

Spatial Data Infrastructure Development in Lesotho: Overcoming Obstacles

Lehlohonolo David MOETI, Lesotho

Key words: Policy, standard, technology, spatial, infrastructure, information

SUMMARY

Basic to the ingredients for sustainable development for any nation is the availability of good information pertaining to national resources and services. Such information is vital to governments, parastatals and NGOs for planning purposes and decision-making. Information is derived through manipulation, analyses and interpretation of data. Information serves as a basis for knowledge. In order to plan the appropriate use of their resources, nations require the appropriate knowledge about their environment.

This paper describes efforts to develop spatial data infrastructure in Lesotho. It concludes that the common practice of over-protection of spatial/environmental data by government departments and institutions is a serious liability to such governments. Data is of value only if it can facilitate generation of information that can be used to benefit the community. Lesotho is yet to benefit from tones of spatial and environmental data accumulated over the past years and yet is still inaccessible in offices. The influence of international organizations on national projects associated with spatial data as an example of best practice is highlighted.

Spatial Data Infrastructure Development in Lesotho: Overcoming Obstacles

Lehlohonolo David MOETI, Lesotho

1. INTRODUCTION

Virtually the entire development of countries hinges around the availability of resources, whether natural or otherwise. Resources are located in space and hence have a spatial component. Spatial data is data that defines a location or is associated with a particular place on the earth's surface. Spatial data describing location, quantity and status of resources, infrastructure or services is vital for decision-making both at national and global level. Because of the significance of these data it has become necessary worldwide to have it coordinated under what is termed Spatial Data Infrastructure (SDI). SDI whether national, regional or global, facilitates ready access to spatial or geographic data. Global Spatial Data Infrastructure (GSDI) achieves this through coordinated actions of nations and organizations that promote awareness and implementation of complimentary policies, common standards and effective mechanisms for development and availability of interoperable digital geographic data and technologies to support decision-making at all scales for multiple purposes. These actions encompass the policies, organizational remits, data, technologies, standards, delivery mechanisms, and financial and human resources necessary to ensure that those working at the global and regional scale are not impeded in meeting their objective (www.gsdi.org).

Kunda and Musonda (2002:13) perceive National Spatial Data Infrastructure (NSDI) as,

the technology, policies, criteria, standards and people necessary to promote geo-spatial data sharing throughout all levels of government, the private and non-profit sectors, and academia. It provides a base or structure of practices and relationships among data producers and users that facilitate data sharing and use. It is a set of actions and new ways of accessing, sharing and using geographic data that enables far more comprehensive analysis of data to help decision-makers chose the best course(s) of action.

The approach and operation of SDI at national level vary from country to country depending on the circumstances or environment in which it is set up. Hall and van Orshoven (2003) point out that the Australian spatial data infrastructure (ASDI) coordinated by Australian New Zealand Land Information Council, was established through the involvement of the heads of states of the concerned governments. The primary objective of ASDI is to coordinate the collection and transfer of land related information between different levels of government and to promote the use of that information in decision-making.

In Australia, the benefits and costs for establishing a National Spatial Data Infrastructure (NSDI) have been calculated as 4:1, and the existence of ASDI resulted in savings estimated

at \$ 4.52 million Australian Dollars (approximately 2.6 million EURO) for the period 1989-1994. A significant factor of the objectives for implementing ASDI was to increase high level political awareness and support. Spatial information is extremely crucial for decision-making by politicians hence its coordination, quality and accessibility is matter that affects them.

In the United States NSDI is described as technology, policies, standards, human resources, and related activities necessary to acquire, process, distribute, use, maintain and archive spatial data. Like in Australia, the national significance for coordination and management of spatial data saw the Office of Management and Budget (OMB), setting up an inter-agency Federal Geographic Data Committee (FGDC) through Circular A-16 that required coordination in the development, use, sharing and dissemination of surveying, mapping and related spatial data. Very senior government officials are part of FGDC (Hall and van Orshoven, 2003).

Drawing on another comparison, Hall and van Orshoven (2003) suggest that the Canadian Geospatial Data Infrastructure (CGDI) was influenced by the Inter-Agency Committee for Geomatics (IACG) which is a high level committee comprising federal government agencies and the Canadian Council of Geomatics (CCOG). Striving for the same objectives as NSDIs in Australia and the US, CGDI is claimed to have realized savings of up to 10 times on financial resources. In South Africa the National Spatial Infrastructure Framework (NSIF) has been established within the Department of Land Affairs and was endorsed by the Cabinet. Like in the cases already cited, the underlying objective was to minimize the costs associated with spatial data due to unnecessary duplication and to provide framework for ensuring that investment in spatial information results in increased value and quality of information for decision-making. NSIF is advised by Committee for Spatial Information (CSI), made up of senior managers of national and provincial departments and representatives of local authorities (www.nsif.org.za).

In Sub-Saharan Africa, the concept of SDI has been facilitated by the Environmental Information System (IES) Program funded the World Bank in the 1990s. Figure 1 shows representatives of environmental units in Lesotho at an EIS/GIS SETES (SADC Environmental Education and Training Sub-program) national training hosted by the Department of Geography, National University in 2002 with support from the Program under the coordination of the University of Botswana. The original perception of EIS has evolved considerably since that time. From a purely technological concept, EIS is now considered mainly as an institutional and technical framework, together with the set of data management tools, essential for enabling environmentally related data and information to be accessed and analysed by a broad spectrum of users to assist in decisions affecting the environment, natural resources and sustainable development at all levels from national to global (Gavin and Gyamfi-Aidoo, 2001). NSDI essentially fulfills the objectives of an EIS.



Fig. 1: SETES National Training Workshop Participants at NUL in June 2002

Except for South Africa, the preceding background suffices to underline the significance of NSDI in developed countries. In the same manner developing countries including Lesotho, stand to reap huge benefits by developing their own SDIs. As noted by Mabote, Mapetla-Mokhesi and Molapo (2000) the value of geographic information to support decision making and management of natural resources was indicated as crucial at the 1992 Rio Summit as well as by the special session of the United Nations General Assembly during the appraisal of the implementation of Agenda 21 in 1997. Furthermore, the Johannesburg Plan of Implementation endorses the sharing of knowledge and experience through the use of information and communication technologies. For Lesotho, the principle of availing information in order to inform decision-making is enshrined in the Environmental Policy of 1998 (Makume, Mapetla-Mokhesi, Hoohlo & Kabi, 2004). Consequently, knowledge of what environmental data or information is available, nationally, and where and how it can be accessed, is crucial for a sustainable development of our environment. The location map for Lesotho is shown in figure 2.

Numerous resource inventories have been undertaken in Lesotho in the past and these may still be accessed in the form maps and reports, for example, the Land Resources of Lesotho by Carroll and Bawden published in 1968. Binnie and Partners produced a series of reports on water, geology and soil resources in 1971. Extensive studies on ground water resources were carried out by Bonney during 1974 and 1975, and a comprehensive study and mapping of the Lesotho soils was completed by Carroll and his team in 1979 (Schmitz & Rooyani, 1987).

Between 1983 and 1986 the Range Division of the Ministry of Agriculture initiated a vegetation survey with a particular focus on the development of Rangeland policy. Information from the study was used for cattle inventory whereby digital capturing and analysis of spatial data was employed in 1989 (Moeletsi, P., 2001, pers. comm.). Nonetheless, today, a great deal of this important information that was undoubtedly expensive to collect, is either not readily accessible or no longer available. Firstly it may not

be readily accessible because only limited copies can be found and secondly it may not be available because remaining copies have either been misplaced or lost. Furthermore, during the 1998 political upheavals, the Range Division lost a lot of information through looting. However, a great deal of digital data has been recovered from consultants. This point underlines the value of thoughtful data archiving and exchange.

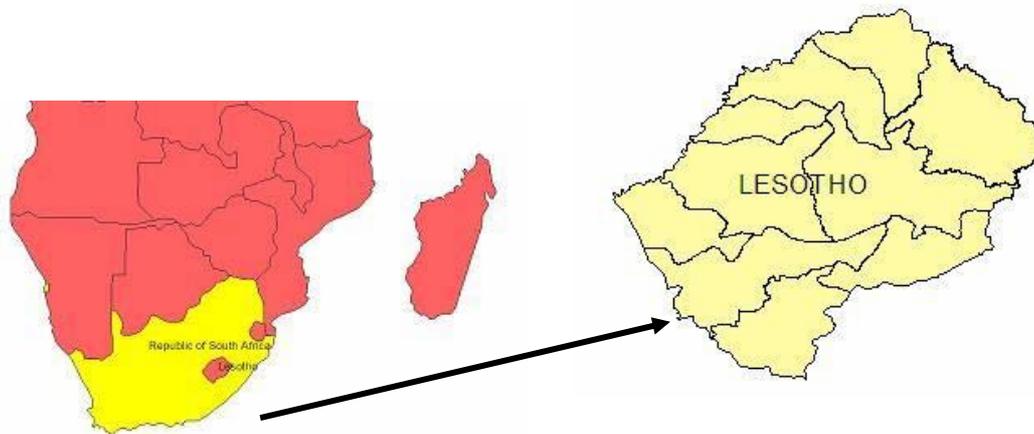


Fig. 2: Location map of Lesotho

Two fundamental questions need to be raised here in connection with the objectives for compilation of such information.

- Was the information used to inform policy in order to improve the utilisation of the relevant natural resources before becoming unavailable or inaccessible?
- Are further scarce financial resources being expended on studies of certain natural resources over and over again because there is no sufficient information available from previous studies for decision-making or because there is no systematic record of information available?

Similar or related environmental data continues to be collected by different organisations for their own specific purposes thus in many cases resulting in a duplication of efforts. These problems can be avoided to some degree by creating a national environmental and spatial metadatabase. The problem that might still remain even after the creation of such a database could be the incompatibility of data and/or institutional obstacles. Hence the need for the national data access and exchange guidelines which once accepted could be formulated into a policy cannot be overemphasised.

2. SPATIAL DATA POLICY INITIATIVE IN LESOTHO

Indications for concern regarding spatial data exchange in Lesotho were initially noted in the discussions that led to the formation of an informal group made up of professionals from the Department of Geography National University of Lesotho (NUL) and some government

departments in the Ministry of Agriculture and the then Ministry of Interior and the Lesotho Highlands Development Authority (LHDA) in the early 1990s. The group became known as the National Remote Sensing Coordination Committee (NRSCC) and was able to attract membership from other government departments that made use of, or were potential users of aerial photographs and satellite imagery. With the advent of Geographic Information Systems (GIS) the initiatives of NRSCC were formalised and expressed in the constitution of the Lesotho Society for Geographic Information Systems (LSGIS) established in 1992. Indeed most of the participants of the Third SADC Regional EIS Workshop held in Gaborone, Botswana in 1995, where LSGIS represented Lesotho echoed similar sentiments on matters of spatial data exchange (SADC-ELMS 1995).

The requirement by the Drakensberg/Maloti Mountain Conservation Programme for an assessment for availability of facilities and spatial data for geographic information systems (GIS) was useful in documenting the level of geo-spatial data sharing and exchange in Lesotho in 1999. In that study, 8 government departments, a parastatal and an academic institution were identified to possess some level of GIS implementation. The study showed that there was no coordination mechanism for the different role players in GIS implementation (Moeti and Cutler, 1999). Although there has not been an update of the 1999 GIS baseline study, the involvement of both government and parastatal has increased and lack of coordination continues. LESGIS became moribund in 1995, however, the ground-work it initiated towards the development of policy in relation to spatial data standards and exchange has been pursued by the Committee on Environmental Data Management (CEDAMA) established under the National Environmental Secretariat (NES), Ministry of Tourism, Culture and Environment (MTCE) in 1999. The mandate of NES is to co-ordinate all environmental issues throughout the country and CEDAMA acts as an advisory body. Membership of CEDAMA is drawn from the environmental units of various line ministries, NGOs, private sector and parastatals and their duty is to co-ordinate environmental data generation and activities. The specific objectives of CEDAMA are:

- To promote a culture of environmental data exchange
- To advise NES on issues of environmental database management
- To advise NES on issues related to data quality standards
- To advise NES on the formulation of relevant policies
- To advise NES on measurable environmental quality indicators for different sectors of the economy
- To assist with the analysis of trends in environmental indicators and recommend appropriate policy interventions.

As a first step in an attempt to equip CEDAMA to fulfil its mandate, the first Environmental and Spatial Data Management Workshop was organised in December 1999. The objective of the workshop was to clarify the committee's mandate and to develop strategies of achieving the same. Significant input was received from keynote speakers who were from the National Spatial Information Framework (NSIF) in South Africa. The workshop concluded that the top management of various departments that deal with environmental data had to be taken on board with regard to significance of the dissemination of information generated from spatial data to all levels of the community, hence enhancement of its participation in policy

formulation. Consequently CEDAMA organised a workshop on Data Management for Decision-Makers in December 2000. The theme of the workshop was “informed decision making for sustainable development.” The National Capacity Building in Environmental Management Project funded by Danish Co-operation for Environmental Development (DANCED) initiated in February 2000 was influential in the hosting the workshop. To workshop heads of departments requires an intervention from structures above the heads themselves. The workshop was poorly attended.

In addition, through the recommendations made to NES by Moeti and Cutler (1999) DANCED has funded a programme on Data Management Capacity Building within NES and the development of policy guidelines in relation to data exchange and standards. Naturally, one would have expected the Department of Land Surveys and Physical Planning under the Ministry of Local Government, to be playing a leading role in guiding the process on issues related to spatial data since they are responsible for national mapping or spatial information. However, the Department’s participation and contribution has not been to the expected level although it has expressed unwavering support to the concept. Lesotho is not currently formerly affiliated to the regional or global SDI because that requires a commitment of a government ministry and in this case the Ministry of Local Government.

The vision of the Chief Surveyor’s office is to have the Lesotho map 1:250 000 which is already in digital format, accessible to other GIS users as the current format (DXF) is not popular. The 1:50 000 topographic maps are yet to be digitised (Selebalo, 1999). Digital urban mapping at 1:2500 has been undertaken and the data is now accessible to the general public and GIS users at a prescribed cost. In order to address the question of mapping specifications, the office of the Chief Surveyor arranged for a consultative workshop with spatial data users in the country in October 2000. The purpose of the workshop was to consolidate the views of spatial data users in relation to the current plans of national digital mapping specifications and standards. However, serious financial constraints within the Department particularly in 2003/4 led to very little being achieved in terms of digital spatial data. Indeed a concern has been raised especially among members of CEDAMA that the pricing for geospatial products, in particular digital data is unreasonably high compared to other spatial data producers.

In an attempt to find out what environmental and spatial information was available in different environmental units, NES initiated a project of metadata creation in 1997 which still continues today but with little success. The exercise received new impetus with the support from DANCED in 1999. The significance of this exercise is that such information is fundamental for professional data exchange. During the workshop on Data Management for Decision Makers, it was reported that about 93% of the records held in the metadatabase were from LHDA (Mabote et al. 2000). The Department of Land Surveys and Physical Planning has since the beginning of 2001, embarked on a metadata development exercise for all spatial data in their possession. The process is still continuing, once it has been completed, the metadata will be made available to the users. The same workshop further deliberated on data exchange guidelines. Data exchange and access guidelines were further presented for discussion during the Workshop on Sustainability/Environmental Indicators for the State of

the Environment Report 2002 held in January 2001 as a continued effort to seek input from the stakeholders.

3. THE PROPOSED NATIONAL DATA ACCESS & EXCHANGE GUIDELINES

Major issues that need to be addressed in relation to data access and exchange include, copyrights, ownership, privacy, freedom of access to public data, standards and/or quality control, documentation and interoperability (Mabote et al. 2000). The authors further submit that it is important that originators of data are known so that they should be duly acknowledged after data has been exchanged. Hence the emphasis on the establishment of metadata (complete data documentation). Data originated by government departments often ends up in being copyrighted by non-originators and thus limiting its accessibility to the public. Value added data should acknowledge the originator and new copyright introduced as required.

Government departments acquire data and generate information primarily as a service to the tax-payers. Section 95 of the Environment Act, underlines free access of environmental information to the public. However, some data may be sensitive (classified) and consequently may not be released to the public. The usability of digital data may be limited by its structure and/or file format, whether they are compatible to those of other users. To some extent this is still a problem, though technological advances in software have made great inroads in addressing the problem.

The proposed guidelines for Lesotho adopt a classification of users criterion. These users have been grouped as; trusted data users, trusted data suppliers and other users. Data categories have also been classified as sensitive, ownership, public and departmental specific. There is an exchange agreement that defines the roles and obligations of the data supplier and recipient. It is expected that the supplier of data will:

- Provide a data quality statement
- Levy a charge based on cost-recovery
- Provide efficient and effective access to data
- Define conditions of access and use of the data

On the other hand, the recipient of data has to agree to:

- Not further disseminate the data without written agreement from the custodian
- Give back updated copies of the data to the supplier as appropriate
- Not sell the data to any other third party
- Acknowledge the source of data in any documentation derived from or associated with the use of the data.

The guidelines propose that data requests should be send to heads of Data Management Divisions who will ascertain data category as well the user category. A charge to be levied can then be established and data provided (Mabote et al. 2000). More than a decade since Lesotho began working towards a central coordination of spatial data, very little seemed to have been achieved and the challenges that still remain seemed insurmountable. Reports of SDI developments from other SADC member states during the regional SDI meeting held in

Johannesburg in early 2004 added new enthusiasm in the midst of imminent despair. CEDAMA was aware that there was a need to win support at a Ministerial or at least Principal Secretary level, which had hitherto not been the case. Without support at such a level it was obvious that the committee was faced with an impossible task.

4. A BREAKTHROUGH FOR THE DEVELOPMENT OF NSDI IN LESOTHO

Immediately after the Johannesburg 2004 Regional SDI meeting, CEDAMA set up a task force to work on a motivation paper on SDI to be presented before the parliament. Since the Committee's secretariat is in the Ministry of Tourism Culture and Environment (MTCE), the motivation was to be sent through the same ministry. It was advised that the Minister of Tourism Culture and Environment would discuss the motivation of with the Minister of Local Government, as the general feeling was that, the responsibility for championing NSDI lay in that ministry. In November 2003 a study funded by the World Bank on "Lesotho Integrated Transport Program (ITP) GIS Enhancement Needs Assessment" was carried out. The consultants met with some members of CEDAMA and the Department of Geography at the National University of Lesotho (NUL). The Department of Geography through its representation in CEDAMA echoed the Committee's sentiments that the consultants will present their findings and explain the significance of NSDI as it relates to ITP to the decision and policy makers at levels suggested above, their assignment would have failed.

In the meantime, 2004 also saw the hosting of the clearinghouse and metadata training course by NES and NUL under the aegis of EIS Africa and SADC Regional Remote Sensing Unit (see figure 3 below). The training injected more enthusiasm for lobbying for government support at high level. In June 2004, the consultants presented their final report in a number of meetings one of which was specifically for the Principal Secretaries! Someone who was part of that meeting remarked that most if not all the Principal Secretaries started presenting justifications why each one of them believed that NSDI should be the responsibility of their own ministry! It was eventually agreed by the Ministers and their Principal Secretaries that the Ministry of Finance and Development Planning (MFDP) would facilitate the development of NSDI. At this point, the idea of presenting the motivation paper that had been completed fell off. Through its liaison with CEDAMA and other stakeholders MFDP has commissioned a baseline study for the development of NSDI.



Fig. 3: National Metadata and Clearinghouse Training Workshop in June 2004

Spatial data has been formally or informally exchanged between government departments, institutions and individuals based on some agreement which is usually not inclusive of everyone who may require such data. It is therefore imperative that for every country, there should be a clear policy or guidelines

that govern production and dissemination of environmental or spatial data at a national level. This is particularly important with regard to the information for which governments may have heavily invested in, with the purpose of such information reaching or being used for community development. If such information fails to reach the target communities or to influence decisions on their behalf because of limited accessibility, or has to be re-gathered because knowledge of its existence was limited, that is tantamount to wasteful resource use. In other words governments departments are failing to discharge their mandates. This has been happening and continues to happen in many developing countries. The establishment of NSDI in Lesotho will resolve this anomaly.

5. CONCLUSION

The guidelines for environmental and spatial data access and exchange have been produced but are still to be adopted for use by all the stakeholders. Once adopted it is hoped they will form the basis for a policy on environmental data access and exchange. Whilst the question of cost-recovery seems to have been emphasised in the guidelines, it has to be understood that most government departments are mandated to render services to the public freely or in some circumstances for a nominal fee. Unless the requisition of spatial data is for profit making purposes, the free access kind of policy should be encouraged. The common practice of over-protection of data especially by government departments and institutions is in fact a serious

liability to such governments, since data is of value only if information can be derived from it, and used for the benefit of the people.

One of the requirements for spatial data to be exchanged is that it should conform to certain standards, both in terms of format and accuracy. For instance exchanging incorrect data implies that further use of such that will generate erroneous results. There are many examples of such data today in circulation. Establishment of NSDIs comprising of senior government officials supported by a cadre of experts in the related fields such as spatial sciences would guarantee that only information that conforms to acceptable standards is made available to decision-makers.

Lesotho and other African countries need to be assisted to bring on board the participation of key government officials at the decision and policy-making levels such as the principal secretaries in the case of Lesotho. Participation at this level and even higher seems to have been the foundation for success in Australia, the US, Canada and South Africa. The concept of NSDI needs to be packaged with vivid applications at a level of lay persons for each individual country and presented perhaps to governments at Cabinet level. Awareness campaigns at levels below this are not likely to attract the necessary political and financial support such as has been the case in Lesotho. Success for such high level campaign would require a cooperative effort between committees championing SDI initiatives such as CEDAMA in Lesotho and a regional body like SADC Regional Remote Sensing Unit that is responsible for regional SDI initiatives.

REFERENCES

- Chauke, M., 2004, Spatial Data Infrastructure Act (Act 54 of 2003): South Africa. Paper presented at SADC SDI Workshop, February 2004, Pretoria.
- Gavin, E. & Gyamfi-Aidoo, J., (Eds), 2001, Environmental Information Systems Development in Sub-Saharan Africa: Approaches, Lessons and Challenges, EIS-Africa.
- Hall, M. & Van Orshoven, J., 2003, Spatial Data Infrastructures in Australia, Canada and the United States: Spring 2003. Spatial Application Division, K.U. Leuven Research and Development.
- <http://www.gsdi.org>, Mar. 2004, Global Spatial Data Infrastructure home page.
- http://www.nsif.org.za/CSI/csi_backg.htm#back. Mar. 2004, National Spatial Infrastructure Framework
- <http://www.nsif.org.za/news.html>, Mar. 2004, Draft Custodian Policy and Pricing Policy.
- Kangethe, J., 1999, Spatial data infrastructures in Africa, *EIS News*, October, pp. 15-20.
- Kunda, D. & Musonda, E., 2004, Zambia – Assessment of the National Spatial Data Infrastructure to support Institutional networking and data/information sharing.
- Mabote, T., Mapetla-Mokhesi, P. & Molapo, L., 2000, Report on workshop on data management for decision makers: Informed decisions for sustainable development, December, Maseru, NES.
- Makume, M., Mapetla-Mokhesi, P., Hoohlo, Q. & Kabi, M., 2004, Spatial Data Infrastructure (SDI) Report: Lesotho. Paper presented at SADC SDI Workshop, February 2004, Pretoria.

- Moeti, L. & Cutler, J., 1999, Report on geographic information systems, data handling and information production, prepared for PARTICIP GmbH of Freiburg, Germany, Maseru, NES.
- SADC-ELMS, 1995, Environment information systems development in the SADC region: Third SADC regional EIS workshop, Gaborone Botswana, June 1995, SADC-ELMS, Maseru.
- Schmitz, G. & Rooyani, F., 1987 Lesotho Geology, Geomorphology, soils, Roma, National University of Lesotho.
- Selebalo, Q., 1999, National mapping as a component of spatial data infrastructure: Is Lesotho ready? Paper presented at the First Environmental and Spatial Data Management Workshop, Maseru, December.
- Smith, R., 1999, A consolidated effort towards sharing metadata in South Africa, *EIS News*, October, p. 21.

BIBLIOGRAPHICAL NOTES

Dr. **L. Moeti** holds M.Sc. in Environmental Remote Sensing and a Ph.D. in Natural Sciences. He is a senior lecturer in the Department of Geography, National University of Lesotho where he has worked for the past 18 years. He has wide experience working with GIS in Lesotho. Key recent tasks include assessment of available spatial data and production of maps for the Drakensberg/Maluti for Conservation purposes; Spatial data handling and mapping (GIS) in LHDA Biological Resource project at Mohale and in Appropriate Technology Sector national Needs Assessment; Geomorphological Mapping of Mejametalana Catchment in Maseru; Erosion Mapping of Ha-Makuili. Dr. Moeti has also worked as a manager of the Conserving Mountain Biodiversity in Southern Lesotho project of the National Environment Secretariat and was involved in the National Training Programme in EIS/GIS under the auspices of SETES (SADC Environmental Education and Training Sub-program). He is a member of South African Association of Geographers and Environmental Education Association of Southern Africa.

CONTACTS

Department of Geography
National University of Lesotho
P. O. Roma – 180
LESOTHO
Tel. + 266 22213732
Fax + 266 22340000
Email: ld.moeti@nul.ls
Web site: www.nul.ls