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THE STATE OF ENVIRONMENT

INFORMATION NETWORKING IN RWANDA

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PREFACE



People's dependence on natural resources justifies the need to monitor and evaluate the impact of human activities on the environment and the need to make decisions which ensure sustainable development. Environmental assessment and reporting are a key catalyst in the drive towards sustainable development.

During the preparation of the first Rwanda State of Environment and Outlook in 2009, it became evident that there is a lack of reliable core datasets and indicators on the environment. As such there is need for improved collaboration between institutions dealing with environmental information management. All institutions working in the natural resources sector will benefit from the creation of an infrastructure for sharing environmental data. An environmental information network that improves data access at all levels of society will in turn support the country's sustainable development objectives.

With the valuable support from the United Nations Environment Programme's Global Resource Information Database based in Arendal (UNEP/GRID Arendal), the Government of Rwanda undertook an assessment of the status of environmental information management in the country in 2009. This was necessitated by the need to understand the existing institutional and policy framework for environmental data management, data availability, and data use and sharing mechanisms.

This report contains the findings of the assessment and provides a number of recommendations for consideration in setting up the Rwanda Environment Information Network,

including the establishment of working groups in order to ensure that the network is functional. The establishment of a national environmental resource centre is also very important to improve access to environmental information, as well as to facilitate informed and science-based decision-making.

I take this opportunity to thank UNEP/GRID Arendal for their valuable support. My deep appreciation goes to the Government of Rwanda through the Ministry of Environment and Lands for their leadership and also to other national institutions and individuals who contributed to the production of this report. It is my hope that this report will provide guidance towards the improvement of environmental information management in Rwanda.



SUMMARY

The need for information

Rwanda's economy and the livelihoods of the citizens are dependent on natural resources such as land, minerals, water, plants and animals. These natural resources are under increasing pressure from unsustainable use, resulting in environmental degradation (REMA 2009).

The circle of the interdependence between people and the environment is well known. The scale of future changes, their impact on Rwanda's development and the feedback from these changes in human behaviour cannot be forecast without adequate information. Scientists, regulators and the private sector need reliable observations and data if they are to contribute towards the sustainable development of Rwanda's economy.

At present, environmental data collection is largely sectoral with each institution focused on meeting specific needs. This sectoral approach to data management does not lend itself to contemporary decision-making. Specifically, the sustainable development approach adopted by Rwanda requires a more integrated methodology. Since environmental management is multidisciplinary by nature, cooperation across institutions and districts is necessary. Scientists working in different disciplines and at different levels need to access, comprehend and be able to use data collected and distributed by scientists from various disciplines.

In recognition of the above challenges, REMA wishes to establish the Rwanda Environment Information Network (REIN) to facilitate the capture, sharing and analysis of data in a way that is suited to multiple applications and integrated analysis. As a starting point to establishing the REIN, an assessment to survey the

national capacity for information management was undertaken. This report contains the findings of this survey and provides a number of recommendations for consideration in setting up this network.

Policy and institutional framework

The existing institutional and policy framework informs the structure for environmental data management, data flows and reporting. The Constitution of Rwanda (2003) provides for the right to information and also entitles every citizen to a healthy and satisfying environment. The Organic Law No. 04/2005 on protection, conservation and preservation of the environment indicates that every person has the right to information on the state of the environment and the right to take part in the decision-making strategies aimed at protecting the environment. In addition, the Access to Information Bill (2009) obliges public officials to release information to the public.

Data availability

A number of institutions are involved in the management of environmental information in Rwanda. On the overall, there is a sectoral approach to data collection and management with specific institutions having the mandate for particular types of data. There are substantive data holdings in the different institutions. However, there are also data gaps. Many of these data gaps have been identified in key government development strategies, and measures are underway to address them. Access to data is generally unrestricted with most information being given out free of charge.

Who uses the data and what is it used for?

The data produced by the institutions is used by various stakeholders. These include national and local governments, the private sector, international agencies, NGOs, and research and academic institutions. The information is mainly used to support various management functions including monitoring compliance, enforcement of regulations, policy formulation, research and operations.

Networking

Networking appears to be well established among institutions working in the environment sector in Rwanda. The networks include steering groups or committees made up of local institutions, while some have membership from outside Rwanda. In October 2006 Rwanda began implementing a Spatial Data Infrastructure (SDI) initiative. Under this initiative, the Rwanda Metadata Portal was launched.

Despite evidence of networking, there are barriers to sharing of data, including differences in data collection methodologies, data structures and the predominant absence of data sharing policies or information strategies. The skills, expertise and numbers of employees vary greatly between organisations. The same applies to equipment. There is a need for capacity building and improvement in these areas.



RECOMMENDATIONS

- 1. It is recommended that the Rwanda Environment Information Network (REIN)** be established to facilitate environmental data exchange, and to reduce duplication of effort, thus making more efficient use of financial resources.
- 2. Institutional coordination and capacity building** for both staff and equipment are needed.
- 3. In order to improve access to information**, an environmental resource centre needs to be established.
- 4. The REIN should undertake activities that promote the use of environmental information in decision-making processes at all levels within the country.** These activities must be carried out within the framework of Rwanda's obligations towards meeting national development goals and targets. Each network member would continue to provide information support to national priorities such as the Economic Development and Poverty Reduction Strategy while still fulfilling their own mandate.
- 5. All REIN network members should develop a system for documenting their research findings in order to address the lack of awareness of existing and available environmental information.** This can be done through the development of metadata.
- 6. An outreach strategy should be developed to enhance dissemination and use of generated information, as well as increase awareness of the REIN.** Positive perceptions amongst the public and policy makers would contribute to better understanding of the value of data and justify the need for networking.
- 7. Policies and strategies to guide access to and management of environmental information must be developed.** This would strengthen the provisions for information management that already exist under the current legal and policy frameworks.

An aerial photograph of a lush green terraced landscape. A small, simple house with a thatched roof is situated on a hillside. A dirt path winds through the terraces. The landscape is covered in various types of vegetation, including tall grasses and small trees. The overall scene is vibrant and green.

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RWANDA



▣ National capital

○ Provincial capital

• Town or village

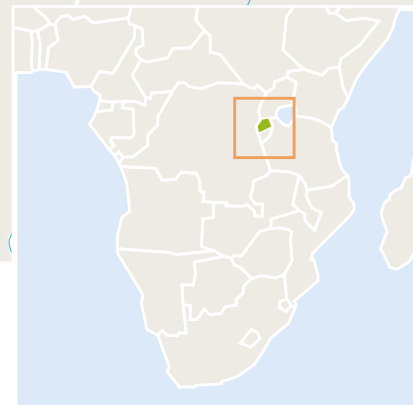
— Major road

— Track

■ National park

0 10 20 30 40 50 km

Source: based on a Umap by The United Nation, Department of Field Support, Cartographic Section, 2008.



Background

The Need For Environmental Information

Rwanda's economy and the livelihoods of Rwandans are largely dependent on natural resources. However, these natural resources are under increasing pressure from unsustainable use resulting in environmental degradation (REMA 2009). The dependence of people on the environment is well known and documented. However, the scale of future changes to the environment, their effect on Rwanda's development and the impact of these changes on human behaviour cannot be forecast without adequate information. Scientists, regulators and the private sector need reliable observations and data if they are to contribute towards the sustainable development of Rwanda.

The Rwanda Environment Management Authority (REMA) coordinates environmental management using both a sectoral and cross-sectoral approach. Currently environmental data collection is largely sectoral with each institution focused on meeting specific needs. This may be regulatory, operational or the furtherance of scientific knowledge.

Since the advent of the decentralisation policy in 2001 local governments have the mandate for environmental management, including environmental information at local level. The districts are responsible for planning and implementing their own environmental activities, while the central government remains responsible for environmental policy, standards, regulations, technical guidance, monitoring and evaluation. However, even at district level data management is largely sectoral.

The sectoral approach to data management does not lend itself to current decision making. Specifically, the sustainable development approach adopted by Rwanda requires a more integrated methodology. Since environmental management is multidisciplinary by nature, cooperation across institutions and districts is necessary. Stakeholders working in different disciplines and at different levels need to access, comprehend and be able to utilize data collected and distributed from a variety of disciplines.

Setting up the Rwanda Environment Information Network (REIN)

In recognition of the challenges in environmental information management, REMA wishes to establish a system that facilitates the collection, sharing and analysis of data in a way that is suited to multiple applications and integrated analyses. REMA proposes to do this by establishing and implementing the Rwanda Environment Information Network (REIN) under the framework of the Africa Environment Information Network (AEIN). The AEIN was established by the African Ministerial Conference on the Environment (AMCEN) at its 9th session in 2002. The aim of the network was to enable African countries establish an enabling framework for improved data and information processing for better management of natural resources. The AEIN is currently being facilitated by the United Nations Environment Programme (UNEP).

The REIN initiative was supported by UNEP/GRID-Arendal, a collaborating centre of UNEP based in Norway, whose mission is to communicate environmental information to policy-makers and facilitate environmental decision-making for change. GRID-Arendal is part of the UNEP-GRID network of environmental data and information centres under the UNEP Division of Early Warning and Assessment. GRID-Arendal works to support key activities of UNEP through training programmes and transfer of technologies that improve access to and dissemination of information.

The REIN aims to enable the Rwandans to access environmental data and information in support of development planning and decision-making. Its specific objectives are to:

- a. support the establishment of a national environment information network within the AEIN framework for the exchange and use of environmental information through the development and implementation of management structures and appropriate policies;
- b. build capacity amongst environment practitioners to generate, integrate, analyze and process environmental data and information;
- c. package this information into products and effectively disseminate them to support planning and decision making; and,
- d. provide easy access to environmental data or information in the country through establishing an environmental information and documentation service centre.



Assessing the capacity for environmental information management in Rwanda

As a starting point to the establishment of the REIN, a survey of the national capacity for information management was undertaken. This report contains the findings of this survey and provides a number of recommendations for consideration in establishing this network.

Methodology

This report is based on the results of a field survey carried out in Rwanda over a one-month period in August 2009. The questionnaire (Assessment of Information Management Capacity and Data resources) used for the data collection in this survey was designed by UNEP and adapted to the Rwanda case. It consists of two parts. Part 1 captures information on networking and information management capacity whilst Part 2 captures information on assessment of data and information resources.

The AEIN National Coordinating Office in REMA was responsible for managing the administration of the questionnaires. The questionnaires were sent out to 26 institutions. These included five districts and two umbrella NGO associations, with the rest being public institutions that included research and academia. No institution was coerced to participate as per the premise upon which the AEIN is based. Participating institutions must have environmental information and be willing to share it. The institutions that returned the questionnaire were assumed to fulfill this basic premise. It was not possible to survey each and every institution involved in the management of environmental information. Although the sample may be considered small, it still served three main purposes:

- a. raising awareness on how environmental information is managed in Rwanda;
- b. guiding stakeholders on how to improve environmental information management systems; and
- c. establishing the foundation for implementing the REIN.

The responding institutions were taken to be a representative sample, providing relatively precise details on how the organisations working in the environment field in Rwanda manage their information and data holdings. Some of the organisations surveyed are already active in the field of data and information management with collaborating networks of their own from both within and outside Rwanda, while others were not advanced. The sample therefore provided a good picture with respect to the information resource inventory. In total, questionnaires from 19 organizations were returned. Of these, four were NGOs, 11 government institutions, two research/academic and two from local government institutions.

In order to ensure institutional ownership, reliability of the response and the highest political support for this exercise, the questionnaires were forwarded from the office of the Director General of REMA. The respective heads of the receiving institutions then designated an officer(s) to respond to the questionnaires on behalf of their organization. The completed questionnaires were returned to REMA through the same avenue.

A number of the responding institutions were visited and pertinent areas of the questionnaires reviewed for greater insight and clarification. Personal interviews were also conducted to collect additional information on some activities related to the management of environmental information within REMA and other institutions.

Data analysis was kept simple. Conclusions for the data tables were based on arithmetic combinations of the questionnaire results, and the results presented as a percentage of the size of the responding samples.

A draft report was presented to a stakeholders' workshop on 14 July 2010 to validate the findings before the final report was prepared.

Format of the report

Following this introductory background, chapter 2 highlights the key findings of the overall assessment. It sets the stage by highlighting the main data issues, and this forms the justification for establishing an environment information network in Rwanda. The ensuing discussion is presented in four sections: availability of data in Rwanda; application of the data and information; existing networking initiatives; and capacity building.

Chapter 3 is the detailed institutional assessment. It presents the data for each surveyed institution and includes the following parameters: environmental mandate of the institution; type of organisation; environmental data held or managed; available equipment within the institution; information management skills of the staff; methods of data handling and dissemination; and the institution's contact details. Based on the information highlighted in chapters 2 and 3, chapter 4 presents a SWOT analysis of the environmental information management situation in Rwanda. The aim of this analysis is to aid the decision-maker in areas requiring improvement while highlighting areas of opportunity and strength. Chapter 5 presents recommendations for action.

The status of environmental information management

Policy framework for environmental information management

Article 34 of The Constitution of Rwanda (2003) provides for the right to information. Article 49 entitles every citizen to a healthy and satisfying environment, and further states that the State shall safeguard and promote activities to protect the environment.

The Organic Law No. 04/2005 on protection, conservation and preservation of the environment in Rwanda, provides in Articles 7, 44 and 63 for every person the right to information on the state of the environment as well as the right to partake in the decision-making strategies aimed at protecting the environment. The Access to Information Bill (2009) is expected to further enshrine these values. It will, among other things, oblige public officials to release information to the media (RDG 2009).

These commitments confirm the Government's recognition of the centrality of environmental information to effective participation, decision-making and justice and its role in influencing the quality of life.

Institutional framework for environmental management

The Rwandan government has committed itself to support environmental management in the country and has provided a supporting structure for this purpose. REMA is in charge of supervising and managing environmental issues in the country and is supervised by a cabinet ministry. REMA is comprised of the following three organs:

- the Board of Directors whose role is to provide strategic vision and programme oversight.
- the Directorate, which is involved in the day-to-day implementation of environmental programmes. It is headed by a Director General appointed by the Prime Minister.
- the National Consultative Committee whose role is to provide views and recommendations on concrete programmes.

The Directorate comprises of five departments, through which it carries out its work at international, regional, national and sub-national levels. The structure for environmental management in Rwanda is shown in Figure 1.



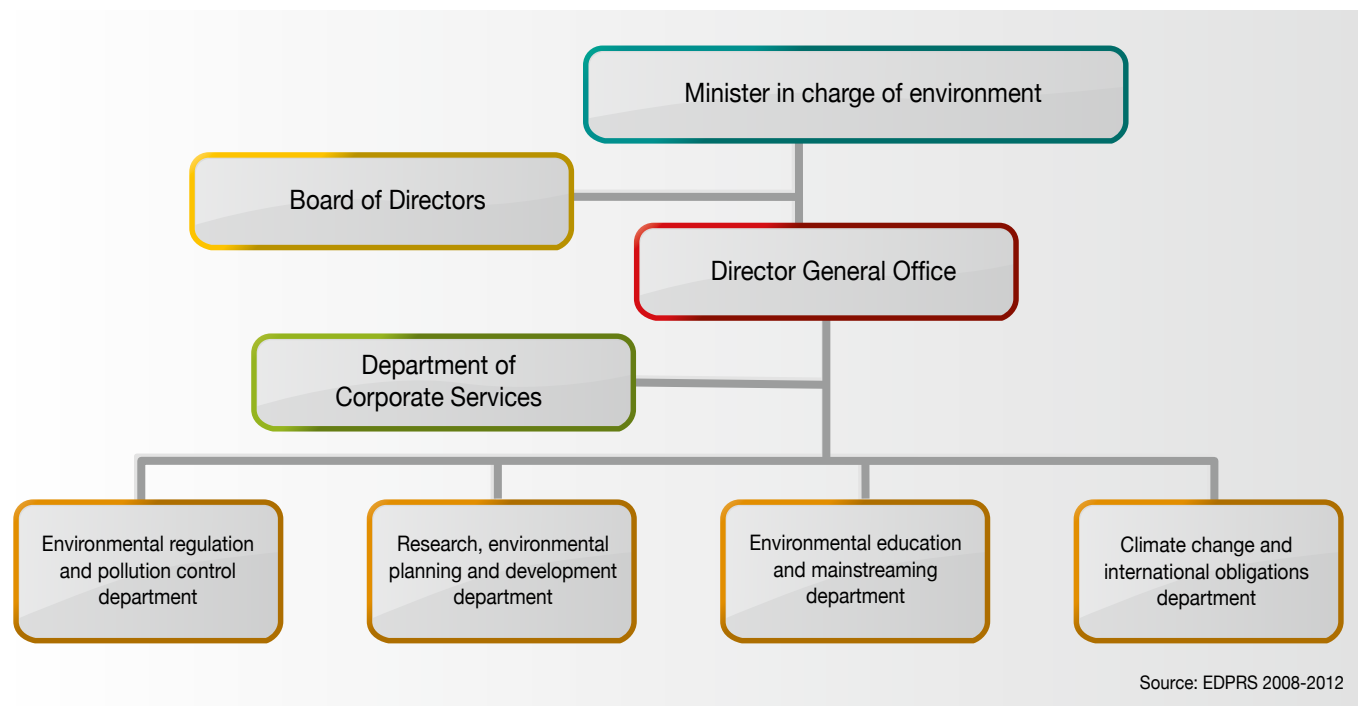


Figure 1: Structure for environmental management in Rwanda

Environmental management at sub-national level

The decentralization policy has been in force in Rwanda since 2001. It provides a clear delineation of responsibilities. The central government is responsible for environmental policy, standards, regulations, technical guidance, monitoring and evaluation. The country's four provinces and the capital of Kigali are responsible for coordinating activities within their jurisdictions. The 30 district level governments are responsible for leading implementation of governmental activities at local level. These activities include the mandate for environmental management, including environmental information at that level. The provincial, district or town committees are responsible for environmental protection. Each district has an officer in charge of environmental management. Below the districts there are three further levels of administration: sectors (Imirenge), cells (Akagari) and villages (Imidugudu) (GOR 2007).

Data infrastructure

The institutional and policy framework informs the structure for environmental data management, data flow and reporting.

The Economic Development and Poverty Reduction Strategy (EDPRS) is the key national development plan with priorities that are set for a five year period. The Strategy also reflects some of the long-term objectives of the Rwanda Vision 2020. Vision 2020 is a development strategy which seeks to fundamentally transform Rwanda into a middle-income country by the year 2020. Implementation of the EDPRS is carried out at different levels through the Sector Strategic Plans and Line Agency Strategies and lower down through the District Development Plans and Vision 2020 Umurenge. Even though each level has a different planning tool, there are links between the different levels of the administrative hierarchy. To enhance

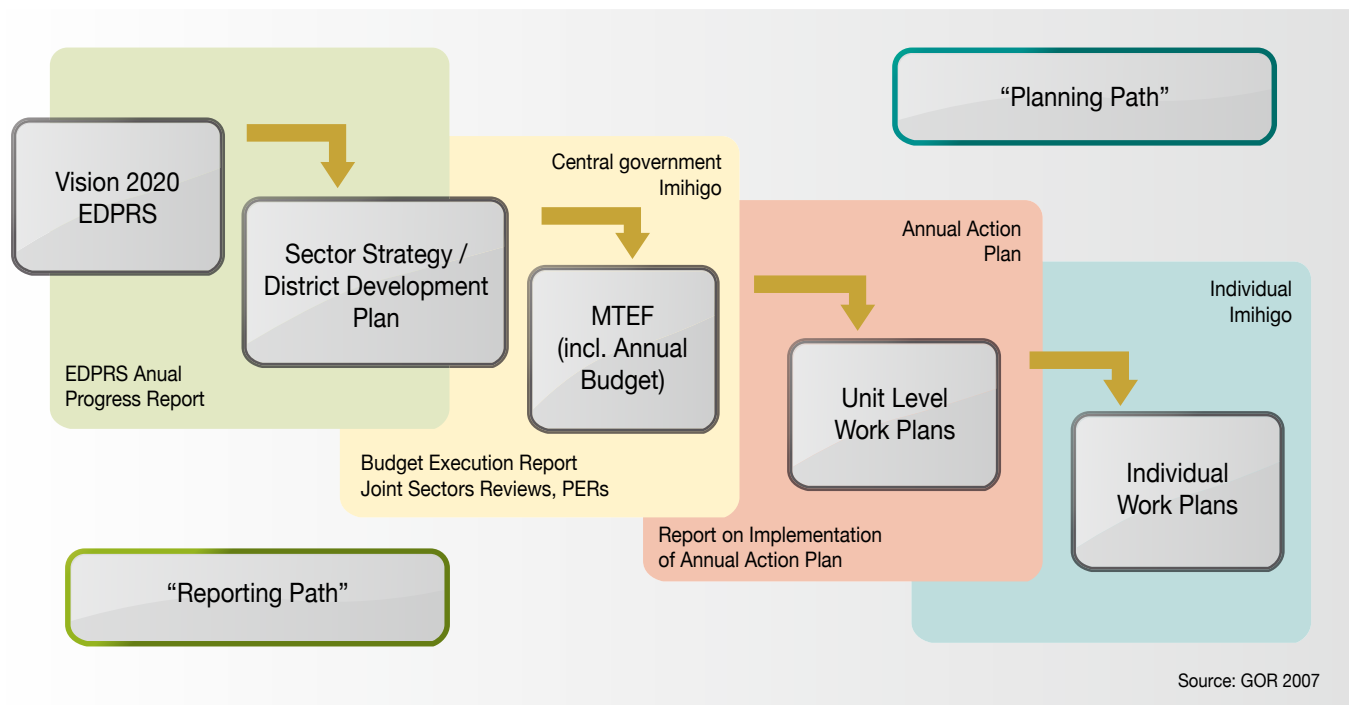


Figure 2: Planning and reporting pathways for key national development policies

the effectiveness of planning, regular reporting is required to gauge if efforts are yielding the desired results. These planning tools are thus matched to a reporting path. This planning and reporting pathway is visualized in Figure 2.

Another reporting mechanism that is gaining currency is the annual District Performance Contract (*Imihigo*). *Imihigo* is a contractual performance approach between service providers and local governments or national policy-makers. It serves as an implementation device for the District Development Plan (DDP). Each contract is signed by a district mayor and the President of Rwanda. To facilitate reporting, line ministries offer districts a choice of performance indicators for inclusion in the *Imihigo*. Work is currently underway to achieve a closer alignment of DDP indicators with the pattern of lo-

cal spending, so as to improve the monitoring of the EDPRS across different indicators (GOR 2007).

The array of indicators required for reporting at the different levels, coupled with different reporting deadlines and the disparate avenues for data collection combine to complicate what should be a relatively simple process of reporting. For instance, the reporting requirement for current implementation modalities such as the Joint Sector Reviews (JSR) and the district performance-based approach (*Imihigo*) are every three and six months, respectively. At the same time, there are additional reporting obligations that may come up from time to time such as those that are required by regional or international conventions.

Reporting on the state of the environment

In addition to the national requirements for reporting such as the Vision 2020 and the EDPRS, REMA is also required by Law No. 16/2006 - the law establishing REMA - to report on the state of the environment (SOE) every two years. This is a huge undertaking and if legitimacy and relevance of the publication is to be maintained, it is essential that REMA provides leadership to the process that ensures adequate data collection, analysis, management and dissemination. The current trend with SOE reporting is to adopt an integrated assessment and reporting approach. This approach requires bringing together information and analysis that is usually spread across a variety of disciplines and organizations. In order to meet these expectations the requirement for high quality data and information support is paramount. In addition, there is a growing trend towards participatory and evidence-based policy making in the environmental sector, all of which call for a sound data and information foundation.

The need for a system to manage environmental information

While decisions are informed by available statistical data, the quality of this data vary greatly. At times the data is fragmented or of uncertain quality and thus does not lend itself to trend analysis or cross-referencing with other sources of information (Ndayitabi 2009). The EDPRS recognises that quality control over information collected by line ministries is often the weakest link in the data chain (GOR 2007). Data is collected at the community, district and national levels as a result of the activities of institutions. However these activities remain largely sectoral and therefore provide basic data rather than the integrated format which is required for environmental management.

The entire process of environmental information management needs to be systematised and formalised. Proper mechanisms to support the exchange of data are equally important. These tasks do not only require internal capacity in human resources and equipment for environmental infor-





mation management, but also many collaborative tools and mechanisms to manage data generated and used externally. Issues such as policy, standardization, and access to data are very important as they impact the collection, analysis, marketing, dissemination and use of the information.

Given that a number of institutions and sectors are involved either as information users, producers or both, there is a need to establish institutional, legal and technical mechanisms for environmental data and information management and reporting. Against this background there is a case for the establishment of an environment information network that can allow for greater synergies by sharing and coordinating facilities, approaches and efforts in diverse but interlinked areas such as environment, health, agriculture, economy and education.

Employing an integrated approach

As already indicated, a major ongoing challenge is the sectoral approach to environmental management in Rwanda. A critical capacity weakness of this approach is the lack of appreciation of the inter-linkages that exist across seemingly unrelated sectors. Many sectoral specialists, for instance economists may have little understanding of the environmental consequences or challenges associated with different economic activities such as agricultural intensification, irrigation or dam construction (UNDP 2005). There is thus a need to transform the 'sectoral thinking' into a more interlinked and holistic approach.

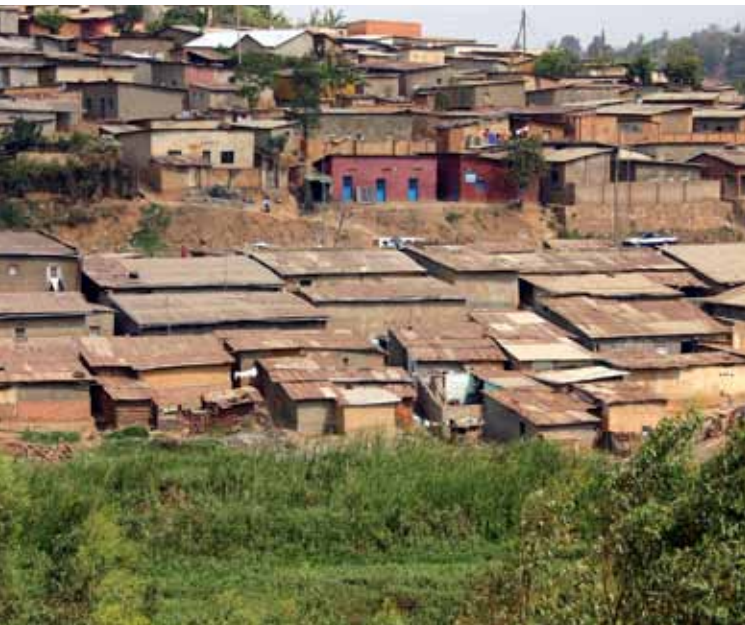
To ensure sustainable development in Rwanda, it is required that each of the individual line ministries or sectors adopt an integrated approach to natural resources management. Indeed, a key target of the EDPRS is to strengthen links and improving information management.

The assessment

In order to understand the data management framework for the environmental sector in Rwanda, the analysis in this chapter is presented in four sections, namely data availability, application, networking and capacity building.

Data availability

This section seeks to address the question: what data is available and where is it? The assessment looks at what data the institutions have and where some of the gaps are. Data issues such as methods of collection, quality, accuracy and conditions of access are also discussed.



Institutions involved in data collection and management

A number of institutions in Rwanda are involved in data collection and management of environmental information. These include the government, non-governmental organisations and the private sector. Those that responded to the survey questionnaire included:

- Ministry of Environment and Lands (MINELA)
- Ministry of Health (MINISANTE)
- Ministry of Infrastructure (MININFRA)
- Ministry of Agriculture and Animal Resources (MINAGRI)
- Ministry of Finance and Economic Planning (MINECOFIN)
- Rwanda Development Board (RDB)
- Centre for Geographic Information Systems and Remote Sensing of the National University of Rwanda (CGIS-NUR)
- Institute de Sciences Agronomiques du Rwanda (ISAR)
- National Land Centre (NLC)
- National Forest Authority (NAFA)
- Geology and Mines Authority (OGMR)
- National Institute of Statistics of Rwanda (NISR)
- Rwanda Electricity Corporation-Rwanda Water and Sanitation Corporation (RECO-RWASCO)
- Rwanda Environmental Awareness Services Organization Network (REASON)
- Rwanda Environmental NGOs Forum (RENGOF)
- Rwanda Bamboo Society
- Rwanda Initiative for Sustainable Development (RISD)
- Nyarugenge District Environment Office
- Karongi district



There is a sectoral approach to data collection and management with specific institutions having the mandate for particular types of data. However, there are instances where certain institutions are carrying out activities that are officially mandated to other organisations. Currently many national mapping activities are being undertaken by the CGIS-NUR and the Rwanda National Institute of Statistics (NISIR) (Mugabo 2009), yet it is the Rwanda National Land Office (under MINELA) that is in charge of national mapping activities. NISIR has the legal mandate for all census data while CGIS-NUR is a Geographic Information Systems and Remote Sensing National and Regional Outreach Center within the National University of Rwanda (NUR). If these activities are being undertaken without an official memorandum of understanding they could potentially open up avenues for conflict between institutions or create problems related to coordination, quality and standards. This was the case in Uganda as described Box 1.

Box 1: Who owns the data? Learning to work together

In Uganda, the National Environment Information Centre (NEIC) was established in 1990 to provide environmental information to support decision making for development by collaborating with sector institutions. Initially, NEIC's approach was to establish a Geographical Information System to carry out mapping activities; and to collect and store all available environmental data. This effort was partly abandoned due to the huge amounts of data involved, but also because of the fact that storing data belonging to other institutions was leading to inter-institutional conflict. NEIC's authority to generate statistics and maps was disputed by the Department of Statistics and the Department of Surveys and Mapping. The two institutions claimed the sole mandate to generate the two outputs under contest. This situation was eventually resolved by the agreement by both institutions to actively and jointly participate in an environment information network.

The sectoral approach implies that each institution generates data and information using their own institutional standards and codes. Whilst there has been some progress in developing policies and strategies for environmental management in general, there are no policies that specifically address the management and access to environmental information.

There are also a number of projects within the various institutions that both collect and manage environment-relevant data. Although this may only be for a limited duration, they are still important. Some of these include the climate change project in REMA that is carrying out a greenhouse gas inventory, the wetlands inventory, the mineral certification project in OGMR, the "Projet d'appui à la reforestation" (PAREF) in NAFA, and a project to establish a Biodiversity Information System in REMA.

Data classification

This report classifies environmental data according to five thematic areas. Each of these groups is then broken down into a list of data items for further clarity. This is so as to eliminate the use of overlapping terms. The five groups are:

- Land use – forestry, agriculture/livestock, fisheries, nature conservation, tourism, water, mining, energy, transport, urban planning, etc.
- Land cover/ecosystems – forest, woodland/scrub, grassland, freshwater, coastal and marine, dryland/desert, highland/mountain, etc.
- Species/genes – mammals, birds, reptiles/amphibians, fish, insects, invertebrates, plants (higher/lower), etc.
- Social/economic/political – culture, health, land tenure, demography, policies, governance, trade and industry, sustainable development, etc.
- Physical features – hydrology, geology, soils, topography, climate, etc.

Existing datasets and data gaps

There are substantive data holdings in the different institutions. However, there are also data gaps. Although the questionnaire specifically required institutions to indicate the datasets held by the institutions, many did not fill in this section. Therefore the evaluation of data gaps has been obtained from an analysis of the available literature (REMA 2009, GOR 2007). Some of the data gaps are indicated in Table 1 and they follow the data classification indicated below.

Table 1: An indication of data gaps

Data class	Data gap
Species/genes	The knowledge base of the national biodiversity stock could be improved
Physical features	Data on transport emissions and resultant pollution effects is virtually absent except for a national inventory on greenhouse gas emissions carried out under the UNFCCC in 2002. Data on ground water and aquifers is incomplete.
Land use	Information on the renewable energy alternatives and technology is limited. Information on the petroleum sector is scanty.
Social/economic/ political	Data on waste generation, source of waste and quantities disposed of is absent. Some elements of health data for example maternal mortality rate are missing. This is because the earliest Demographical Health Survey (DHS) was conducted in 1992. There is a lack of baseline data with regard to youth including the role they play, number of support groups and institutions for sport, youth and culture, the priorities of youths, the range and effectiveness of current support systems and the degree of youth participation or the effectiveness of the role they play.
General comment	Data for the different thematic or programme areas disaggregated by gender and other vulnerable/ disadvantaged groups

Source: REMA 2009, GOR 2007

Many of these data gaps have been identified in key government development strategies and measures are underway to address them. For instance, with regards to the meteorology sector, the aim is to provide a wide range of timely, high quality weather and climate information. Some of the initiatives include the development and implementation of a sound policy and strategy that supports a major rehabilitation of



existing terrestrial weather stations; introduces efficient telecommunications systems; modernizes data processing and forecasting systems; ensures the timely acquisition of real time weather and remotely sensed data through investment in a long-range radar system supported by trained staff; implements the installation of a Satellite Data Distribution System (SADIS); and improves the dissemination and application of weather forecasts and other meteorological information (GOR 2007).

Data needs versus available data

What is evident from this survey is that the data needs across the indicated thematic areas are greater than what is available. This implies that institutions (for various reasons) are unable to generate all the required datasets. For instance, most institutions surveyed indicated that the data items they required most for their work were those in the land use data class. In fact only the NLC manages the entire array of data items as listed in the land use data class. This is to be expected as it is within the mandate of the NLC to do so. But it further emphasises the need for a network where - through exchange and leveraging of comparative advantage - most data needs can be satisfied.

Data collection methods

Data is obtained from routine and non-routine data collection methods. Examples of routine data collection include geographical data on physiography/topography, roads, water distribution, water quality and water production collected by RECO-RWASCO using Global Positioning Systems (GPS). It is collected at local, provisional and national level at variable scales. Other institutions which carry out routine data collection include the Ministry of Internal Security (MININTER) that records daily events which are then reported to headquarters. Others are MINISANTE which amongst other things records births daily.

Non routine data collection methods include surveys, population census and quantitative or qualitative rapid assessment methods, among others. These include the twice-yearly crop assessment surveys and the 5-year agricultural surveys that are carried out by MINAGRI; the 5-yearly Service Provision Assessments and the Census of Population and Housing conducted every 10 years by NISR.

Quality and accuracy of data

Quality and accuracy of data and completeness or non-existence of datasets are important because they impact on the subsequent reliability and use of secondary information and other derived products. The most common limiting factor regarding the existing datasets was the quality and accuracy of the data. Four fifths of the institutions cited it as a problem. This is also a challenge at the sub-national level where district environment officers use information from the sectors (Imirenge) to compile their reports. For example in Nyamagabe district issues surrounding the accuracy of submissions from sectors at times necessitates extra trips by the environment officer to cross-check the data. Further, the reports from the sectors could be more integrated and employ standard usage of units of measurement (Ndayitabi 2009). This is shown in Figure 3.

Completeness of data was the second most common problem being cited by more than two thirds of the institutions. Additionally six per cent of institutions indicated that total absence of data was a problem.

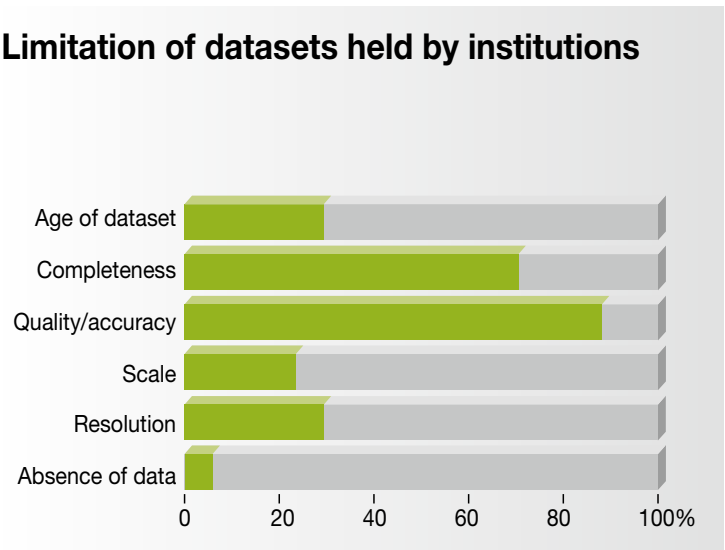


Figure 3: Limitation of datasets held by institutions

Some of the above problems arise because of the source of the data, the manner in which it is collected or due to the absence of guiding environmental indicators. In some cases it is collected in an ad hoc manner from books, reports or downloaded from the Internet. Most data is acquired from other organisations, presumably those which have that particular data man-

date. The number of institutions that collect their own data is quite high – at 70.6 per cent. Figure 4 shows the main sources of data for institutions. MINELA - an institution which is responsible for a number of natural resources sectors - is currently carrying out a data inventory of information contained in sectors and parastatals such as the National Forest Authority and REMA (Byansi 2009). A data gaps analysis will then be undertaken.

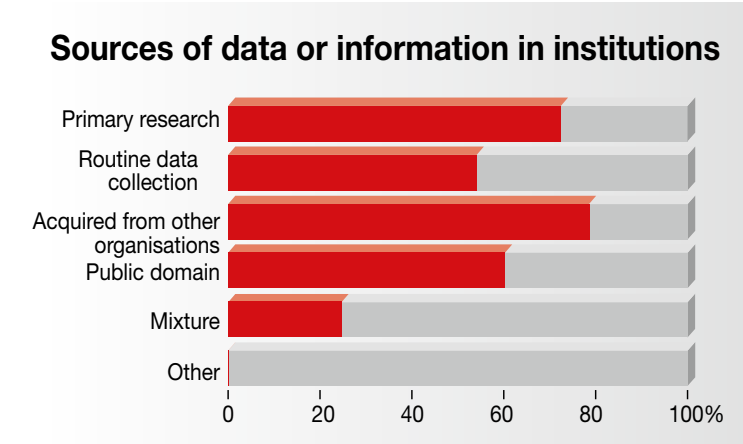


Figure 4: Sources of data or information in institutions

Then there is the issue of lack of data consolidation (the process of combining data from various sources into a centralized system). This is especially with regard to data obtained from projects. Ideally, projects are designed to support existing programmes and should fit within the programme-based monitoring and evaluation framework. As such, data collection should fit smoothly into the existing processes that support programmes. However, sometimes the reality is different. In institutions such as REMA, which coordinates or implements many projects there are challenges in making these data fit into the existing information systems so as to remain useful at various levels. Where such challenges exist, merging time series datasets to support scenario modelling or trend analysis becomes difficult.

The issue of environmental indicators is one which requires urgent attention in Rwanda. Environmental indicators are simple numerical values that help track what is happening in the environment. They can be developed and used at different levels – from local to national - and provide a logical and efficient way to track the state of the environment. Environmental indicators have gained currency since it is impractical to record every possible variable in our multifaceted environment.

MINELA has developed a set of about 71 general and 22 environmental indicators that are geared towards obtaining information to feed into the EDPRS (Byansi 2009). The MINELA framework of desired natural resources indicators covers environment, forestry, water, mining, and land. REMA has also developed a set of environmental indicators but these are yet to be operationalised. REMA thus urgently needs to update and operationalise the existing set of environmental indicators to ensure that the data required for tracking environmental change is collected. In addition, there must be an effort to harmonize the two sets of indicators to ensure coherence in national environmental data management. Box 2 provides more information on these indicators.

A significant component in the development of indicators is the articulation of a core dataset. The core dataset provides a list of key indicators which are considered critical for most institutions in environmental reporting. It underpins the reporting system on trends and developments in the environmental sector and as such is critical for most types of environmental work.

There is evidence of work towards a definitive core dataset in the environmental sector. Indeed the work of MINELA and REMA is to be cited. However the lack of an industry standard from which to develop a suitable model may have led to delays in operationalising a core dataset. Because of this, the core datasets which have been developed have been done according to the standards set by the various institutions. The REIN should move towards identifying a comprehensive core dataset that would effectively support work across the environmental sector. To this end, collaboration with the Rwanda Devinfo national database for the management of Rwanda’s monitoring information is also called for. It is planned for this database to contain standard indicators such as those defined by the Vision 2020 and the Millennium Development Goals, together with other specific indicators defined in the sector strategies’ monitoring and evaluation frameworks (GOR 2007).

Box 2: Indicator development in REMA

In 2006, REMA established an environment information system with environment indicators. It treated environment both as a sector and cross-cutting issue. The objective of designing the system was to:

- support the development and future updating of environmental indicators which were to be used during the production of key environmental reports;
- streamline the utilization of these indicators by the staff of the former Ministry of Lands, Environment, Forestry and Mines (MINITERE); and
- enhance sharing of these indicators within different stakeholder groups.

These indicators have not been used due to the approach utilized to develop them was not participatory enough. Indicator development requires the agreement of key stakeholders on such issues as what indicators to use, and where the data will be gathered and at what frequency. Another possible explanation is that there might have been lack of follow-up on the part of MINELA and REMA due to the lack of staff qualified in environmental information management at the time.

Source: Mugabo 2009



Conditions of access to data

Access to data is generally unrestricted with most information being given out free of charge. Only in a few cases is information charged at market value or on full cost-recovery basis. Examples of institutions that sell their data include CGIS-NUR, NLC and OGMR. Even where data is for sale it may be free of charge for certain groups of users. For instance, CGIS-NUR gives free data for academic purposes.

Information management functions of institutions

There are activities in support of data management in terms of budgetary provision, projects or assignment of staff. While it was not possible to determine exact budgetary provisions, it is clear from the activities carried out by these institutions, the equipment available and staff allocated to specific information management duties that money is regularly allocated for information management functions.

The institutions surveyed manage their information holdings in different ways. Almost all institutions surveyed cited reporting and information dissemination as a core information management function. Data interpretation and analysis, decision support and data gathering were the next most important functions. Although data gathering is an important function, in some organisations the mechanisms that support the regular collection of data and update of information systems according to a set timeframe is lacking (Mahundaza 2009). This can impact on key functions of the organisations such as reporting, or monitoring and evaluation. Figure 5 highlights the key information management functions of the institutions.

Library and archiving services are provided by only a third of institutions. However this function should be accorded greater prominence given the powerful role libraries have to play in

development. Traditionally, libraries were looked upon as places where collections of books are housed. This concept has evolved and today they are considered as places where there is free access to information in a choice of formats and from a range of sources. By improving access to and use of information, libraries or resource centres support education and research and by extension social and economic development. The concept has proved very successful in Uganda and has even trickled down to the district level.

There are strong arguments in support of establishing an environment resource centre in Rwanda. The primary objective would be to improve access to environmental information at all levels, as it is not rare to find information being personalised (Byansi 2009). REMA, as the lead environmental agency in Rwanda, should consider establishing a resource centre as a public service to those seeking information on the environment.

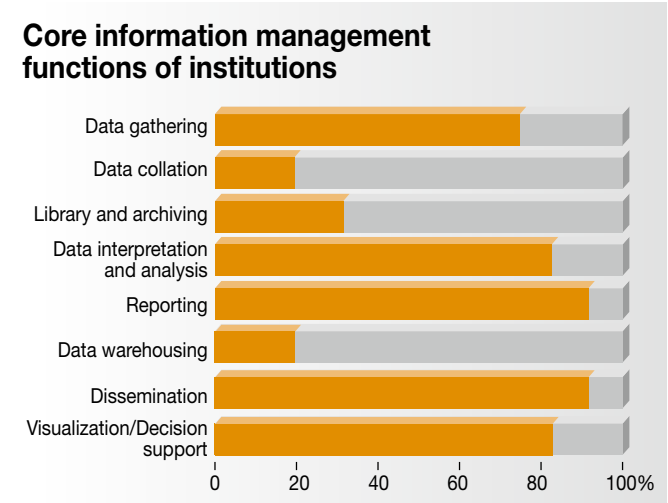


Figure 5: Core information management functions of institutions

Application

Information is produced so that it can be used. The main area of interest in this section is to investigate how the information produced is used and who uses it.

Uses to which environmental information is put

In general, information is used to support a variety of functions. The various applications including monitoring, compliance, enforcement of regulations, policy formulation, research and operations shows an appreciation and ability of institutions to utilise environmental data and information as a resource. Figure 6 shows that the majority of the institutions use information for decision-making. The second most common use of information is for planning and management.

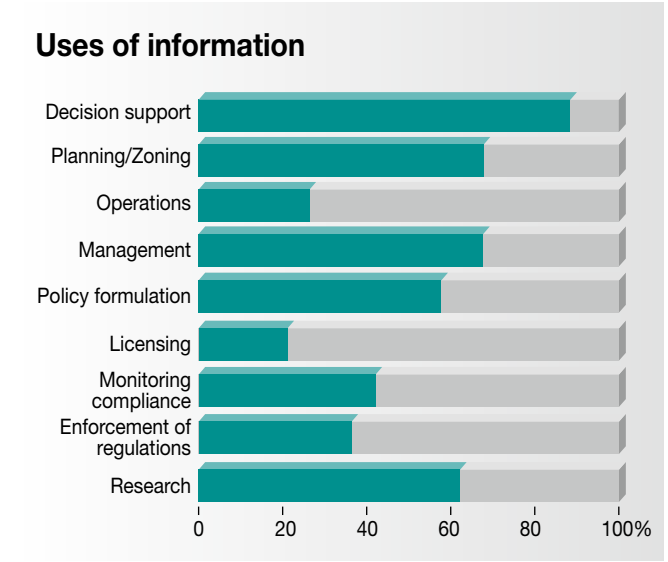


Figure 6: Uses of information

There are opportunities to learn from the experiences of other countries. In Lesotho, data from one member of the Environment Information Network (the National Environment Secretariat) has been used to support conservation activities in highly degraded areas. Through the Maloti Drakensberg Trans-frontier project, areas of high biodiversity value were identified and maps such as that in Figure 3.7 produced. These maps were disseminated to all affected districts and have played a big part during the formulation of the district development plans (UNEP undated).

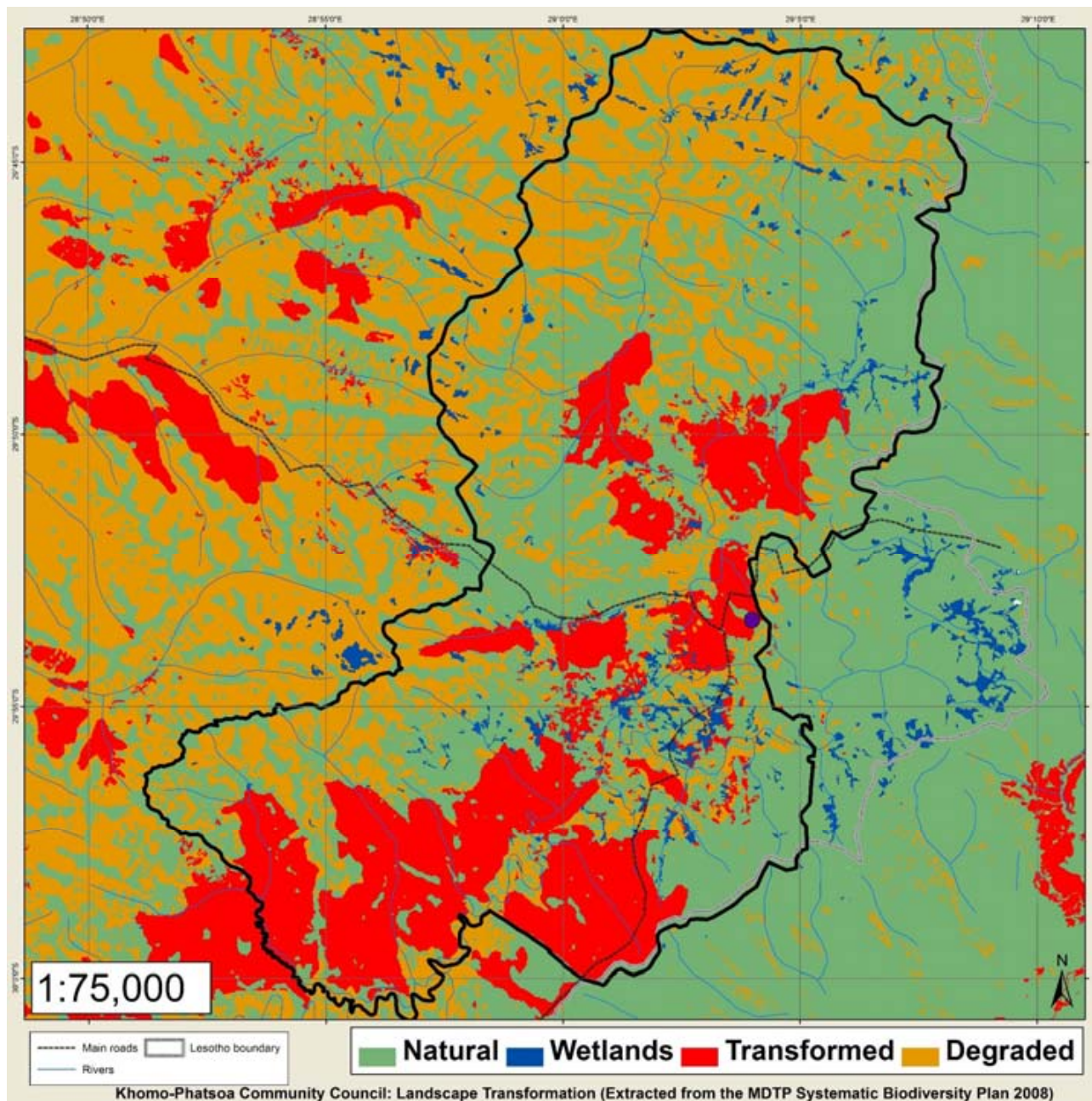


Figure 7: Landscape transformation in Khomo-Phatsoa Community Council

A recent example of how environmental information is being used in Rwanda is the process that culminated with the publication of the 2009 state of the environment (SOE) report. The SOE report brings together information from the sectors to show the cause-and-effect linkages of human and natural actions and their impacts on the environment (REMA 2009). A key aspect of the SOE report is the analysis of national policies and strategies and tracking of progress in achieving these. The entire SOE process was a joint effort of REMA, lead agencies, major governmental and non-governmental stakeholders, the private sector and national experts in the different thematic areas.

Users of environmental data

The data produced by the institutions is used by a variety of stakeholders. More than two thirds of the data is used internally as shown in Figure 8.

Government departments, NGOs and the private sector are also significant users of this information. The varying uses that information is put to show increasing appreciation to utilize information as a resource. The more institutions understand the extent to which information can be used to support decisions, the greater the demand for it. Previously, such information support functions were not regarded as serious. But this is changing, partly due to new policy requirements. For instance, the need for environmental impact assessment (EIA) prior to undertaking any environmentally related activity in Lesotho is fuelling the increased use of environmental data by other stakeholders (UNEP undated). EIA is also a legal requirement in Rwanda and will likely increase the demand for information.

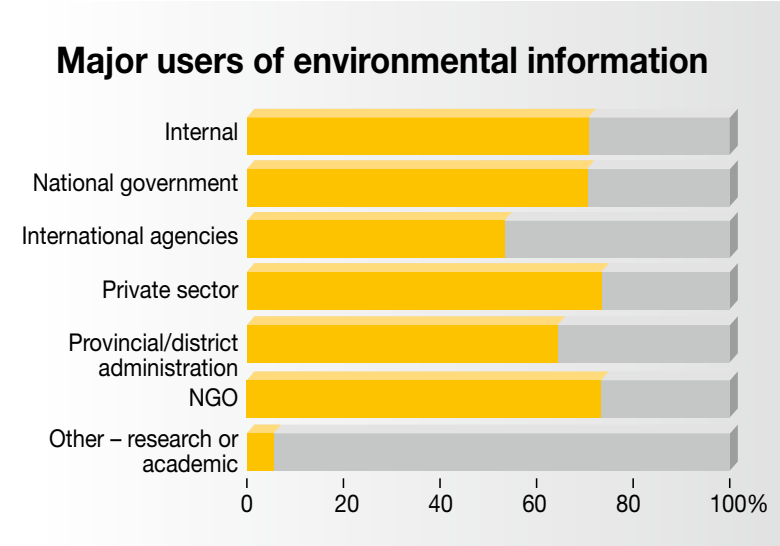


Figure 8: Major users of environmental information

As Rwandans appreciate the importance of environmental information, it will be used by a growing array of stakeholders. In Zambia the environment information network and monitoring system project has for a long time facilitated the development of data and information products. Indeed the necessity of environmental information for planning has grown so much that it is now entrenched in the National Development Plan (ROZ 2006). For instance the SOE reports produced have been used to provide information to the Fifth National Development Plan (FNDP), the National Policy on the Environment and the Integrated Development Plan for Solwezi district (UNEP undated). The Lusaka Environment Outlook has contributed to the master plan for Lusaka city and the Tourism Action Plan being developed for Livingstone city.

Environmental information and public perceptions

One of the emerging challenges in applying packaged information is how to deal with already established perceptions of certain types of data. For instance, the apparent discrepancy between weather forecasts and the reality, has resulted in a certain degree of mistrust amongst the Rwandans public for weather reports broadcast by the media (Twahirwa 2009). So despite the fact that meteorological data is available for decision-making, it is sometimes ignored for this reason. According to the Department of Meteorology, some of the reasons for this could be a lack of knowledge on how to apply the

data or the inadequate level of technology that limits their ability to accurately predict the weather. With only a few stations operational, making use of weather-related information is a real challenge (Twahirwa 2009). But the government is aware of this and has set up mechanisms to address these shortcomings (REMA 2009). This situation is not unique to meteorology. In the water sector only 22 out of an existing 69 hydrological stations are fully functional affecting the data integrity and regular update of information on national water quality and quantity (REMA 2009).

Networking

One of the requirements of this assessment was to highlight any existing networks – in Rwanda or with neighbouring countries - that could either be promoted or included in the proposed Rwanda Environment Information Network. It further investigated the existence or non-existence of a national spatial data infrastructure (SDI) in the country.

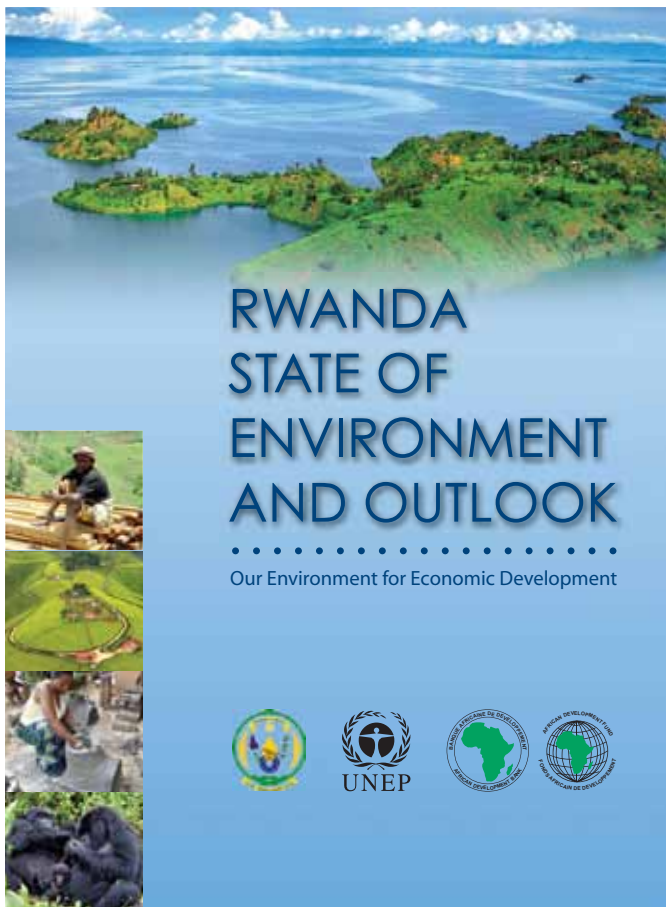
Evidence of networking activities

Networking as a concept appears to be well established among institutions working in the environmental sector in Rwanda. There are a number of networks, steering groups or committees made up of institutions inside the country, and some with institutions outside Rwanda. Whereas most of these networks operate without a formal agreement, some have formalized their working relationship. Some examples are listed below:

- CGIS-NUR has formal agreements with ITC (Faculty of Geo-Information Science and Earth Observation of the University of Twente) in the Netherlands, the Regional Centre for Mapping for Development (RCMRD) in Nairobi, and University College of Lands and Architectural Studies (UCLAS) in Dar-es-Salaam. They also have formal agreements for data supply with the Wildlife Conservation Society (WCS) and the Ministry of Education for school data.
- The Rwanda Development board has formal agreements with the protected areas management – the Volcanos, Nyungwe and Akagera National Parks; International Gorilla Conservation Programme, Wildlife Conservation Society, Karisoke Research Centre and others.

- REASON, which coordinates the environment clubs in Rwanda, has formal agreements with UNEP, RENGOF, Kenya Forestry Research Institute (KEFRI), International Union for the Conservation of Nature (IUCN), and REMA in the areas of publications and training.
- MINELA coordinates the Environment and Natural Resources Sector Working Group.
- RECO-RWASCO has formal agreements with mining companies for mining data.
- Rwanda Initiative for Sustainable Development coordinates the Landnet and has formal agreements with some of its data providers.
- The Rwanda Environmental NGOs Forum coordinates the environmental NGOs, but does not have any formal agreements for data supply.
- The Ministry of Health is involved in the Water and Sanitation Steering Committee and the National Steering Committee of Environmental Health and Hygiene.
- The Albertine Rift Biodiversity Information Monitoring System bringing together Burundi, Democratic Republic of Congo, Rwanda, Tanzania and Uganda.
- The World Network of Biosphere Reserves between the UNESCO-MAB and l'Office Rwandais du Tourisme et des Parcs Nationaux (ORTPN).
- The Rwanda Devinfor - the national database for the management of the Government of Rwanda monitoring information.

Institutions belonging to these various networks exchange data in a multiplicity of formats and scales. It is likely that difficulties are experienced when exchanging data due to differences in data collection methodologies, data structures and the predominant absence of data release policies. In addition, the lack of an information strategy to guide the entire information life-cycle process could be a hindrance to improved management.



In some organisations similar projects for data gathering or information management activities exist. This duplication of effort is further compounded by the absence of comprehensive documentation of available data, for instance in the form of metadata. According to the analysis more than half of the institutions have documented their data holdings in the form of metadata. These include institutions such as MINELA, CGIS-NUR, NLC, ISAR, MINECOFIN, MINAGRI, RECO-RWASCO, RDB, REASON, NISR, OGMR and the NLC.

Internal policies for information management and networking

As part of the survey, the institutions were asked whether they have an information strategy and a data policy (including data exchange). An information strategy can be defined as a long-term plan for bringing together the people, processes and technology to deliver information that is accurate, timely and relevant. A data policy is more specific to data and outlines the responsibilities of those involved in the collection and management of data. It can include aspects on data acquisition, data management, access and use and costs for access.

Of the institutions surveyed, about half had an information strategy. With regard to a data policy most institutions did not have data policies. The existence of information strategies and data release policies in some of the institutions is an indication of some awareness regarding the importance of formalising the information management and sharing process.



Photo: © REMA Rwanda State of Environment and Outlook, Page 117

Spatial Data Infrastructure (SDI)

Rwanda has recently started implementing a Spatial Data Infrastructure (SDI) initiative. Box 3 describes SDI in more detail.

The SDI initiative was launched in October 2006 and is currently being spearheaded by the National University of Rwanda Centre for GIS and Remote Sensing (CGIS-NUR). The initiative is driven by the fact that even where data is available, information cannot be cross-referenced or combined because the data does not use common references for geographical or administrative areas. Addressing these issues has necessitated the adoption of an SDI for Rwanda. The development and management of metadata is a cornerstone of this SDI. According to CGIS-NUR (2009), developing such an SDI including metadata will:

- unlock the potential hidden in data and stimulate economic activity,
- reduce duplication of effort among agencies,
- make geographic data more accessible to the public by encouraging the use of standards,
- improve quality and reduce costs related to geographic information,
- facilitate value-added services by enabling combination of data from multiple sources, and
- increase the benefits of using disaggregated data, and establish key partnership with states, cities, academia and the private sector to increase data availability.

The SDI initiative is a partnership between the Global Spatial Data Infrastructure Association (GSDI), the Rwanda Development Gateway Group and the CGIS-NUR. The initial focus was on spatial data inventory and metadata management for the spatial data holdings at the CGIS. An inventory of existing spatial datasets was conducted and the current state of their metadata was assessed with the aim of improving it. The metadata search facility developed is the Rwanda Metadata Portal.

Currently, the CGIS-NUR is in the process of developing a spatial data sharing policy document.

Box 3: What is Spatial Data Infrastructure (SDI)?

A spatial data infrastructure (SDI) is a framework of spatial data, metadata, users and tools that are interactively connected in order to use spatial data in an efficient and flexible way. Another definition is the technology, policies, standards, human resources and related activities necessary to acquire, process, distribute, use, maintain and preserve spatial data. Some of the main principles are that data and metadata should not be managed centrally, but by the data originator or owner. Tools and services connect via computer networks to the various sources. A GIS is often the platform for deploying an individual node within an SDI. Good coordination between all actors is necessary as is the definition of standards.

Due to its nature (size, cost and number of interactors), an SDI is usually driven by government. Examples include the United Nations (<http://www.ungiwg.org/documents.htm>), the United States (<http://www.fgdc.gov/nsdi/nsdi.html>) and Kenyan SDI initiative <http://www.knsdi.go.ke/>

Source: Ryttersgaard 2001

Capacity building

The assessment looked at the available skills and equipment that exists, and based on this, highlighted areas where the respondents felt more capacity was required.

Human resources

The levels and numbers of employees vary greatly from one organisation to the next. When staffing levels are low, tasks considered mundane such as data collection, checking and archiving tend to get relegated. High staff mobility can also result in reduced focus. In some cases, new staff with no historical institutional knowledge and understanding have re-engaged in activities or ignored data unknowingly leading to wastage of resources including repetition of data collection.

Technical capacity to handle and manipulate environmental information also varies. Most institutions identified the need for data collection, data analysis and technical writing as major constraints. Some organisations had a decent number of well-qualified personnel with skills in the management of environmental information. This is especially the case in research or academic-based institutions. Other institutions are not so fortunate, especially at local levels. For instance in Nyamagabe district only about four officers in the district can manipulate GIS data (Ndayitabi 2009). The main areas identified by respondents for training included:

- Data collection, entry, processing and analysis,
- Quality assurance,
- Database development,
- Development of indicators,
- Technical writing,
- Proposal writing,
- GIS and remote sensing,
- Archiving of data and spatial imagery,
- Graphic design (publishing),
- Communications,
- Web applications,
- Environmental management and planning for sustainable development, and
- Environmental accounting, fiscal reform and budgeting.

Equipment

Although most organisations have computers, their quality and quantity varies. Some organisations like CGIS-NUR, Ministry of Infrastructure, ISAR, RECO-RWASCO, Ministry of Finance, NLC, have state-of-the-art computers and software, with fibre optic or satellite-linked internet access. At the other end of the spectrum are institutions with no computing or even communication facilities. This latter group make up a third of all surveyed institutions. This extreme variation in computing capacities raises challenges when institutions attempt to share data. Even where equipment is available, maintenance is at times a problem especially where departmental finances are scarce. This situation is more prevalent at the district level. Table 2 shows the equipment requirements of the institutions surveyed.

Another issue is the use of different software to handle similar but sector-specific data needs of some institutions. For instance the meteorology department uses Windsurf software to draw maps with isobars, and Climlab software for statistical analysis. CGIS-NUR uses ArcGIS and ERDAS Imagine for their mapping and image processing work. The use of different software can become an issue in the face of data exchange and software integration.

Table 2: Equipment needs of the institutions surveyed

Organisa- tion	Equipment requirements	Organisa- tion	Equipment re- quirements
MINISANTE	Electronic archives	National Land Centre	Database manage- ment systemGeo- data processing
OGMR	GIS hardware and software- Database management systemsMin- eral analysis laboratories- Field equip- ment for new mining data	CGIS-NUR	Software (image processing, pro- fessional cartogra- phy)Printers (dual side)PlottersAo scanner Up-to-date licence for GIS & remote sensing software Broadband Inter- net connectivity
Rwanda Initiative for Sustainable Develop- ment (RISD)	Scanners- Graphic design equipmen- tRemote sens- ing equipment- Video camera	REASON	PhotocopierWeb serverInternet client
RENGOF	Photocopier- Web serverIn- ternet client	MINECO- FIN	Document man- agement systemLi- brary system
Rwanda Bamboo Society	Photocopi- erLocal Area NetworkCom- munication/ groupware		

Challenges and gaps

The foregoing chapters provided an indication of the current status, capabilities and requirements for environmental information management in Rwanda. This section of the report synthesizes the findings by presenting an analysis of the strengths, weaknesses, opportunities and threats (SWOT) regarding environmental information management. Hopefully, this analysis will provide REMA with some insight into areas which could be improved.

The SWOT analysis is presented in Table 3 along the following lines:

- Institutions and management of environmental information
- Availability of core datasets
- Application of existing data and information
- Existence of networking activities
- Capacity building
- Policy and legal framework



Table 3: Analysis of the strengths, weaknesses, opportunities and threats for environmental information management in Rwanda

Issue	Strength	Weakness	Opportunity	Threat
Institutions and management of environmental information	REMA is mandated by Law No. 16/2006 to collect, manage and disseminate environmental information for various purposes.	The mandate of REMA is vague regarding the management of environmental information in other institutions. The requirement for collaboration in the area of information is not formalized and this hinders the management of environmental information.	Each institution maintains specific responsibility for environmental management as stipulated in their individual expert mandates. Under Law No. 16/2006, REMA has the mandate to produce the SOE. This could be used as a tool to encourage networking and information sharing among the REIN members.	The lack of willingness to share or exchange data between the institutions.
Availability of core datasets	Core datasets are available in the institutions.	Data has some limitations like currency of dataset, completeness, quality/accuracy, scale, resolution and complete absence of data. The sectoral approach to data collection and management opens up avenues for potential conflict between institutions, and creates problems related to quality and standards. Lack of consensus on indicators and therefore datasets used to monitor progress.	Information management functions of institutions as provided for by law. Collaborative arrangements with regional institutions like the Regional Remote Sensing Centre in Nairobi that can negotiate with international data providers or software makers like NASA and SPOT.	Institutions may be unable to invest in state-of-the-art equipment and human resources required to maintain accuracy, manageability and timeliness to contemporary standards. Although not an immediate problem, commercial interests governing the sale of data may override the initial networking ethos and put restrictions on availability of data.
Application	Environmental information is being used to support decision making and development planning.	Absence of an environmental resource centre which would otherwise enhance access to and use of the environmental information	Demands and needs of the users and availability of new technologies can drive the process for new and innovative approaches to environmental information management and products.	Institutional ability to tailor data production to the users' needs may not happen. Public perceptions can undermine the usefulness of data.
Capacity building (human resources and equipment)	Positive political will within REMA. Supportive development partners like GRID-Arendal and UNEP to enhance professional development. Existence of institutions with expertise provides possibilities for in-country capacity building.	Few professionals in natural resources sector trained in the requisite information management skills.	Prospects for organisational learning between institutions. For instance from the current SDI initiative: lessons learned could be disseminated and integrated into the REIN. Some Rwandans have training in environmental information skills e.g. GIS and remote sensing	Regular investment in state-of-the-art equipment and training of staff can be a challenge. Inadequate staffing levels within institutions specifically to deal with environmental data.
Networking	Various networks already exist within Rwanda. Partnerships with local institutions and with development partners.	Conflicting institutional policies for information management and networking	The Spatial Data Infrastructure initiative presents opportunities for improved networking. REIN activities open avenues for targeted programmes to fill in any data gaps. Decentralisation policy offers a chance to build information sharing systems from the grassroots, while addressing issues that are of relevance to the specific region.	Linking environmental information networking to policy process (eg ERDPS) to ensure relevance
Policy or legal framework	There exists a policy framework that supports the right to information on the state of the environment and regular reporting on environmental issues.	The environment policy does not clearly call for the sharing and exchange of environmental information between institutions.	The new Access to Information Bill (2009) may offer prospects for improved information exchange between institutions and in the public domain.	Funding for the activities related to environmental information could be improved.

Conclusion and Recommendations

Conclusion

It is evident from this survey that there is potential and capacity for environmental information networking in Rwanda. However, the level of capacity varies between institutions. Some institutions manage information because it is part of their mandate, while others are exclusively data users. For those institutions that manage core data which is essential to their work, they may inevitably need information that may be produced by other organisations.

Either way, there is need for better collaboration between institutions in terms of information exchange and sharing. All institutions working in the sector of natural resources will benefit from the creation of a better infrastructure for the exchange and sharing of environmental data. Less time will be spent collecting data, cross-checking and analysing it. An environment information network that delivers better access to data at all levels of society will support the country's development objectives and drive economic change.

Recommendations

There are many arguments in support of the establishment of a REIN to facilitate data exchange, sharing of environmental information and to reduce duplication of effort. Although preliminary work has been accomplished with regard to establishing the REIN, it will be necessary to bring possible network members together, first of all to buy into the concept and select the core data producers for capacity building.

Further to this the core data producers should meet to agree on the overall strategy, general framework for the network including its management, basic information layers, training and equipment for all participating institutions. It could also be possible to agree on a time frame after which, based on outcome, scale up of activities should be commenced. Box 4 highlights some of these steps.

Box 4: Suggestions for implementing an effective Rwanda Environment Information Network (REIN)

Planning stage

- Introduce the EIN concept eg AEIN programme of UNEP and others.
- Draw up a work plan to establish a REIN.
- Carry out an assessment to establish the status of environmental information management in Rwanda.

Pilot activities

- Hold a national workshop to present the findings of the above assessment, gain consensus and agree on the REIN work plan, implementation structure and select pilot institutional and local nodes, and agree on memoranda of understanding.
- Start-up activities such as establishment of working groups to develop network tools on data standards, training or indicator development.
- Implement pilot capacity building activities – equipment purchase and staff development.
- Execute pilot activities around an agreed network product.

Implementation

- Test and fine tune the tools and mechanisms to facilitate data collection and exchange and interoperability of systems.
- Collaboration with development partners and neighbouring countries for learning, expertise or financial support.
- Participate in national, regional and international environmental information activities.

Up-scaling the network activities

- Evaluate pilot phase and based on findings address key challenges and design an implementation strategy for the future.
- Increase number of participating institutions at national and sub-national level.
- Hold regular network meetings for purposes of continuous dialogue between members.
- Implement an outreach strategy to enhance public awareness of the REIN.
- Produce regular products such as SOE reports, thematic maps, data catalogues and databases.

Maintaining relevance into the future

- Carry out regular market research to understand the users' and producers' information requirements and needs and ensure currency of the REIN approach.
- Work towards financial sustainability through the national budget.



Table 4: Suggestions for capacity building

Human resource development	Technology implementation	Infrastructure development
• Team building awareness in using information to support decisions and policy • Appropriateness of technology	• Hardware selection and installation	• Institutional frameworks defining roles and responsibilities • Organisational structures
• Training in concepts and methods for systematic data collection • Use of standards • Use of data and appropriate indicators • Quality assurance • Training of trainers • Integrated environmental assessment and reporting	• Software selection and installation database management systems • Geographic information systems • Graphic and presentation packages • Image analysis software	• Networks data sharing • standards and harmonisation practices • "lead" centres
• Training in technology tools system specifications • Assessing functionality • Specific software packages • Training trainers	• Telecommunications capacity local and wide area networks • Email • Internet connections	• Policy strengthening legal frameworks • Data dissemination

Source: Adapted from Martin 1996, Ndayitabi 2009, REMA 2009

Issues of institutional coordination and staffing are critical to the success of the REIN. The institution selected to coordinate the REIN should ideally have the mandate for environmental oversight in the country. One such institution is REMA. If REMA is to take the lead in coordinating the REIN, issues of staffing will be critical. Currently there is only one staff member within REMA who is leading the REIN initiative under a project framework. The project approach does not lend itself to continuity and long-term sustainability, and may likely affect the approach towards network activities. Capacity building is likely to be a key component of activities in the REIN. As observed from the survey, the institutions are at different levels in terms of human capacity (numbers and skills) and available equipment. As some of the organisations lack computing facilities, there is a need to upgrade these to bring them up to the same level as the others. A more comprehensive equipment-needs assessment may be necessary. In any event, the guiding principle for capacity building should be inter-operability and functionality. Institutions will need to identify and implement systems that are appropriate to their requirements and resources, but that also enable easy exchange of data across different software protocols. Some areas for training are shown in Table 4.

Possible mechanisms for implementing capacity building activities in any of the above areas include: exchange arrangements, formal training, workshops, symposia, pilot projects and on-the-job training.

The establishment of a library or environmental resource centre would be an asset to environmental management in the country. Improving access to environmental information would enable individuals to play a more meaningful role in decision-making and strengthen opportunities for environmental justice. Not only would a library support network activities, but also the wider environmental community. Such a resource centre should be easily visible and accessible to its users and should also have room for expansion. The experience in Uganda showed that soon after the establishment of the information centre, the number of users quickly outgrew expectations (Gowa 2009). In these cases, issues of staffing would also have to be considered. Box 5 shows some of the issues that would need to be considered in setting up such a resource centre.

Box 5: Issues for consideration in setting up an environmental resource centre

- Clearly define the rationale for setting up the resource centre
- Carry out an information audit – determine REMA's information resources and identify the information needs
- Recruit and train staff to manage the centre
- Define services to be provided by the library
- Budget for and manage the finances of the centre
- Set up the resource centre based on recommendations from the audit. This would include premises, design and technical requirements. Lessons can be learned from other resource centres such as NEMA in Uganda and ENFO in Ireland.
- Develop a system to ensure regular acquisition, storage, organization and dissemination of information materials in various media
- Establish networks and other resource centres to facilitate sharing and exchange of information, facilities and expertise
- Pursue alternative sources of support for the library inside and outside the organization
- Develop and carry out an outreach programme for the resource centre, including marketing and advertising
- Develop and implement an information policy to guide the functioning of the resource centre.

The REIN should undertake activities to promote the use of environmental information in decision-making processes at all levels within the country. One possible methodology could involve working on a suitable 'outcome' that will bring the network members together. Having all institutions work on providing their 'data layers' will help to solve issues of data compatibility and coordination; thus collectively facilitating the proper and smooth functioning of the network and implementation of its activities. One such product could be the SOE, which could be adopted as a core product of the REIN. The data layers would then be the data type for which any and each of the network members has the institutional mandate. Future reporting of SOE could be structured to include major input from the key network members to start with, with room for expansion as the process continues. If the SOE project

is considered too big at the outset, other suitable options could be to update a map sheet of an identified area in Rwanda. Whatever the selection of project, REIN activities must be carried out within the framework of Rwanda's obligations to national development goals and targets. Each network member would thus continue to provide information support to national priorities such as the EDPRS while still fulfilling their own mandate. In order to address the issue of lack of awareness of the existence and availability of environmental information, it is necessary that all participating institutions develop a system of documenting their data through the development of metadata. The existence of metadata will help to address this type of problem.

An outreach strategy will be required to enhance dissemination and use of information, generate and increase awareness of the REIN. Improved perceptions amongst the public and policy makers would contribute to improved attitudes towards data and build confidence across the network. By remaining relevant to key national development processes, the REIN will at the same time be ensuring its own future sustainability.

Policies and strategies to guide access to and management of environmental information need to be developed. This would strengthen the provisions for information management that already exist under the environment law.





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Acronyms

CGIS-NUR	Centre for Geographic Information Systems and Remote Sensing of the National University of Rwanda
EDPRS	Economic Development and Poverty Reduction Strategy
EIA	Environment Impact Assessment
GIS	Geographical Information System
ISAR	Institute de Sciences Agronomiques du Rwanda
MINAGRI	Ministry of Agriculture and Animal Resources
MIDIMARC	Ministry of Disaster Manegment and Refugee Affairs
MINECOFIN	Ministry of Finance and Economic Planning
MINIFOM	Ministry of Forestry & Mines
MINISANTE	Ministry of Health
MININFRA	Ministry of Infrastructure
MINELA	Ministry of Environment and Lands
NAFA	National Forest Authority
NISR	National Institute of Statistics of Rwanda
NLC	National Land Centre
OGMR	Geology and Mines Authority
RDB	Rwanda Development Board
REASON	Rwanda Environmental Awareness Services Organization Network
RECO-RWASCO	Rwanda Electricity Corporation -Rwanda Water and Sanitation Corporation
RENGOF	Rwanda Environmental NGOs Forum
RISD	Rwanda Initiative for Sustainable Development
SDI	Spatial Data Infrastructure
SOE	State of Environment





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