are under development pressure.
 - Many environmental layers (particularly sensitivity) are too coarse for a project level consideration;
 - A general lack of broad political commitment to the environmental cause at all levels of government but most specifically at the national level;

- From an information perspective many EIAS are seen as “run away” EIAs that include completely unnecessary and expensive information. The resulting ‘information overload can make it difficult to make a decision on the EIA. This can result in the inclusion of every possible set of data, whether or not it is relevant to the project.

- The ever increasing requests for information increases the costs of EIAS, which are already perceived as being expensive.

- The EIA process is often used incorrectly as a data gathering exercise. The general lack of baseline information about environmental thresholds, the general state of the environment and environmental no-go areas, has often resulted in the EIA process being used to collect this information, otherwise the potential impact of a project cannot be measured properly. The Environmental Management Frameworks that DEAT has provided for in NEMA and the EIA regulations are starting to address some of these concerns, but in itself, is perhaps bias towards the biophysical aspects. Other tools under the Protected Areas and Biodiversity Acts are also emerging that could assist in this regard.

In addition SoER and other tools should be making data available and easily accessible to the EIA process.

- In some cases government, including competent authorities, do not make information available to assessments and rather hold back on it to use later during the assessment and decision stage. This puts the EAPs at a disadvantage when assessing the site and limits decisions on deciding on the best options.
- Misalignment of data (and the implications for monitoring and reporting). This includes a number of areas where data misalignment occurs including:
 - Projects that cross administrative boundaries may not have data that matches. E.g. provinces may capture data at different scales, or only certain areas have data
 - The scale and resolution of data do not match. It is difficult, or not possible to do a fine scale assessment with nationally modelled data.
 - The means of data capture may differ
 - The units data is measured in may differ
 - Without effective coordination and standards there layers of information may not overlaying with each other accurately
 - Coordination of information across different departments is problematic. This is particularly evident at local government levels where integration of different sector information becomes critical.

- Access to data. The costs to generators or custodians of data can be high and they will seek to recoup these costs. A major problem that results it entrenches the idea that the information collected by the agencies belongs to them and that they can control access through regulations and costing, or use this to generate a profit. However, a conflict of interest can arise when that data is in the public interest and can make a difference in effective decision making.
- There are specific problems experienced around information for decision making in EIA applications related to mining, where access to information surrounding mining applications and its impacts are often seen to be inadequate or inaccurate.
- As difficult as it can be to access information from within government departments, when data is housed outside of government it can become even more difficult to access.
 - There are no real established links between the various sources of information.
 - Parastatals are seen as particularly difficult to access information from
- It is very difficult for role players to access information on where EIA applications are currently underway. One of the central problems expressed by all role players (particularly NGOs) is to know who is applying for what activities in which area. The NEAS system attempts to capture this information but access is limited to a few government staff.
 - Links related to access to information on water availability, reserve determinations and tracking water use licenses should be established. These processes often generate large amounts of information that can influence EIA decisions.
 - There is a need to access Environmental Management Plans as well. The NGO and society stakeholders have expressed difficulty in accessing the EMP and conditions that are set within it. This will enable better monitoring and ensuring that applicants adhere to the conditions set within the RoD.
- Access in rural areas to environmental information is very limited due to the lack of access to IT infrastructure and bandwidth issues.

- NGOs have noted the concern that it is often difficult to access information throughout an environmental assessment process. Difficulty had been experienced accessing RoDs and site EMPs. Concern has also been expressed around the quality of the wording of RoDs and EMPs which can make interpreting the reports and implementing them difficult.
- An issue that still needs a decision to be made on is access to sensitive information that could be abused (for example ecologically sensitive areas and the Department of Mineral Resources that currently only issues information via a request to the DG)
- Links to information related to the urban edge which is an important layers within the new regulations. In many cases the urban edge information differs at local and provincial government levels.
- Map reading and interpretation skills are becoming increasingly important. Maps presented in Environmental reports are often seen as accurate and correct and the information is questioned less frequently than the accompanying report. This can become problematic if the information is incorrect or not complete.
- Primary data collection mostly happens at a project based level and not by custodians of national or regional spatial data sets. This can become problematic when modelled data is used to model new interpretations at a course scale, but used to make inferences at a project EIA level.
- Development and land use change is happening at a rapid scale in South Africa and data layers may not be updated often enough to keep pace with this. An example is the use of the 2001 land cover data produced by the CSIR which 10 years later is still frequently the only usable land cover layer available to EAPs.

8.3 ISSUES ARISING FROM STRATEGIC PLANNING TOOLS

Increasing important and necessary tools within the IEM field are the forward, strategic planning tools like Environmental Management Frameworks (EMFs) or Strategic Environmental Assessments (SEAs). While they require information on many of the same specialist areas as project based tools (like EIA), it is often at a broader scale and is more holistic and forward looking.

A status quo phase within an EMF sets the current state of the environment and key issues within a locality. These studies cover a larger area than an EIA often without the budget of a full EIA for data collection. Thus they rely quite heavily on existing data and information bases on what happens within an area.

EMFs should provide useful forward planning tools for a locality and should direct whether or not other environmental tools like EIAs are needed. However, in many cases the EMF may not be easily accessible or applied within an area, without applying the information and knowledge contained within these plans.

What these plans do is provide a more holistic view of the environment, gives guidance (depending on the scale of the data) for where priority areas are, provides a more systematic database for decision making, provides useful land use guidelines for planning and highlight gaps in current knowledge. Where they are not so successful is that the data used generally not fine scale enough for land use planning at a municipal level, they do not always link to Bioregional planning initiatives (as per the NEM: Biodiversity Act) to development priorities (IDPs and SDFs) and only in some cases link to open space systems and municipal servitudes.

9 SYNTHESIS

The problems experienced with environmental information sharing can be summarised as follows:

All integrated environmental management projects generate, manage and distribute information in some format. However, that information differs greatly in how it is accessed, used, interpreted, and shared. As a result:

- Most information that is produced is not available for parties other than its generators. Raw data are usually not stored nor distributed beyond the publication of results, scientific articles, policies, impact assessment reports or summary documents, among others.
- In many cases the available information cannot be used by people or initiatives different from the ones that produced it, nor is it possible to use that information for purposes different to the ones it was obtained for. This is as available information may not be collected or distributed with the acknowledgement of its usefulness; or is not properly documented (metadata). While available information may comply with specific disciplinary standards during its collection (e.g. accepted faunal sampling methods) it does not follow standards for integration purposes, so it is not able to be integrated across projects or spatial areas.
- The willingness to share information is often missing in generators, custodians or projects developers. The rules to assign appropriate recognition of intellectual property --and credits-- if the information is accessed or used, usually are not established or observed. In other words, there is reticence to share information that may not be properly acknowledged or the generator recognised. In many cases information is hoarded by custodians to be used as a currency to determine their value.

It is essential that one central department or agency take responsibility to ensure that all information that has been, or will be, generated on projects is appropriately managed in terms of standards and storage. Equally important is that access to all stakeholders is allowed and encouraged. Ultimately, this will allow the environmental community to reduce duplication of efforts, and make a better use of resources.

It should be noted that there is a difference between information management for environmental management and GIS. An information management system refers to the system to collect, manage

and share relevant information. A GIS is a tool that can be used to apply information to a particular problem or issue. GIS is often reserved for the use of specialists or environmental practitioners with spatial know-how. An information management system should be more participatory as many more role players are involved in feeding information into the system and directing its use.

Different people and users groups require access to different types of information and use it for different purposes. Not all users of environmental data generate new information that needs to be returned into an information management system. This means that an information management system for integrated environmental management will need to tailor its use and management to a number of different levels of users.

Any information management system for integrated environmental management would be a sophisticated and complex system to set up and manage. These systems can take many years to develop and is a long term investment to update and maintain. Any changes, updates or modifications to environmental legislation will also affect the functioning and use of the system. For example, the gazetting of the 2010 Environmental Impact Assessment Notices affects how and what information is recorded and used.

What information is currently available?

- GIS (Only updated in increments, meaning data may not be updated)
- NEAS captures application info related to 2006 and ? Regulations only
 - NEAS 2010 also request info on other existing authorisations
 - NEAS aims to provide consistent approach & security
- Public portal will make some info available at different levels:
 - Applicant/ EAP who wants to track an application's progress (requires reference no.)
 - General public

What is info needed for?

- To improve quality of EIAs
- For decision-maker: To ensure that all relevant info has been considered
- For proponent :to provide certainty on investments (forward planning docs.
- For I&APs:
- For NGOs:

- For creating awareness and create best practices (Challenge: EAPs copyright info or limit the availability of info for dissemination on info to landowners and communities)
- NGOs: requires info to participate effectively if sufficient info is not available
- For monitoring purposes, info on mitigation measures should be available

9.1 STRATEGY STATEMENTS/ PRINCIPLES

Principle 10 of the *Rio Declaration on Environment and Development*

Environmental issues are best handled with *participation of all concerned citizens*, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. *States shall facilitate and encourage public awareness and participation* by making information widely available. *Effective access to judicial and administrative proceedings*, including redress and remedy, shall be provided.

[own emphasis]

Principles for an environmental management information management system (EIMS):

- Any information management system is dynamic and should be adaptable to changes in the environment, tools and legislation. The system should be dynamic and able to continually accept new information.
- An EIMS does not have to be complete to be used, particularly because it takes a lot of time and effort to develop. Different components and uses can be activated over time as the system developments and as new issues and priorities come out.
- Any EIMS requires continuous support and funding over the long term to ensure its success. Maintenance and updating of the system form the core of its success and usefulness.
- AN EIMS accepts the best information available. It is tempting to set very ambitious standards and require very detailed data (often which may be unfeasible), however this can slow the implementation of information management tools which are needed in the short term. The more information is incomplete or patchy, the more important a value judgement on its usefulness becomes. In these cases it is very important to record confidence limits with the data as well as the data source.

- Avoid falling into a data trap. It is tempting and all too easy in this information age of becoming trapped in a cycle of requesting more information and at a finer resolution without answering the questions or needs that the data was collect for in the first place. It is a challenge to decide at which point enough information is needed to make a decision, and here expertise and knowledge of individuals play an important role to make these choices.
- A consistent standard for data collection and method of interpretation of data trends is needed in order to effectively integrate and use multiple data sets within an EIMS.
- The EIMS needs to be accessible to everyone, whether in the public, private or civic sectors. This is an extremely important principle for a number of reasons. First, transparency of data and decisions builds public trust and confidence. Second, it is not possible to monitor trends or implementation (e.g. for an EMP requirement) without access to information. Third, the more people use a system, the more people can add data to the system. Forth, information that is hoarded and not shared loses value and relevance over time as there can be no value addition or interpretation.

10 PROPOSALS

Proposals for knowledge and information are linked to the proposed IEM phases. The proposals are made to streamline and improve information and knowledge flows and usage. It should be noted though, that key to success in these proposals is having a clear vision of the future of information and knowledge management *for integrated environmental management* as well as the political and administrative will to achieve the vision.

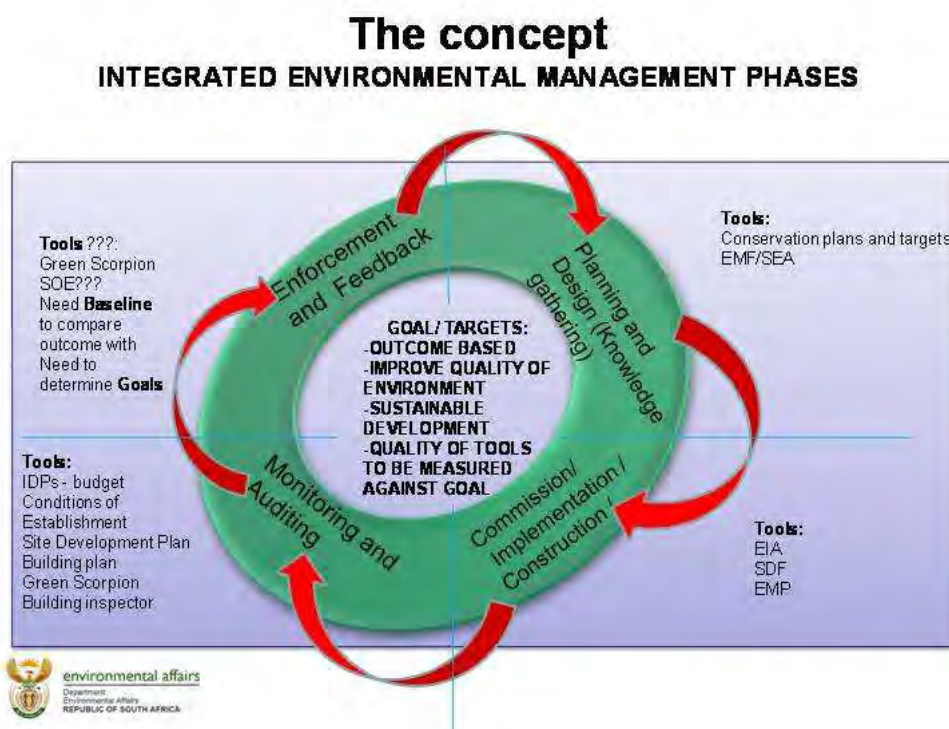


FIGURE 6: INTEGRATED ENVIRONMENTAL MANAGEMENT CONCEPT

Within the upper right-hand quadrant of the figure access to information is important. It will allow those who develop plans to ensure better planning decision making by providing access to the right information. For Conservation planning and EMF development systems like BGIS become a valuable resource to understand land use based information. Most of the information gathering happens at a status quo phase where most of the data is generated. There is also reliance on information that was generated during the auditing and feedback phase.

Within the implementation, commissioning and construction phase the information and plans generated in the previous phase are applied to the tools like EIA. There is reliance on cataloguing systems like NEAS to monitor progress and applications. Data generated is often in the forms of reports (e.g. EIA reports, EMPs and do on) often which are difficult to access to those outside of the competent authority or the applicant.

The next phase is monitoring and auditing where the information generated in previous phases is used to monitor compliance against norms, standards and legislative requirements. Monitoring and auditing becomes very difficult where information is not available or difficult to access. Effective monitoring will require access to reports, standards and outcomes of decision making processes (e.g. an RoD).

The enforcement and feedback phase is equally dependant on information from the monitoring phase to understand trends and breaches of environmental conditions. Only if information is reported on environmental conditions and subsequent contraventions can it be acted on. Where the loop of feeding information from the planning and goal setting stage does not follow all the way through to monitoring, enforcement becomes difficult, if possible at all. It then becomes critical that feedback from the enforcement phase is fed back to the planning phase so that any subsequent planning activities adapt to any changes with in the system.

10.1.1 Develop a departmental vision and objectives for information management

In order to ensure the right information is collected, at the right time, at the right scale and at the right standard coordination between information generators and users will be required. For DEA this means ensuring that data collection efforts are not duplicated, coordination happens between departments (e.g. with SANBI's BGIS tool) and that similar standards are used. This can only happen if a DEA has a clear Information management policy.

The policy should have objectives that are linked to NEMA requirements and aimed at ensuring policy objectives are achieved. Once this is in place, then data custodianship, sharing data and quality assurance will be better facilitated.

Elements of a successful environmental information management system include:

- a clear vision of the future of information and knowledge management to achieve integrated environmental management (i.e. a vision that is directed towards achieving *environmental* goals (as opposed to pure data goals)
- the political and administrative will to achieve the vision
- long-term commitment for the development and maintenance of the necessary systems and infrastructure
- an action plan to coordinate, implement and monitor the required activities
- securing of sufficient resources (staff, hardware, software and funds) to implement the strategy
- a structure (work groups, committees etc.) that is mandated to manage the required activities and achieve the objectives
- and a willingness to share and disseminate information to all stakeholders and interested parties

10.1.2 Enable five key processes for effective information management (fitness for use)

Effective management of information needed for IEM requires five key processes to be in place (Suárez-Mayorga and Orrego 2008 and Gumps and Blommestein, 1997):

1. Description of information resources. This process refers to the use of metadata standards and catalogues to describe which information exists, where it resides and what can be shared. A catalogue of what and where information is available is critical to it being accessed and used.
2. Data standardisation. Independently of how information is going to be stored and shared, data standards need to be set to allow it to be used by other users and across different applications. Good data standards lead to interoperability and confidence in data use.
3. Data digitisation. In order to share and leverage information, it must be available in digital formats. This process also covers allowing to the user to know about the tools, the standards, the protocols and the people involved in building and storing of digital data (e.g. the regulations and standards as opposed to just the data alone). Digitisation of data will be a challenge in South Africa, particularly where so much of the reports produced, particularly from the EIA process, are only in hard copy and not often accessible to the general public.

4. Data quality assurance. This process provides the user with assurance in the data verification and cleaning process and ultimately allows the data to be confidently used for different purposes at different times and to different stakeholders.
5. Data provision. This process covers making the information available to *all* users, stakeholders and interested parties. Data sharing is the last step for the user (after the processes mentioned above) and the first step for the information network and using that information for informed decision making. Making data available to all role players will be a challenging exercise, particularly when there is a lot of resistance by data holders to share data.

A sub-recommendation made within this proposal is that the EIA process needs to become a digital process, where all reports, decisions and specialist data needs to be submitted electronically. Information flow and transparent decision making can be made easier by using a central portal and data storage area for all EIA reports. The NEAS does begin to fulfil this role, but stops short of data sharing by only capturing applications, not full reports and data; nor does it make the applications accessible to the general public.

10.1.3 Establish a catalogue of what and how many data sets are available

It is necessary for DEA to know about what datasets are in existence, what data should be shared and what the quality and usefulness of that data is. A data catalogue provides access to standardized descriptions of information resources, the information itself and data standard. The data catalogue should be available electronically via the internet as a public resource. The data format and catalogue should be compliant with international standards to facilitate sharing of data outside of South Africa. This is particularly relevant to southern Africa transboundary projects where catchments and ecosystems cross administrative boundaries.

The most suitable means to establish what and how much data is available is to register the datasets using references/links to their metadata. In this way the user will know how much data is available for a particular area (e.g. biodiversity), at what scale and for what purpose it was collected and where to go to access the data for use.

Decisions around data custodianship become more involved and should be linked to departmental requirements (in terms of legislation) and policy directives. Only when a departmental vision and objectives for information management are set can decisions be taken on who is responsible for what data. This requires both vertical and horizontal coordination across government departments to ensure alignment of resources and data collection and management.

10.1.4 Information technology and internet access

The environmental sector in South Africa is increasingly utilizing and relying on information technologies in the management of the environment; however, their level of use differs across stakeholder groups and is very dependant on the ability to access the internet. For example, connectivity and use in rural and isolated areas is far lower than in cities.

While many South African's have access to the internet, access is still very limited in rural and isolated areas. In addition, where there may be access it is often slow and downloading and accessing data is difficult or even not possible. A lack of connectivity to Internet remains a major constraint to information exchange. Effort is needed to improve access to internet access for environmental data sharing and knowledge exchange

Particular recommendations:

- Improve access to the internet and digital information to rural and isolated areas to improve information sharing and disseminated knowledge on environmental issues.
- Bandwidth and the ability to access and download data remains a problem and any provision of internet facilities should be done with consideration to accessibility issues. Effort should also be made to package data in as small a file format as possible.

10.1.5 The need for baseline data

Baseline data sets include information on the basic environment, natural resources and surrounding infrastructure and land uses (for example rivers, roads, vegetation types, land use, cadastre and so on). The coverage of baseline data in South Africa is often uneven, only available at a coarse scale and the quality of the data is uncertain. For example, the most commonly used

river data layer is available at a 1:500 000 scale and often inaccurate and lacking detail at a local level. Capturing or refining base data is a time consuming and expensive exercise and out of the budget and scope of many EIA studies.

The availability of accurate baseline data is critical to the effective management of the environment, understanding environmental impacts and to implement monitoring programmes as provides a baseline to measure from. Often the data and information necessary for the day to day management of natural resources is not available.

In some cases, depending on the scale of a study, baseline data is collected during the execution of a project. In these cases there must be a mechanism to incorporate the data into national data or information networks for subsequent use. All countries identified the need for a coordinated system to integrate data and information from various institutions or sources, and for the creation of computerized databases, starting with baseline data which already exists.

Particular recommendations:

- It is necessary to strengthen the collection of baseline data in priority areas (particularly for base data sets needed for environmental impact studies). This will include making government staff available for the task, providing the necessary equipment (hardware, software and monitoring equipment) and formalising collaboration agreements between data custodians (mostly national government departments).
- New or revised policy, programme and tool development must be linked to the information collection and sharing requirements needed to give effect to the tool or policy. As environmental mandates, roles and responsibilities change so does the type and scale of data needed to fulfil that role. When policies or tools are put in place institutions may not be fully aware of the type and range of data and information which they would require in order to meet their mandate, nor the effort required to collate and share it.
- Basedata sets (particularly spatial) data should be made available to all users and stakeholders to enable better decision making. Standards for the scale of data, access and feedback should also be set to ensure accurate data at the level of analysis needed is available.

10.1.6 The need for linkages between environmental and socioeconomic data

It is essential to recognise the linkages between natural resource, demographic and socio-economic information within the planning process for integrated environmental management and decision making. Socio-ecological resilience and sustainable growth and development require understanding and adapting to the linkages between people and natural resources. Equally, there is a need to incorporate environmental considerations in economic and development policy as well as to include economic parameters in environmental policy making.

Particular recommendations:

- There seems to be little awareness of what kind of environmental information can or could assist development planning and economic policy. The development of specific environmental indicators linked to development priorities, at a range of planning scales (local to national) will help respond to priorities.
- Where there is a need for information on environmental issues from other government departments for decision making the response should be quick and accurate information in the required format should be shared.

10.1.7 The need for formal inter-departmental collaboration

Collaboration between departments responsible for and custodians of, data is essential for effective environmental information management and value addition. While informal networks and communities of practice are important, departmental staff move and departmental priorities and budgets change so formal inter-departmental collaboration agreements for data and information collection, generation and management are essential.

At the national level, there are already inter-departmental relationships for environmental matters through, for example, committees, where a Head or Director usually represents the agency (for example GIS collaboration led by the Department of Land Affairs and Rural Development). However, there are still many obstacles which need to be overcome to achieve effective collaboration in the collection, and management of data and information.

As an example, producing State-of-the-Environment reports requires accessing and sharing data and information from a variety of national departments and institutions. Mechanisms are needed

not only to access and exchange the data needed, but also to overcome any resistance to making contributions and to encouraging participation and ownership of the final product.

Yet, it also needs to be said that some of the obstacles cannot be dealt with by formal collaboration agreement, especially when (a) individuals and/or departments perceive that their power base may be threatened or (b) that the release of data may expose weaknesses and other deficiencies.

In the absence of an information dissemination policy and faced with bureaucratic obstacles, people have often resorted to informal networks of like minded people sharing information. Such networks can include certain government departments, private sector individuals and NGOs. These networks are based on personalities of individuals involved and shared interests and needs. Problems can however arise with this approach and include:

- Contacts are highly personalized and access to information is, at times, undermined by personal dislikes.
- While the informal network may exist, invariably there are individuals or government departments which are not part of this network and from whom it is difficult to obtain information.
- Often one gets the information if one finds out (sometimes by accident) that this information exists.
- If one is not a member of such a network it may be difficult if not impossible to obtain the information sought.

Particular recommendations:

- Co-ordinate GIS activities between role players in a way that data, information, programmes or models developed can be shared and improved on
- Formalise collaboration between national government to enable sharing of key government data and baseline information
- Make collaboration and sharing of integrated environmental information an integral part of departmental activities, and include measures for sharing in performance management processes
- Acknowledge and encourage informal (and formal) communities of practice and sharing

10.1.8 Establish and maintain data standards linked to environmental priorities

It is critically important that all information and knowledge management activities are linked to environmental legislation, policy requirements and a clear vision for IEM. Information management is an expensive and long term exercise and resources that used need to be clearly aligned to priorities and legislative requirements to ensure that it does not become an exercise of collecting data for the data's sake.

A large challenge is to ensure cooperation between:

- Environmental domain experts who need to articulate their specific needs and requirements
- IT and database experts who need to create the data models and applications
- GIS experts who need to bridge the gap between spatial and non-spatial data standards

Particular recommendations:

- Ensure that Provincial Departments are closely involved in developing standardized formats for data collection during the execution of their daily work and simultaneously ensuring the availability to the National Department e.g. information required for international conventions, policy evaluation and formulation
- Aim to reduce expensive duplication of effort, facilities, infrastructure and information
- DEA should facilitate policy and standards for the compilation and distribution of information, specifically where the information is needed to fulfil particular legislative requirements linked to environmental management

11 RISKS

Environmental data and information arise from many disciplines; sources are dispersed and a variety of methods and institutions are used in their compilation. In a similar manner to the data sources, users of information cover a broad variety of interests and needs. This combination of data, sources and users poses a challenge to environmental information management that the information management strategy needs to be designed to deal with. Furthermore, where there is existing data that is currently not well managed, the concerns and risks will only increase if a strategy does not recognise the need to retroactively manage and care for data.

The absence of an explicit information management policy for DEA and a generally weak approach to information management from the public sector can restrict environmental information management. It is often easier to focus attention and resources on the upgrading of hardware and software rather than dealing with issues such as mechanisms to facilitate access to government data and information, the management of information, and mechanisms for sharing and coordination of data inputs across users.

Particular risks would also include:

11.1 LIMITED COLLABORATION FOR INFORMATION AND DATA SHARING

Within particular government departments vertical coordination (provincial to national) and knowledge sharing works well particularly where linked to reporting structures. However, serious deficiencies exist in terms of horizontal collaboration within and among departments and between the government, the private sector, NGOs and other groups. A particular example is the difficulty experienced gaining access to information on mining applications and prospecting rights and its influence on the outcomes of environmental policies.

Few government departments consider the potential use that others have for the data and information which they generate. In general there is no framework to establish, guide and strengthen routine working linkages across departments at the level of data and information generation and management. These weak links become even weaker with links between government, the private sector and NGOs.

Furthermore, the lack of an information management strategy precludes awareness of new and additional information needs which must be met if a department is to respond to changing mandates and responsibilities.

11.2 WITHOUT A FORMAL INFORMATION SHARING NETWORK IT MAY BE IMPOSSIBLE TO FUNCTION

From an inter-institutional perspective there needs to be formal mechanisms and policies to permit rapid and effective flow of information and collaboration in environmental management. Informal networks are important and should be seen to reinforce agreements for sharing of data and information - and not as the only means to acquiring data and information. Failure to address this will continue to add to the problem and will also contribute to a depletion of institutional memory over time. In other cases individuals who feel threatened or need to demonstrate their authority, withhold the circulation of information and data.

11.3 DIFFICULTY IN ACCESSING DATA AND INFORMATION

Difficulty in accessing data and information is influenced by several factors including:

- Bureaucratic procedures for obtaining permission for data access and use. In many instances there is no policy for releasing data and information; consequently it is easier and probably "safer" to reject a request for data and information than to answer it. In other cases, there is a reluctance to share data and policies in place severely limit or restrict access to data.
- The perception of possible damage to certain areas or to the performance of sectors, particularly tourism. For example, locations of rock art sites (valuable heritage resources) are not shared out of fear of vandalism of sites. Another example is the reluctance to release crime statistics and the fear that its release would damage the tourism industry.
- Providing information may cause embarrassment to government or to the institution which provides this information. This is particularly so when this information can be used as a productivity or effectiveness indicator (e.g. EIAs processed or RoDs issued).
- A lack of acknowledgement of data sources and models. Sources of data and information made available to third parties are not always acknowledged properly.

- Power of ownership of information whereby there is a desire to control how the data is used by others, if it can be used at all.
- Information not or no longer available in digital format. For example, much of the valuable specialist data from EIA studies is only contained within hard copy reports or electronically filed with EAPS and any further subsequent access to that information (for example for use in an EMF) is severely limited, if possible at all. While such information may be a valuable database, the lack of access diminishes much of its value as retrieving such information may not be cost effective or feasible.
- Data and information are available but their format may not be appropriate or their quality is questionable. Many departments have individual data sets which they require for their own work programmes. Those data sets are developed for specific purposes and not shared elsewhere.
- Methodologies for data collection, storage format, analyses and presentation may be tailored to objectives of a specific department, project or purpose. Frequently, information is then presented either too aggregated/summarised form or from too narrow a perspective to be of much use to others.
- Data and information may not exist. This factor has affected the efficacy of all aspects of environmental management.

12 REFERENCES

Decker, B. (2001). Environmental Management Information System: Sustainable Cities Programme (SCP) of the United Nations Centre for Human Settlements (Habitat) and the United Nations Environment Program (UNEP), Paper from the International Conference on Spatial Information for Sustainable Development, Nairobi, Kenya

Gowa, E.K. (2009). Best Practices in Environmental Information Management in Africa: The Uganda Case Study. A joint publication of UNEP/DRID-Arendal and NEMA Uganda. Available at: <http://www.grida.no/publications/the-uganda-case-study/ebook.aspx>

Gumbs, B. and Blommestein, E. (1997). Environmental Information Management in the Caribbean, Economic Commission for Latin America and the Caribbean, Subregional Headquarters for the Caribbean, International Development Research Centre, United Nations Environment Programme

Suárez-Mayorga, A. M. and Orrego S., M. (2008). Guidelines For Environmental Information Management In World Bank/ Inter American Development Bank Projects, Latin America And The Caribbean, The World Bank Group, Inter American Biodiversity Information Network – IABIN, WB Consultancy PO714676

Roux, D.J., Murray, K. and van Wyk, E. (2006). Principles enabling learning environments for good ecosystem governance. Book chapter in Governance as a triologue – Government-Society-Science in transition Turton. A.R., Hattingh, J., **Maree**, G.A. Roux, D.J., Claassen, M., and Strydom, (eds), Springer-Verlag

Van Wyk, E., Roux, D.J. and Drackner, M and McCool, S.F. (2008). The impact of scientific information on Ecosystem Management: Making Sense of the Contextual Gap between Information Providers and Decision Makers. Environmental Management.

Appendix A: Available Core Data sets

Dataset	Data to be included	Data Custodian
1. Administrative Boundary Datasets		
Administrative Boundaries	Provincial Boundaries	Demarcation Board
	District Boundaries	Demarcation Board
	Local Municipal Boundaries	Demarcation Board
	Magisterial Districts	Surveyor General
	Administration Boundaries	Surveyor General
	Registration Divisions	Surveyor General
	Ward Boundaries	Demarcation Board/ StatsSA for social information
	Cadastral Boundaries	Surveyor General – Provincial level
2. Biophysical Environment Datasets		
Geology and Soils	Geology	Council for Geosciences
	Soil depths	Department of Agriculture: AGIS
	Soil capability	Department of Agriculture: AGIS
	Soil Potential	Department of Agriculture: AGIS
Topography	Topography	Department of Agriculture: AGIS
	Slopes	Department of Agriculture: AGIS
	Contours	Data custodian unknown
Hydrology	River systems	Department of Water Affairs
	Dams	Department of Water Affairs– national and provincial
	Catchment areas	Department of Water Affairs

Dataset	Data to be included	Data Custodian
	Water Management Areas	Department of Water Affairs
	Sources of water	Department of Water Affairs
	Water tables	Department of Water Affairs – national and provincial
	Water quality	Department of Water Affairs– national and provincial
	Coastline	Department of Water Affairs
	Bulk water infrastructure	Department of Water Affairs– national and provincial
Climate	Temperature	Department of Agriculture
	Rainfall	South African Weather Service
	Wind	South African Weather Service
	Climate change	Data available from DEA, SANBI, AGIS
Agriculture	Agricultural Potential	Department of Agriculture
	Existing agriculture	Department of Agriculture
	Valuable agriculture areas under threat	Department of Agriculture
Environment	Eco-system status	SANBI
	Protected areas	DEA
	Critical Biodiversity Areas and Ecosystem Service Areas (NEM:BA)	SANBI
	Provincial Nature Reserves	Provincial Environmental Departments (DEA in some cases)
	Game farms	Provincial Environmental Departments
	Private Nature Reserves	Provincial Environmental Departments
	Vegetation types	SANBI
Vegetation	Landcover	CSIR (2001 data set), Provincial departments that have commissioned data (KZN, Gauteng, North West)
	Fire prone areas	Data custodian unknown
	Invasive alien species	Data custodian unknown

Dataset	Data to be included	Data Custodian
Heritage	Heritage Resources	Department of Sport, Arts and Culture
Mining	Mineral resources available for mining	Department of Mineral Resources
	Location of mines and its status	Department of Mineral Resources
	Potential mining areas	Department of Mineral Resources, Council for Geosciences
3. BUILT ENVIRONMENT DATASETS		
Transportation	Transport networks (Hierarchy)	Department of Roads and Public Works
	Public transport	Scale dependant: Department of Roads and Public Works, Provincial Departments and Metropolitan Municipalities
	Non-motorist transport	Scale dependant: Department of Roads and Public Works, Provincial Departments and Metropolitan Municipalities
	Access and movement patterns	Scale dependant: Department of Roads and Public Works, Provincial Departments and Metropolitan Municipalities
Energy	Locality of infrastructure	ESKOM
	Provincial Bulk infrastructure	Provincial Roads Departments, SANRAL, Transnet
Telecommunications	Coverage Areas	TELKOM
Human Settlements	Land identified for housing	Scale Dependent: Department of Co-operative Governance, Human Settlements and Traditional Affairs, Provincial Housing Departments.
	Housing Projects	Scale Dependent: Department of Co-operative Governance, Human Settlements and Traditional Affairs, Provincial Housing Departments.
	IDP Projects	Scale Dependent: Department of Co-operative Governance, Human Settlements and Traditional Affairs, Provincial Housing Departments, or local government.

Dataset	Data to be included	Data Custodian
Land Use	Existing land use	Scale Dependent: Provincial Planning Departments, Provincial Housing Departments.
Tourism	Location of tourist attractions	Department of Tourism, Department of Economic Development and Tourism
	Tourism Corridors	Department of Tourism, Department of Economic Development and Tourism
Settlement Densities	Average gross dwelling unit densities	<u>StatsSA</u>
	Population densities	<u>StatsSA</u>
	Dwelling unit densities	<u>StatsSA</u>
4. SOCIO ECONOMIC DATASETS		
Demography	Population Figures	<u>StatsSA</u>
	Growth Rates	<u>StatsSA</u>
	Population distribution	<u>StatsSA</u>
	Migration patterns	<u>StatsSA</u>
Health	Type and distribution of facilities	Department of Health
Employment and Income Profile	Employment sectors	Statistics South Africa
	Unemployment	StatsSA, Department of Economic Development
	Income profile	StatsSA, Department of Economic Development
	Small business development	Department Trade and Industry
	Economic Growth	Department Trade and Industry
Poverty	Poverty data	Department of Social Services, StatsSA
	Poverty Pockets	StatsSA
Education	Type and distribution of facilities	Department of Education

Dataset	Data to be included	Data Custodian
	Education levels	StatsSA
Crime	Categories of crime	South African Police Service
	Distribution of crime and problem areas	South African Police Service
Economy	Economic Potential	Department Economic Development, StatsSA
Land Reform	Comprehensive Rural Development Programme (CRDP) Sites	Department of Rural Development and Land Reform
	Restitution claims	Department of Rural Development and Land Reform
	Land reform projects	Department of Rural Development and Land Reform
	State land	Surveyor General
	Land ownership	Surveyor General
5. Raster Data and photography		
SPOT 5		Department of Co-operative Governance, Human Settlements and Traditional Affairs
Aerial photography		Department of Rural Development and Land Reform.