10

PGIS and mapping for conservation in Namibia

by JO TAGG and JULIE TAYLOR

Introduction

Conservation groups all over the world are increasingly using mapping technologies in the devolution of environmental management. These technologies include Geographic Information Systems (GIS). There has been a shift towards local participation in natural resource management. Participatory mapping, and the use of GIS, is seen as a logical step for capacity building and empowerment. It is also an instrument to assist environmental monitoring and management.

This article examines the emergence of mapping and GIS as a central community-based natural resource management (CBNRM) tool in Namibia's community conservation programme. Here, the use of GIS in CBNRM has evolved in response to community, NGO, and government needs.

In CBNRM, it is important to develop an equal relationship between rural communities and outside agents. So it was essential for these communities to gain access to appropriate information technology and its benefits. Now there is improved access to this technology and its outputs. This has helped strengthen local institutional capacity needed to devolve authority for resource management to local authorities and communities themselves.

The GIS approach outlined here allows for the participation of all partners: communities, government and NGOs. It seeks to integrate local knowledge with information technology. This provides a common information base that is both understandable and acceptable to all partners, and is freely available to all partners. It is used for planning, managing and monitoring natural resources, and for decision-making.

Background

Like several southern African countries, Namibia has followed the pattern of devolving rights over wildlife to rural communities. CBNRM in Namibia, however, is specifically based on the conservancy model. Communal area residents form a common property resource management institution (a conservancy). They are granted conditional rights over wildlife species while they are also able to benefit from tourism as a land-use. To be registered as such, a conservancy needs to have:

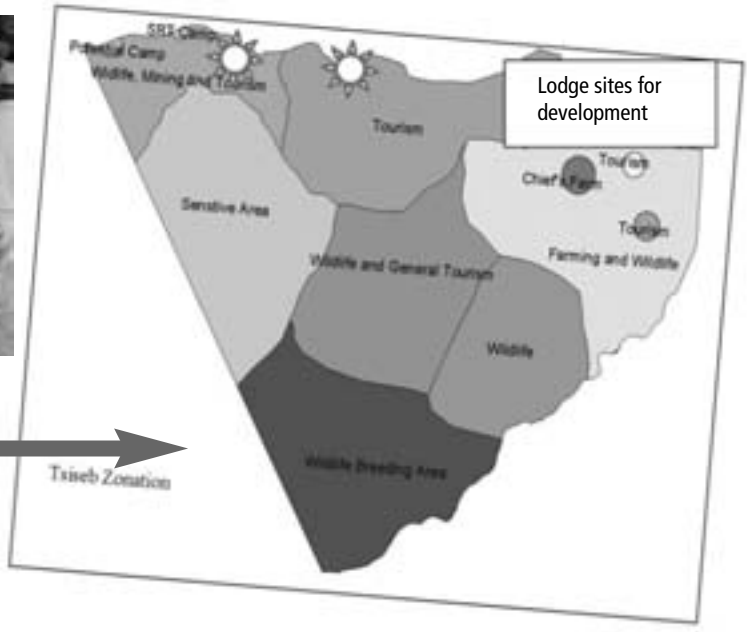
- a defined boundary and membership;
- a representative management committee;
- a legal constitution recognised by government; and
- a plan for the equitable distribution of benefits.

Conservancies are social and legal arrangements for improved natural resource management. From a natural resource point of view, they are not ecological units: they form part of a larger system. So a common overarching

Figure1: Land-use planning

Competing land use activities take place within conservancies (for example, farming, wildlife, settlement, mining). Consequently, land-use planning is a key need.

Appropriate tools are also needed to communicate the plans to residents, government and investors.



The NRM group provides assistance to Conservancies to develop land use plans and zonation maps through participatory mapping.

Credit: Greg Stuart-Hill, Jo Tagg, 2001

system that would facilitate monitoring of natural resources was required:

- across geographic areas;
- over time; and
- involving different communities and institutions.

This means that different information can form parts of a larger picture and should be continuous, representative and compatible. This was the impetus for using spatial data, mapping and GIS as tools to support CBNRM and for creating a national CBNRM GIS. More recently (in 2005) legislation was passed which affords rights over forest resources. To date, 13 community forests have been proclaimed and these contribute further to the national CBNRM effort.

GIS are not only capable of storing diverse sets of data. They are also powerful spatial analysis and modelling tools. These can prove highly valuable for monitoring wildlife and joint decision-making. Successful common property management often hinges upon both local expertise and knowledge and a broader, regional view. So it was imperative to promote a collaborative management approach between all partners in the CBNRM programme.

The Namibian CBNRM GIS developers are an informal coalition of government and NGO natural resource management service providers. A conventional user needs analysis was not undertaken at the outset as those central to the development had little GIS background but focused on immediate resource management issues. Instead, the GIS evolved slowly over several years. It started modestly in late 1995 in response to the most immediate need of mapping boundaries and infrastructure.

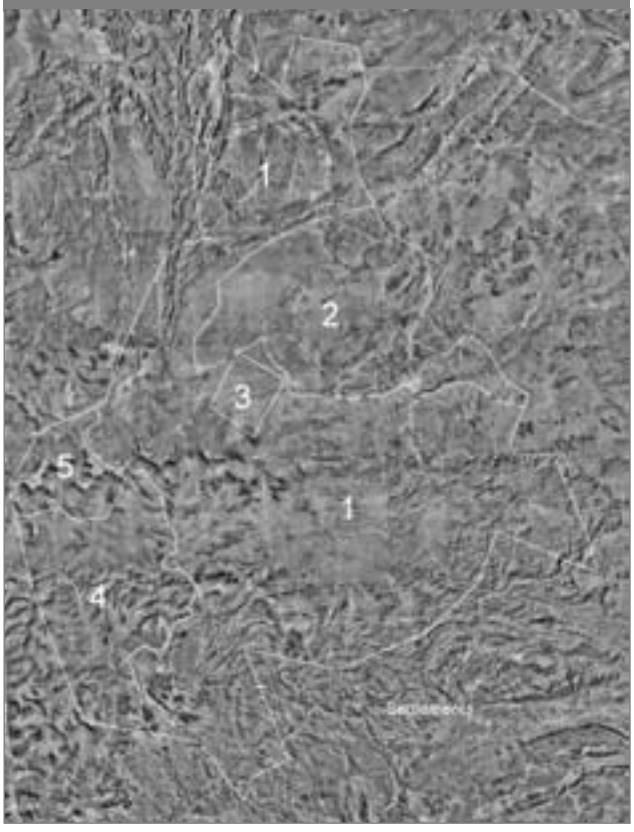
Main aim of the project

During the process of forming a conservancy, a variety of needs for spatial data tools have arisen.

Boundaries

Boundaries are a legal requirement for the registration of conservancies. Conservancies need a defined boundary agreed by neighbours. But this process has often been lengthy, due to disputes and negotiations over boundaries between different parties. So maps and spatial data, which promote common spatial understanding, are central tools for conflict resolution and decision-making.

Figure 2: ≠Khoadi //Hôas conservancy zonation



Credit: Jo Tagg, 2006

Land use planning

The purpose of creating different land use zones (zonation) is to plan land use. Using a participatory process, conservancies establish the best locations for different activities which are selected according to existing land use practices, and the nature and potential of the natural resources. Importantly, this activity seeks to reduce conflict between land uses and optimise benefits. It is not a 'one-off' activity but rather responds to changing opportunities and needs. Technicians use a variety of spatial data sets to develop appropriate maps. These support the mapping and planning process. Conflicts over resource use and benefit distribution are more readily resolved if all parties have the same spatial understanding of the contested resources.

The ≠Khoadi //Hôas conservancy zonation represents an approach which includes participatory mapping and locally undertaken resource inventories (see Figure 1). To support the process, technicians provided a range of datasets including satellite imagery, aerial photographs and topographical maps. Five zones were identified and agreed upon. Each has its own rationale and development rules:

- Zone one: livestock and wildlife zone. This is where the presence of wildlife is encouraged, but where livestock rearing is a priority. Wildlife utilisation is allowed.
- Zone two: farming. This is farming zone is the most densely settled area, where no hunting is allowed although wildlife tolerated.
- Zone three: livestock. This is an intensive livestock breeding area. A small-stock improvement scheme is located here.
- Zone four: exclusive wildlife zone. This zone is the centre of a lucrative trophy hunting enterprise. The conservancy actively supports a carefully managed and low impact hunting concession.
- Zone five: exclusive tourism development zone. This zone was added in 2004 following significant tourism investment. The conservancy developed a lodge here, using a grant, and by working with a private sector partner. This initiative has led to further investments with the re-establishment of black rhino. This meets both biodiversity objectives and development needs.

Monitoring wildlife

With conditional rights over wildlife, conservancies are also responsible for managing that wildlife. Supported by NGOs, they define certain management objectives for themselves. This includes monitoring different activities. GIS has become an essential support tool in planning, undertaking, and reporting on monitoring activities, for example:

- annual wildlife game counts (for wildlife numbers, trends and distribution);
- monitoring of poaching; and
- problem animal incidents.

Much of this data is much easier to understand when spatially represented. The spatial element has been incorporated in the event book local-level monitoring system (see chapter 9, this issue). Using GIS technologies mean that maps, based on local-level monitoring data, can be produced to support further planning. They are also useful communication tools.

Communication

GIS and maps are essential tools for conservancies to communicate their plans to other parties. They need to communicate internally with members and externally to neighbours, government, partners, donors, and investors. Using GIS and maps leads to greater shared understanding of important issues about natural resource management and land use planning.

Methodology and process

The Namibian CBNRM GIS approach has been to optimise and combine local and indigenous knowledge. It also uses the knowledge and skills of those supporting and assisting the community to build a GIS. The GIS must be accessible and appropriate for all parties and ultimately, beneficial for a wide range of natural resource management efforts. From the early stages of development, the collaborating group adopted an approach of sharing public domain datasets, as well as approaches and resources.

For land use planning, the GIS support group, which includes individuals from government, NGOs and private sector partners (e.g. tourism concession holders), collects and collates as much existing data as possible. These include commercial maps, remote sensing imagery, reports, and existing GIS layers. These are integrated into the national GIS. Service providers have helped local communities to capture additional information that is important to them, and provide maps and other spatial resources to local people for land use planning.

In terms of a support strategy for GIS in Namibia, the Windhoek-based GIS managers provide:

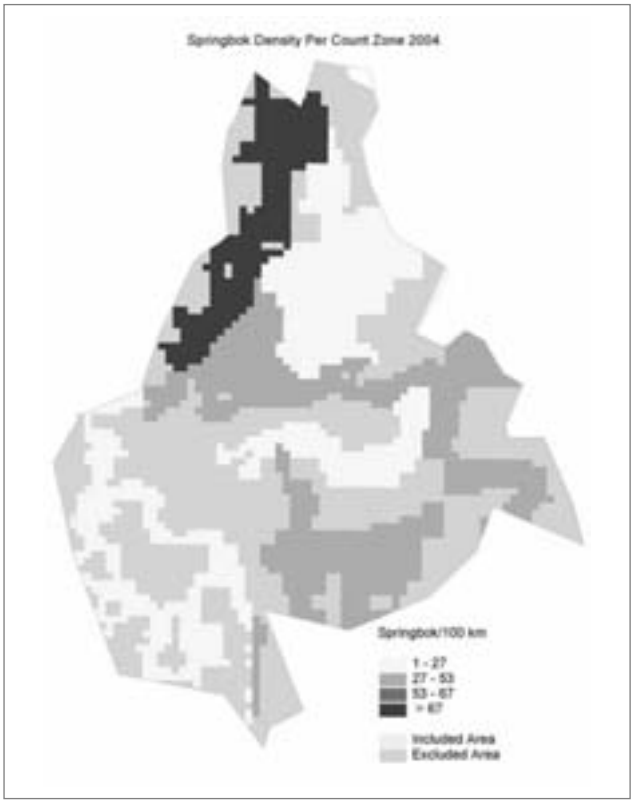
- roll-out systems and baseline data;
- technical support;
- training;
- incentives for data-sharing;
- a service which maintains data standards, directory structures; and
- support for the development of GIS.

The regional users are fieldworkers, from NGOs or government, who use GIS in their daily work to varying extents. They depend on central support for initial training and baseline data.

Crucial to developing the Namibian CBNRM GIS was the creation of a data management tool called CONINFO. One challenge when using GIS data is that many slightly different copies of the same data set are often in circulation at any one time. CONINFO was created to store and manage all core conservation data.

CONINFO brings all relevant data sets together in a fixed, understandable, and standardised structure. Information is shared in a structured way. Software (WinZip) places all data in the correct location on all users' computers. Through a user-friendly interface, all levels of users can access conservation-related data quickly, simply and effectively. Users can also extract the data they require. And, by retaining the data structure, they can regularly update or add to their data set, ensuring compatibility over time. Users need not worry about managing CONINFO data themselves because they can obtain updates (e.g. a newly registered conservancy boundary) from an Internet update site. The challenge is to meet the needs of users with limited or no Internet access – updates need to be done through CDs or DVDs.

Wildlife density zones, 2004



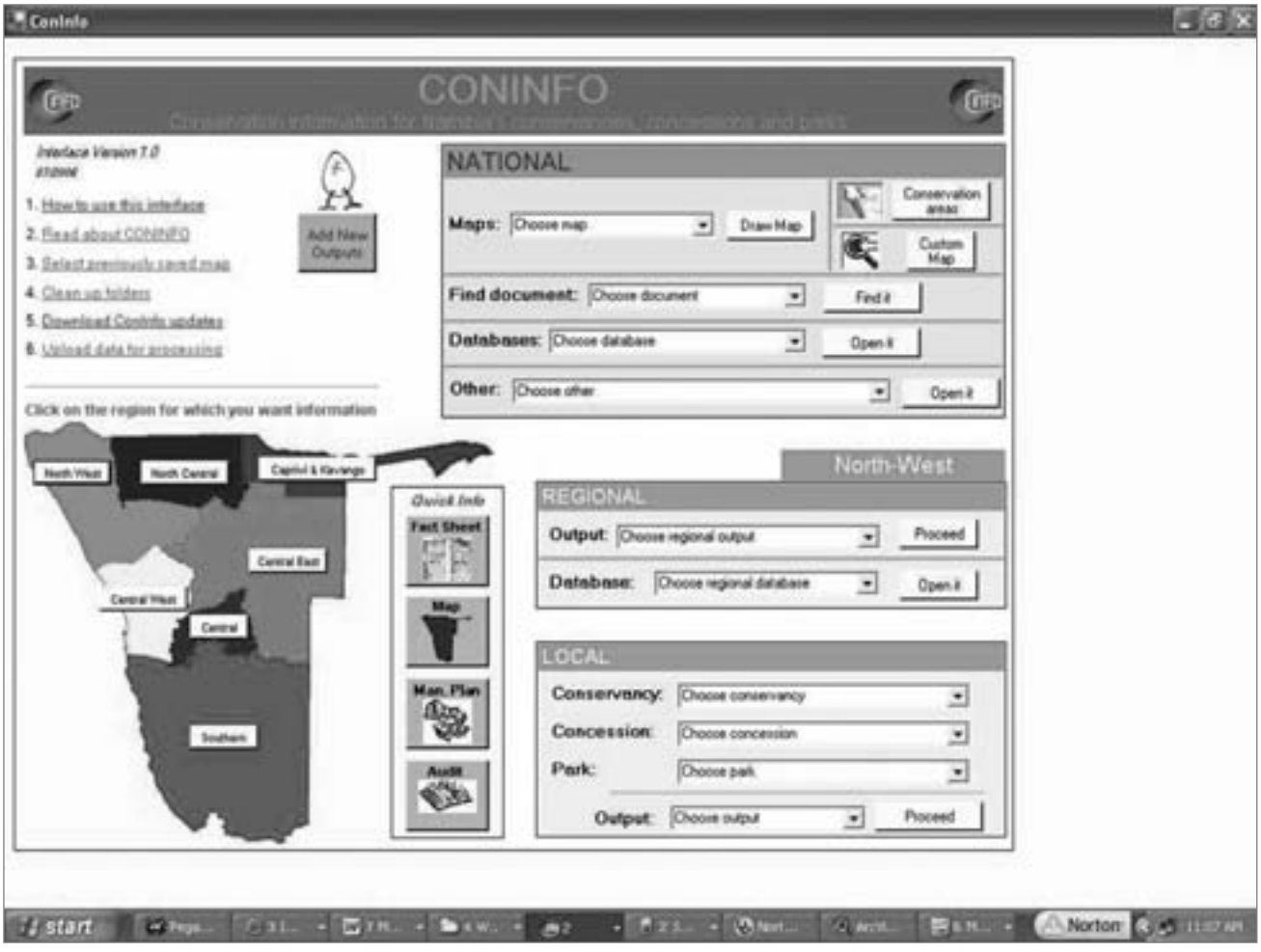
Credit: Jo Tagg, 2004

Lessons learnt

GIS for Namibian CBNRM evolved in response to community, NGO and Ministry of Environment and Tourism (MET) needs. This created joint ownership and, by default, a GIS user group. This informal group shares the incentives of common approaches, systems and access to the most up-to-date data. There are three regional hubs. At central level, users include government (largely MET), as well as four NGOs who collectively provide services to 50 conservancies. As the user group expanded, common systems and directory structures had to be developed to ensure compatibility of approaches. There was also a need to support an ever-increasing network of conservancies undertaking local-level monitoring and participatory mapping.

Subsequently, this approach has gained wider accept-

The CONINFO user interface



Source: CONINFO Interface designed by Tony Robertson, 2006

ance. This has enhanced data collection and quality, sustainability and creativity. Using GIS to respond to user needs has had another very important benefit: generating trust between partners and a common vision between government, communities, and NGOs.

The institutions and technicians developing the GIS need to understand the needs of resource users, technical service-providers and managers. They then need to prepare the information, data, and products in a manner appropriate for the users. For GIS to be a truly effective joint planning, monitoring and management tool. There needs to be a common understanding of the benefits, which the system holds for all parties.

Two key results, broadly classified as 'cooperation' and 'sharing' have emerged from the development of GIS and mapping for CBNRM in Namibia.

Cooperation

Working from a needs-driven approach has been of enormous value. It has built credibility with field users. This has given the core development team great freedom to explore and learn from mistakes. It has led to strong feeling of ownership by ordinary rural people and field-based support staff. GIS has become a strong bridge-building activity between communities, organisations and technical advisors, leading to shared spatial understandings. It has encouraged a culture of sensitivity towards community needs among technical institutions. Finally, it has built critical mass of users, which enhances sustainability. There is better data gathering, technical skills sharing, and data quality. The synergies between all partners, from government and NGOs, keep the system dynamic and functioning. And considerable cost savings have been made as a result of data and hardware sharing between partner institutions.

"All users have access to all existing data, regardless of which CBNRM group or conservancy created them. This reduces or prevents the duplication of information gathering efforts. It allows all users to benefit from available information"

Sharing

Generally, Namibia has a progressive culture of data sharing. To facilitate this, several factors have been necessary:

- adherence to a principle of making data freely accessible (i.e. there is no cost to the user);
- using standardised GIS software;
- using a standardised format for data; and, most importantly
- using a standardised directory structure.

The latter has been one of the best lessons learnt in the evolution of the Namibian CBNRM GIS. All users have access to all existing data, regardless of which CBNRM group or conservancy created them. This reduces or prevents the duplication of information gathering efforts. It allows all users to benefit from available information. It reduces or prevents duplication and splitting of data sets. It allows ArcView projects to be shared easily and allows data to be more easily extracted and disseminated.[1] Finally, broad range of people with different levels of computer skills can use the data.

There have been several challenges. The first has been how to make users aware of what information is available and where they can find it. Second, has been to bridge the technology barrier in terms of gathering, accessing and using the information and, crucially, to create user friendly interfaces. In terms of gathering and integrating field data, one of biggest problems has been having Global Positioning Systems (GPS) incorrectly set up by field users. This then creates entire data sets that are inconsistent with existing data sets.

Another related problem has been the lack of GIS training within the service provider organisations. They have sometimes struggled to manage, access and use their data and software efficiently, and there is still reliance on centralised GIS expertise.

GIS capacity is also limited by the lack of hardware. Its value as a community empowerment tool is often used as an argument for investing in the technologies. Computers become redundant and information technology services are difficult in remote areas. Technologies may not have life beyond donor-supported projects. Sustaining the system has been an ongoing concern, as the development and maintenance has been financed largely by donor funding.

Mapping may also facilitate the entry and involvement of powerful external actors who do not share or support the vision of the legitimate land managers. If communities were operating in isolation this potential problem would be of greater concern. While possible, the present conservancy network minimises this risk. There is a possibility of unequal private sector relationships. But these are more likely to be as a result of lack of understanding business models rather than local mapping.

While the public domain approach to data sharing is an important principle, land managers need to be aware of the possible consequences of sharing critical data (e.g. localities of rare or important plant resources) with a wider and unknown audience. As long as communities understand this, it is likely that key resources may not be mapped.

Ways forward

The collection of field data needs to conform to basic standards of precision and needs to be delivered for processing in a format that excludes processing errors. To address this problem, Namibian partners developed a manual to promote standardised data collection. This however, needs to be made more widely available and integrated into appropriate higher education, government and NGO programmes.

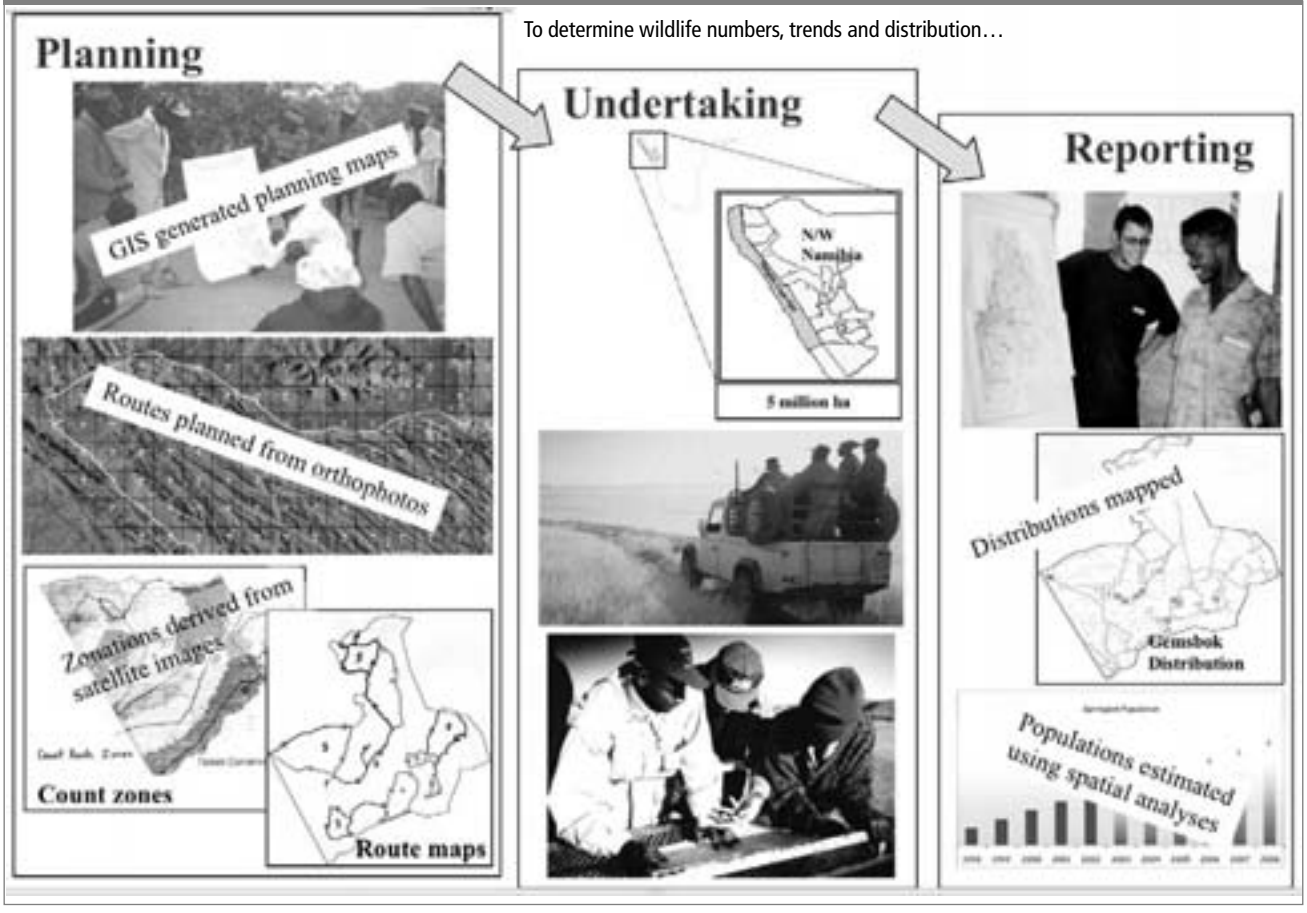
While it is not viable to develop full GIS capability within each institutional or field-based partner, they should have at least some capability, which can be limited to viewing maps and accessing data. There is a similar need for access to data for a range of decision makers within the NGO, donor and government communities. The development of a user-friendly interface has been prioritised and supported by a number of partners including the MET. This should greatly reduce the technology barrier to accessing and using information.

Access to relatively high-resolution satellite imagery is becoming increasingly simple and so much information can be obtained without the cooperation of land managers. So safeguarding local resource rights requires well-informed communities and enabling and supportive policy and legislation.

Reliance on donor funding raises serious sustainability

[1] ArcView projects are mechanisms for storing existing work. The project provides the path for all the datasets used for a particular ArcView application.

Figure 3: Game counts



(Source: NACSO, 2006)

questions. In the past two years, MET has committed donor funding to develop and refine the system. This shall make data more accessible to a wider range of users and expand the range of datasets to cover protected areas. The demand for data should ensure a commitment by MET to cover GIS maintenance costs while the wider range of users in both government and the NGO sector has the potential to promote sustainability.

Conclusions

There are presently 50 registered conservancies in Namibia. They cover an area of about 11.78 million km^2 and which involves approximately 100,000 people. During 2005, CBNRM income is estimated at close to N$20 million (approximately US$2.8 million) with more than half being cash income. The following chart illustrates the sources of benefits.

While CBNRM income cannot be attributable to the use of GIS technologies, each of the 50 conservancies required a boundary and description. Each conservancy develops a management plan with spatial components. Many of the conservancies monitor resources that require spatial understanding and tools.

Using GIS technologies to support the management and monitoring of resources at local level is becoming increasing important. Conservancies are moving beyond the management of wildlife and becoming institutions for integrated resource management. While this places additional demands on service providers, the approach has the potential to add significantly to sustainable land management and rural development.

The benefits of GIS technologies have supported conservancies to plan concessions and negotiate with trophy hunting and tourism partners. These income-generating

"Conservancies along the Kwando River and neighbouring protected areas in Caprivi, for instance, have recognised this need. They are cooperating on a wide range of activities from fire management to wildlife introductions"

activities account for more than 50% of conservancy income. CBNRM GIS products are used in planning, management and monitoring of agreements.

Conservancies have social boundaries and operate in larger open systems where collaboration is required. This challenge is becoming more apparent with more formal collaborative resource management initiatives emerging. Conservancies along the Kwando River and neighbouring protected areas in Caprivi, for instance, have recognised this need. They are cooperating on a wide range of activities from fire management to wildlife introductions. This is an important step in a move towards an integrated ecosystem management approach, where individual management authorities seek added benefits from managing resources at an appropriate scale.

The GIS is becoming increasingly important for aggregating local-level monitoring data. This can be used for measuring impact of the CBNRM programme. Combined with spatial data this contributes to an annual 'State of Conservancy' report, which is a valuable resource for service-providers, donors and government. Without this information, stakeholders could not share lessons learnt, successes, and impacts between themselves and with a wider audience. This information sharing is critical for filling policy gaps, improving service delivery and replication. It is these ingredients that shall ensure that the CBNRM programme is responsive to local needs and evolves in the face of new opportunities and challenges.

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