

Developing Sustainability Indicators for the Kogelberg and Cape West Coast Biosphere Reserves, South Africa

by

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Declaration

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Abstract

Declines in natural capital, such as the degradation of ecosystems and loss of species, are the result of threats created by anthropogenic activities. The concept of sustainable development encompasses the economic and social growth of societies, with limited impacts on the natural environment. Sustainable development initiatives are being implemented in an attempt to mitigate the global decline in natural capital. Biosphere reserves, which are designated by the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) Man and the Biosphere Programme, aim to be landscape-scale examples of sustainable development. UNESCO requires biosphere reserves to submit a periodic review every ten years to ensure they are meeting their goals. This requires that they monitor and evaluate their progress towards their sustainable development goals. Sustainability indicators are tools used to assess progress towards ecological, social and economic goals, and can thus be useful tools for biosphere reserves to ensure they are achieving their goals.

The Kogelberg and Cape West Coast Biosphere Reserves are both situated within the Cape Floristic Region (CFR). The CFR, located in the South-West of South Africa, has been identified as a biodiversity hotspot owing to its high plant diversity. About a fifth of the CFR is formally protected, while about three quarters has been transformed, mainly by cultivated lands, urban areas and alien vegetation. The socio-economic dimensions of the region are also diverse. A high percentage of its inhabitants have low incomes and live in informal settlements, while a smaller percentage have high incomes and live in middle to upper-class urban areas. Biosphere reserves aim to encourage their diverse stakeholders to collaboratively develop and work towards sustainable development goals.

This research project applied an action research approach. The research objectives were achieved through collaboration with biosphere reserve stakeholders. The first objective was to develop sustainability indicator sets for the Kogelberg and Cape West Coast Biosphere Reserves. Following the introduction to the research provided in Chapter 1, Chapters 2, 3 and 4 of this thesis describe the stages of the research process undertaken to achieve this objective. With the aim of investigating monitoring and evaluation within biosphere reserves, Chapter 2 presents a systematic review of the peer-reviewed and grey literature and Chapter 3 presents the results of interviews with managers of South African biosphere reserves and a web-based survey of the World Network of Biosphere Reserves. Chapter 4 describes the collaborative process of conducting local stakeholder workshops and specialist focus groups to develop sets of sustainability indicators; one set each for the Kogelberg and Cape West Coast Biosphere Reserves.

The second objective was to formulate a national protocol for the development of sustainability indicators for South African biosphere reserves. This was developed through a synthesis of the results and lessons learnt in Chapters 2 to 4. This national protocol was designed to be flexible enough to be adapted to the local circumstances and needs of individual South African biosphere reserves.

The global review of the peer-reviewed and grey literature revealed that monitoring and evaluation studies in biosphere reserves are mostly conducted in the developing world by authors from the developed world and many of the studies and indicators that were developed focused on ecological dimensions. These results show that biosphere reserves need to enhance their local capacity for the development and implementation of improved monitoring and evaluation methods and frameworks. The outcomes of the interviews with representatives of the management of South African biosphere reserves and a survey of the World Network of Biosphere Reserves found that many biosphere reserves identified in this survey are reportedly implementing monitoring and evaluation, but few have developed sustainability indicators. It was found that there are many similar challenges with regards to monitoring and evaluation in biosphere reserves, most notably the lack of capacity and funding

Lastly, the collaborative process used to develop sustainability indicators for the Kogelberg and Cape West Coast Biosphere Reserves proved to be useful and produced the desired outcomes. The local stakeholder workshops produced large sustainability indicator sets, with many indicators that were immeasurable, but most were relevant to the biosphere reserves. The specialist focus groups produced more focused and feasible indicator sets. The local stakeholder and specialist indicator sets were integrated to produce a final set for each biosphere reserve that was relevant to the social-ecological systems of the biosphere reserves, with indicators that could feasibly be implemented.

The action research approach applied in this study delivered a pragmatic set of sustainability indicators that can be implemented by both biosphere reserves. The National Department of Environmental Affairs, and the Kogelberg and Cape West Coast Biosphere Reserve co-ordinators have encouraged and supported the development of the sustainability indicator sets and the national protocol. Supporting these with a social learning institution within each biosphere reserve will be required for ensuring their on-going utility.

Opsomming

Dalings in natuurlike kapitaal, soos die degradering van ekosisteme en die verlies van spesies, is die gevolg van die bedreigings wat deur menslike aktiwiteite geskep word. Die konsep van volhoubare ontwikkeling behels die ekonomiese en maatskaplike ontwikkeling van gemeenskappe, met beperkte impak op die natuurlike omgewing. Volhoubare ontwikkelingsinisiatiewe word implementeer in 'n poging om die afname in natuurlike kapitaal te verminder. Die doel van biosfeerreservate, wat aangewys is deur die Verenigde Nasies se Opvoedkundige, Wetenskaplike en Kulturele Organisasie (UNESCO) se Mens en die Biosfeer-program, is om landskap-skaal voorbeelde van volhoubare ontwikkeling te wees. UNESCO vereis van biosfeerreservate om elke tien jaar 'n periodieke hersiening voor te lê om te verseker dat hulle op pad is om hul doelwitte te bereik. Dit vereis dat vordering teenoor hul volhoubare ontwikkelingsdoelwitte moniteer en evalueer moet word. Volhoubaarheid aanwysers word gebruik om vordering ten opsigte van ekologiese, maatskaplike en ekonomiese doelwitte te bepaal, en kan dus nuttig vir biosfeerreservate wees om te verseker dat hul doelwitte bereik word.

Die Kogelberg en Kaapse Weskus Biosfeerreservate is beide in die Kaapse Floristiese Omgewing (KFO) geleë. Die KFO, wat in die suid-weste van Suid-Afrika geleë is, is identifiseer as 'n biodiversiteitsbrandpunt as gevolg van sy hoë plant diversiteit. Meer as 20% van die KFO is formeel beskerm, terwyl ongeveer 75% omskep is, hoofsaaklik deur bewerkte landerye, stedelike gebiede en uitheemse plantegroei. Die sosio-ekonomiese aspekte van die omgewing is ook uiteenlopend. 'n Hoë persentasie van die bevolking het 'n lae inkomste en woon in informele nedersettings, terwyl 'n kleiner persentasie 'n hoë inkomste het en in middel tot bo-klas stedelike gebiede woon. Biosfeerreservate streef daarna om hul diverse belangegroepe aan te moedig om saam volhoubare ontwikkelingsdoelwitte te bereik.

Hierdie navorsingsprojek het 'n aksie-navorsing benadering gevolg. Die navorsingsdoelwitte is deur middel van samewerking met biosfeerreservaat belangegroepe bereik. Die eerste doelwit was om stelle volhoubaarheid aanwysers vir die Kogelberg en Kaapse Weskus Biosfeerreservate te ontwikkel. Na aanleiding van die Inleiding tot die navorsing in Hoofstuk 1, beskryf Hoofstukke 2, 3 en 4 van hierdie tesis die fases van die navorsing wat onderneem is om hierdie doelwit te bereik. Met die doel van die ondersoek van monitering en evaluering binne biosfeerreservate, bied Hoofstuk 2 'n sistematiese hersiening van die eweknie-geëvalueerde en grys literatuur aan en bied Hoofstuk 3 die resultate van onderhoude aan met bestuurders van Suid-Afrikaanse biosfeerreservate en 'n web-gebaseerde ondersoek van die wêreld Netwerk van Biosfeerreservate. Hoofstuk 4 beskryf die

saamwerkende proses met die uitvoer van plaaslike belangegroep werksinkels en spesialis fokusgroepe om stelle volhoubaarheid aanwysers te ontwikkel; een stel elk vir die Kogelberg en Kaapse Weskus Biosfeerreservate.

Die tweede doelwit is om 'n nasionale protokol vir die ontwikkeling van volhoubaarheid aanwysers vir Suid-Afrikaanse biosfeerreservate te formuleer. Dit is ontwikkel deur middel van 'n sintese van die resultate en lesse wat in Hoofstukke 2 tot 4 geleer is. Hierdie nasionale protokol is ontwerp om buigzaam genoeg te wees om by die plaaslike omstandighede en behoeftes van individuele Suid-Afrikaanse biosfeerreservate aangepas te word.

Die globale oorsig van die eweknie-geëvalueerde en grys literatuur het gewys dat monitering en evalueringstudies in biosfeerreservate meestal in die ontwikkelende wêreld deur die skrywers van die ontwikkelde wêreld uitgevoer word en baie van die studies en aanwysers wat ontwikkel word is op ekologiese dimensies gefokus. Hierdie resultate dui aan dat biosfeerreservate hul plaaslike kapasiteit vir die ontwikkeling en implementering van monitering en evaluering metodes en raamwerke moet verbeter. Die uitkomstes van die onderhoude met verteenwoordigers van die bestuurs van Suid-Afrikaanse biosfeerreservate en 'n ondersoek van die Wêreld Netwerk van Biosfeerreservate dui aan dat baie van die biosfeerreservate wat in hierdie ondersoek geïdentifiseer is berig dat hulle monitering en evaluering implementeer, maar min het volhoubaarheid aanwysers ontwikkel. Daar is gevind dat daar baie soortgelyke uitdagings met betrekking tot monitering en evaluering in biosfeerreservate is, veral die gebrek aan kapasiteit en befondsing.

Ten slotte, die gesamentlike proses wat gebruik is om die volhoubaarheid aanwysers vir die Kogelberg en Kaapse Weskus Biosfeerreservate te ontwikkel, het bewys om nuttig te wees en het die verlangde uitkomstes gelewer. Die plaaslike belangegroep werksinkels het finale stelle volhoubaarheid aanwysers produseer, met baie onmeetbare aanwysers, maar meeste van die aanwysers was relevant tot die biosfeerreservate. Die spesialis fokusgroepe het meer gefokusde en uitvoerbare stelle aanwysers produseer. Die plaaslike belangegroep en spesialis stelle aanwysers is in 'n finale stel vir elke biosfeerreservaat geïntegreer wat relevant tot die maatskaplik-ekologiese stelsels van die biosfeerreservate is, met aanwysers wat implimenteerbaar is.

Die aksie-navorsing benadering wat in hierdie studie gevolg is het 'n pragmatiese stel van volhoubaarheid aanwysers gelewer wat deur beide biosfeerreservate implementeer kan word. Die Nasionale Departement van Omgewingsake, die Kogelberg en Kaapse Weskus Biosfeerreservaat

koördineerders het die ontwikkeling van die stelle volhoubaarheid aanwysers en die Nasionale Protokol aangemoedig en ondersteun. Ondersteuning van hierdie uitsette met 'n maatskaplik-opvoedkundige instelling binne elke biosfeerreservaat sal vereis word om deurlopende nut daarvan te verseker.

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Chapter 1: Introduction

Natural capital is the sustainable flow of ecosystem services and goods that is yielded by natural ecosystems (Costanza & Daly 1992). Sustainable development is one of the leading concepts in the worldwide campaign against the current accelerated rate of degradation and loss of natural capital (Hopwood et al. 2005). Sustainable development can be defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987) or as the enhancement of the quality of human well-being within the limits of the natural environment’s carrying capacity (Munro & Holdgate 1991). One of the principle elements of sustainable development is the balanced relationship between economic and social development, and conservation of the natural environment (Elliott 2013). Numerous instruments, incentives and institutions are used to promote sustainable development. This concept has been promoted by organisations such as the World Bank, the United Nations Development Programme, the United Nations Environment Programme, and the Food and Agriculture Organisation.

The Man and the Biosphere (MAB) programme was initiated by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in 1971. Its primary goals are to mitigate the loss of natural capital through integrating ecological, social and economic dimensions within an interdisciplinary research agenda, and to facilitate international scientific cooperation with emphasis on the interactions between man and nature (Brown 2001; UNESCO 2012a). To operationalise these goals, the MAB programme developed the concept of biosphere reserves (BRs) in 1974, with the first BRs being designated in 1976 (Gregg 1999; UNESCO 1996). This was the first international campaign aimed at operationalising the concept of sustainable development (Brown 2001). The MAB programme is structured around National Committees within participating countries, with the International Coordinating Council representing these participating countries. BRs are run by local organisations, with the MAB playing a coordinating role (Di Castri 1976). The World Network of BRs (WNBR) currently comprises 610 BRs in 117 countries (UNESCO 2012b).

BRs are intended to be landscape-scale examples of sustainable development, where this concept can be demonstrated and tested (UNESCO 2012a). BRs comprise a mosaic of three types of zones. Core areas are typically formally protected areas (i.e., IUCN categories I-IV; Dudley 2008) where only low impact anthropogenic activities, such as tourism, environmental education and research occur. Buffer zones are usually areas adjacent to core zones where conservation activities such as sustainable resource use occur. Transition zones are areas of high impact anthropogenic activities such as agriculture and urban developments (Gregg 1999; UNESCO 1996). The Statutory Framework

for BRs sets out three core functions of BRs, namely: 1) the conservation of natural resources; 2) economic development that is socially and environmentally sustainable; and 3) logistical support for education, monitoring and research (UNESCO 1996). BRs are managed by a variety of organisations, including government departments, national parks authorities, local government, regional councils, non-government organisations (NGOs) and universities. South African BRs are managed by non-profit companies (UNESCO 2012c) under Section 11 of the Companies Act No. 71 of 2008.

Ensuring the effectiveness of BRs, and other sustainable development initiatives, requires implementation of evidence-based practice (Sutherland et al. 2004). This approach originated in the medical field from concerns that expert opinions, and not scientific evidence, were the primary source of information supporting recommendations and decision-making. In evidence-based practice, the effectiveness of actions is evaluated through systematic reviews of scientific evidence (Keene & Pullin 2011). Management decisions within conservation and sustainable development practices are typically based on common sense or personal experience, while scientific evidence is often not used as effectively as it should be (Pullin et al. 2004; Sutherland et al. 2004). For the effective implementation of monitoring and evaluation (M&E) frameworks and adaptive management, evidence-based measures of effectiveness are needed (Keene & Pullin 2011).

Under the terms of a Statutory Framework for the WNBR, BRs are required to conduct and submit a periodic review to UNESCO every ten years (UNESCO 1996). The purpose of the periodic review is to ensure that BRs are effective in achieving UNESCO's goals for the WNBR. The information required in a periodic review includes physical landscape characteristics, conservation significance, zonation details, human activities such as resource use, educational activities, research and monitoring, and aspects relating to institutional governance (UNESCO 2002). Based on the findings, UNESCO evaluates whether or not a BR is functioning effectively. If not, UNESCO may remove designation of a BR, if it is unable to demonstrate the necessary improvements (UNESCO 1996).

An M&E framework is essential for the effective operations of a BR, as it enables BRs to meet their reporting requirements for periodic reviews, as well as for current and prospective funders on which BRs typically depend (J. du Toit, pers. comm.). A M&E framework also forms the basis for implementing adaptive management (Levrel & Bouamrane 2008; Margoluis et al. 2009; Reed et al. 2006). Monitoring involves the development of measures for quantifying changes in dimensions of social-ecological systems (i.e., indicators), periodically collecting and analysing information relating to these indicators, and using this information to inform management decisions (Margoluis &

Salafsky 1998). Evaluation is the activity of comparing the impacts of a project or decision against explicitly stated strategic goals of a project or organisation, including assessing the cost-efficiency and utility of inputs (e.g. funding, training of staff) and outputs (e.g. projects, community awareness) and the effectiveness in achieving goals (Shapiro 2011). When these processes function together within a M&E framework, valuable information on the state of a system and the effectiveness of management actions can be assessed (Keene & Pullin 2011; Legg & Nagy 2006).

Indicators are pragmatic evidence-based tools that can be used for the implementation of M&E as they summarise information in a manner that allows for easy communication and interpretation by decision-makers and stakeholders (Beratan et al. 2004; Levrel & Bouamrane 2008). Indicators provide information on the current state of a system and whether it is moving away from or towards a desired state, or is being maintained at a particular state (Ukaga & Maser 2004). They form an integral component of adaptive management frameworks, functioning as feedback and early warning mechanisms (Mitchell, 1996).

Sustainability indicators (SIs) are evidence-based M&E tools that aim to assess the progress of economic and social development as well as the conservation of ecological systems (Bowen & Riley 2003). Sustainable development initiatives are thus able to use SIs to track their effectiveness (Morse et al. 2001). Such measures are vital for ensuring that the inadequate resources available to sustainable development are effectively allocated and used (Ferraro & Pattanayak 2006; James et al. 2001; Stewart et al. 2005). As the overarching goal of BRs is sustainable development, SIs are tools that are well suited to measuring the progress of BRs towards this goal.

The use of SIs as a measure of sustainable development is increasing, with many organisations and governments developing and implementing them (Hak et al. 2007). There are numerous global-scale SI frameworks. For example, the Environmental Sustainability Index, developed by Yale University's Centre for Environmental Law and Policy, measures the ability of countries to conserve the environment, with 21 indicators across the categories of "environmental systems, reducing environmental stresses, reducing human vulnerability to environmental stresses, societal and institutional capacity to respond to environmental challenges, and global stewardship" (Esty et al. 2005). Another example is the indicators developed by the UN Commission on Sustainable Development that serve as a guideline to assist countries to develop SIs that are relevant to their local circumstances and needs (UN Department of Economic and Social Affairs 2007).

The above two examples are known as top-down frameworks. Top-down approaches to SI development use national-or international-level data, in contrast to bottom-up approaches which develop SIs using local-level data, with high levels of community involvement (Reed et al. 2006). Top-down approaches may not include measures which are important within the local context (Reed et al. 2006) and not involving local stakeholders in the indicator development process can discourage them from participating in the implementation of the indicator framework (Freebairn & King 2003). However, local stakeholders may wish to push their own agendas, which may not be beneficial to sustainable development, thus a balance between top-down and bottom-up approaches is required if SIs are to be developed and implemented effectively (Reed et al. 2006).

Conceptual models (Margoluis et al. 2009) or participatory models (Sandker et al. 2010) could be applied to develop sustainability indicators. The conceptual model approach uses visual depictions of a project's operational context and the pressures on the project (Margoluis et al. 2009). Participatory model approaches include Bayesian networks, system dynamics modelling and agent based modelling (Sandker et al. 2010). The approach used in this study used a combination of methods that focussed on using collaborative processes to derive suitable sustainability indicators.

BRs in South Africa generally recognise the importance of conducting periodic reviews and reporting to funders, and thus the importance of M&E, but currently lack the capacity to implement such a framework effectively, notably developing SIs. Stellenbosch University was approached to develop SIs for the Kogelberg and Cape West Coast BRs (see Table 1.1 for details of these BRs). This was to form the basis of a national protocol for the development of SIs for BRs.

Through collaboration with local stakeholders, as well as specialists who have knowledge of the regional social-ecological systems in which the Kogelberg and Cape West Coast BRs are individually situated, and/or sustainable development related disciplines, this project aimed to produce a set of SIs for the Kogelberg and Cape West Coast BRs. This form of research is known as action research, in that the project is designed to produce an outcome that will be applied to the system upon which the research is based, and the stakeholders within the system play an active role in the research (Brydon-Miller et al. 2003).

The objectives of this study were to: 1) conduct a review of M&E in international and South African UNESCO BRs, 2) determine the relevancy of the local context in SI development through a paired case study of the Kogelberg and Cape West Coast BRs, and 3) to develop a set of SIs for the

Kogelberg and Cape West Coast BRs that is feasible to implement, appropriate and relevant to the BRs. The ultimate goal was to develop a national strategy for the development of SIs for South African BRs.

Aims and Objectives

This thesis is presented as six chapters. Chapter 1 comprises an Introduction, which sets the background to the research and outlines the key aims and objectives. Chapter 2 is a literature review of M&E in BRs. Chapter 3 is a survey of M&E in the South African BR network and the World Network of Biosphere Reserves. Chapter 4 presents the outcomes of the collaborative process of developing SIs for the Kogelberg and Cape West Coast BRs. Chapters 2 to 4 have been formatted as manuscripts to be submitted for publication to international peer-reviewed journals; these chapters thus include some repetition so as to ensure each manuscript is self-contained. Chapter 5 presents a national protocol for the development of SIs for South African BRs. This has been founded on the data gathered, collaborations developed, and the experience provided by the research documented in Chapters 2 to 4, and aims to directly inform national decision-making by the Department of Environmental Affairs, as well as local decision-making by the co-ordinators and stakeholders of the Kogelberg and Cape West Coast BRs. These BR implementing organisations have actively supported this research project, and await its release. The outputs and outcomes of this research will be returned to and discussed with these organisations in early 2013. Chapter 6 comprises an integrative discussion of Chapters 2 to 5, highlighting the main outputs, outcomes and conclusions of the study, and presents recommendations for future research. It is hoped that this research usefully contributes to increasing the effectiveness of the operation of the Kogelberg and Cape West Coast BRs.

Table 1.1: Details of the Kogelberg and Cape West Coast Biosphere Reserves (Mucina & Rutherford 2006; UNESCO 2012c)

Biosphere reserve	Year designated	Total size (ha)	Core areas (ha)	Buffer zones (ha)	Transition areas (ha)	Major vegetation types	Major land cover types	Population
Kogelberg (KBR)	1998	103 629	31 629	40 000	32 000	Sand Fynbos; Shale Renosterveld; Granite Renosterveld	Fynbos vegetation, coastal plains, riparian areas, lakes, marshes, lagoons, estuaries, agricultural land, residential areas	37 900 permanent, 50 000 seasonal
Cape West Coast (CWCBR)	2000	378 240	47 730	172 643	157 867	Shale Fynbos; Sandstone Fynbos	Fynbos vegetation, dune thicket, coastal plains, riparian areas, wetlands, marshes, anthropogenic old lands, agricultural land, mining, urban areas	132 000 permanent, 161 000 seasonal

Chapter 2: Tracking Progress and Effectiveness in Diverse Landscapes: A Review of Monitoring and Evaluation within UNESCO Biosphere Reserves

Abstract

Natural capital is the sustainable flow of ecosystem services and goods that is yielded by natural ecosystems. Sustainable development initiatives attempt to mitigate the rapid rate at which natural capital is currently being lost. Biosphere reserves, designated through UNESCO's Man and the Biosphere programme, are examples of such initiatives. The main goal of biosphere reserves is to achieve sustainable development on a landscape-scale. Monitoring and evaluation are processes that can assist biosphere reserves to ensure they are effective in achieving their goals. We review peer-reviewed and grey literature, detailing monitoring and evaluation activities in biosphere reserves. Web of Science and Scopus were used to search the peer-reviewed literature, and Google the grey literature. The main findings of the peer-reviewed literature analysis were: 1) many authors from the developed world are conducting research in the developing world; 2) about half of the indicators that were developed were ecological indicators; 3) most studies are monitoring only ecological systems; 4) about 50% of studies conducted short-term monitoring; and 5) just over half produced results that were potentially implementable, but a low proportion showed evidence that results were implemented. In contrast, studies from the grey literature: 1) mostly presented social, ecological and economic research; 2) generally presented evaluations; 3) reported results that were to be implemented, but presented no evidence of implementation; and 4) over half of the indicators developed measured social aspects. Many of the indicators developed were not user-friendly or measurable. These findings suggest a need for biosphere reserves to improve their local capacity for developing and implementing monitoring and evaluation procedures. Integrating existing research within biosphere reserves under a sustainability indicator framework, coupled with some form of social learning institution, may be an effective way to achieve these goals.

Keywords: monitoring, evaluation, sustainable development, indicators

2.1 Introduction

Natural capital is the sustainable flow of ecosystem services and goods that is yielded by natural ecosystems (Costanza & Daly 1992). Natural capital is being lost at a rapid rate due to numerous threats such as climate change, pollution, overharvesting, rural and urban development, and

industrialisation (Daily 1997; IPCC 2007; MA 2005; Pimm et al. 2006). Maintaining our natural capital is essential for the continued existence of species, as ecosystems provide many services that are vital to our well-being. In order to reverse this decline in natural capital and to mitigate these threats, evidence-based measures of the effectiveness of conservation and sustainable development activities are required (Keene & Pullin 2011).

Evidence-based practices originated in the medical field in response to concerns that decision-making and recommendations were based on expert opinion and not on data generated through scientific research (Keene & Pullin 2011). Similarly, many decisions made regarding conservation and sustainable development are based on common sense or personal experience, rather than on scientific evidence, thus conservation science can learn from the medical field, where this problem was solved by introducing systematic reviews of scientific evidence relating to the effectiveness of the actions being taken to achieve specified goals (Sutherland et al. 2004). These measures provide the foundation for ensuring adequate monitoring and evaluation (M&E) of these activities and allow adaptive management to be implemented (Keene & Pullin 2011).

M&E are terms that are often used together; however they are two distinct but related activities. Monitoring involves the development of indicators, periodically collecting and analysing information relating to these indicators and using this information to make management decisions (Margoluis & Salafsky 1998). Evaluation involves comparing the impacts of a project or decision against the explicitly stated strategic goals of a project or organisation, including assessing the cost-efficiency of inputs (e.g. funding, training of staff) and outputs (e.g. projects, community awareness) and the effectiveness in reaching goals (Shapiro 2011). Together, M&E is the process of periodically collecting and evaluating data in line with project objectives, goals and activities (Keene & Pullin 2011). This process provides information on the state of a system, measures the outcomes of management actions, and detects the effects of disturbances (Legg & Laszlo 2006).

Indicators provide information on the current state of a system and whether it is moving away from or towards a desired state, or being maintained at a particular state (Ukaga & Maser 2004). They form essential tools for adaptive management by providing a feedback mechanism and acting as early warning systems through the identification of trends in indicator changes (Mitchell 1996). Indicators are used to summarise information in a way that is easy to communicate and understand so that decisions can be made by managers and stakeholders based on this information (Levrel and Bouamrane 2008).

Sustainable development can be defined as growth that satisfies the needs of the present generation without jeopardising that of future generations (WCED 1987), or development that enhances the quality of human well-being while not exceeding the carrying capacity of ecosystems (Munro & Holdgate 1991). Sustainability indicators are evidence-based monitoring and evaluation tools that aim to assess the progress of economic and social development as well as the conservation of ecological systems (Brown & Riley 2003), and are increasingly being used to measure the effectiveness of sustainable development initiatives and projects (Morse et al. 2001). Resources allocated to such development are inadequate compared to the resources allocated to “unsustainable” development (James et al. 2001). This means that resources allocated to sustainable development need to be cost-efficient (Ferraro & Pattanyak 2006). Therefore, evidence-based approaches (such as the use of sustainability indicators) are essential in order to ensure that the management of natural capital occurs in the most cost-efficient way (Stewart et al. 2005).

Achieving sustainable development is highly complex and challenging and requires diverse suites of instruments and institutions (Rammel & van den Bergh, 2003). Biosphere reserves (BRs) comprise complementary instruments and institutions and are established under the Man and the Biosphere (MAB) programme (UNESCO 2012b), which was established by UNESCO in response to growing concerns over global environmental issues. BRs aim to explore, promote and demonstrate a working example of a balanced relationship between humans and the biosphere, achieving conservation and sustainable development on a regional/landscape-scale (UNESCO 1996; UNESCO 2012b) through interdisciplinary ecological and social research (Wangari 1997). There are currently 610 BRs in 117 countries (UNESCO 2012b). BRs are required by UNESCO to fulfil three functions: 1) the conservation of natural capital; 2) economic development that is culturally, socially and environmentally sustainable; and 3) logistical support for research, monitoring and education. To ensure their effectiveness, BRs are expected to report to UNESCO on their progress every ten years (UNESCO 1996).

We conducted a review of the peer-reviewed literature, as well as the grey literature, to investigate M&E activities in UNESCO BRs. The objectives of this review were to determine the: 1) types of M&E studies being undertaken; 2) methods being used in these studies; 3) extent to which the results of these studies are being implemented; and 4) types of indicators that are being developed through studies in or applied to BRs. Recommendations regarding M&E strategies within BRs are given.

2.3 Methods

This research was based on a systematic review methodology (CEBC 2010). The Web of Science and Scopus databases were used to search the international peer-reviewed literature, while Google was used to search the grey literature. Keywords used to search this literature were identified through an iterative process that tested the effectiveness of sets of keywords. Boolean operators were used to combine individual terms where appropriate (CEBC 2010). The keywords used were: biosphere reserve* AND sustainab* indicator* OR biosphere reserve* AND monitor* OR biosphere reserve* AND evaluat*.

Upon completion of the search, relevant literature was identified by applying two filters. Firstly, titles and abstracts were read to eliminate spurious articles. Those with no abstract were initially retained. Secondly, all literature that passed this first filter underwent a full text assessment to obtain a final list of relevant literature (CEBC 2010). Information from individual documents was gathered, including: type of publication, year of publication; lead author country; study country; author affiliations; and organisations funding the research. Study countries and lead author countries were divided into different income classes based on the World Bank categories (World Bank 2012). Information on the type of research or M&E activity performed was also documented. Documents describing results of these activities were classified according to the degree of implementation.

Indicators extracted from the documents that developed indicators were classified according to indicator type. Categories comprised social, ecological and economic indicators (Table 2.1). A small number of indicators measured several aspects, meaning that the indicators could have been placed in several categories. In these cases, the major theme of the indicator was identified and the indicator was classified accordingly. All information used was captured directly from the document, and not inferred.

Table 2.1: The description of the categories according to which the indicators from the peer-reviewed and grey literature were classified and examples of the aspects which the indicators measure

Indicator category	Category description	Examples of measures
<i>Social</i>		
Demographics	Statistics on the characteristics defining the human population	Age, gender, mortality
Culture	Characteristics, behaviour, knowledge and values of particular societal groups	Languages, art, folklore
BR company management	The internal governance processes of administering a BR	Business strategies, project implementation, administration
Stakeholder collaboration	The establishment and management of relationships between the BR and its interested and affected parties	Partnerships, agreements, stakeholder meetings
Societal well-being	Social capital, adaptive capacity and community health generally of BR residents	Health services, access to resources, conflict
Human	Opinion, attitudes and perceptions generally of BR residents	Satisfaction, expectations, concern
Education, training & awareness	Processes for improving the knowledge and/or capacity of individuals	Job training, educational programs, environmental awareness
Research	Scientific studies and outputs	Scientific publications, research projects, R&D expenditures
<i>Ecological</i>		
Species	Distribution, abundance and dynamics of taxonomically identifiable organisms	Species lists, species abundance, species distribution
Landscape	Spatially identifiable ecosystems and habitats and the component features	Habitat quality, conservation of habitats, ecosystem changes
Environmental planning & management	Processes and instruments for achieving conservation goals	Monitoring, evaluation, environmental regulations
Anthropogenic impacts	Effect of humans on the natural environment	Pollution, agriculture, erosion
<i>Economic</i>		
Income & employment	Local- and/or household-scale capacity to meet livelihood needs	Employment rate, change in income
Goods & services	Production and trading of tangible and intangible commodities generally at the regional or national scale	Export/import, types of services, national economy
Tourism	Visitors to the BR, associated services, their marketing and planning	Tourist satisfaction, return visitors, tourist infrastructure
Ecosystem services	The availability, use and quality of natural resources	Types of services, value of services, dependency

2.4 Results

2.4.1 General Information

The Web of Science and Scopus searches produced 67 and 138 documents, respectively, for a total of 205 relevant peer-reviewed documents. These were published in a wide range of journals including ecological, social, economic, conservation and applied science journals. Most documents (97.1%, 199 documents) were published between 1998 and 2011. A large majority of these documents were research articles (77.1%, 158 documents), case studies (12.7%, 26 documents) or essays (9.8%, 20 documents). The Google search yielded 84 relevant documents. These documents covered a broad spectrum of types. Case studies comprised 16.7% (14) of the documents, while research reports and strategic plans each made up 13.1% (11) of the reviewed list. Most of the documents were compiled between 2001 and 2011 (92.9%, 78 documents).

According to region, most of the studies from the peer-reviewed literature were conducted in North America (30.7%, 63 studies), Europe (22.4%, 46 studies), and Asia (18.5%, 38 studies). Documents with a global context comprised 5.9% (12) of the peer-reviewed literature list (Fig. 2.1). Mexico (23.4%, 48 studies), India (9.3%, 19 studies), China (7.3%, 15 studies), Canada (5.9%, 12 studies) and Spain (5.9%, 12 studies) were the countries most commonly studied. In the grey literature, most studies were based in North America (26.2%, 22 studies), Europe (21.4%, 18 studies), and Asia (15.5%, 13 studies). Documents with a global context comprised 13.1% (11) of the reviewed grey literature (Fig. 2.1). Most documents originated from Canada (17.9%, 15 documents), Australia (8.3%, 7 documents), India (8.3%, 7 documents) and Germany (7.1%, 6 documents).

Overall, 51.2% (105) of lead authors of the peer-reviewed literature were affiliated with the country where the study was conducted. Most lead authors came from the USA (22.4%, 46 lead authors), Mexico (10.2%, 21 lead authors), Canada (9.3%, 19 lead authors) and India (7.8%, 16 lead authors). The USA has a relatively large number of BRs (47), but a low portion of studies were conducted in this country (2.9%, 6 studies), in contrast to Mexico which had the highest portion of studies (23.4%, 48 studies) and a large number of BRs (40). The majority of documents were written by lead authors from higher income countries (64.9%, 133 documents), but most studies were located in the lower-middle (20.0%, 41 studies), and upper-middle (46.3%, 95 studies) income countries, but with fewer documents written by lead authors from these countries (9.8% and 24.9% respectively or 20 and 51 documents respectively) (Fig. 2.2). There are more BRs in upper-middle and higher income countries than in lower and lower-middle income countries.

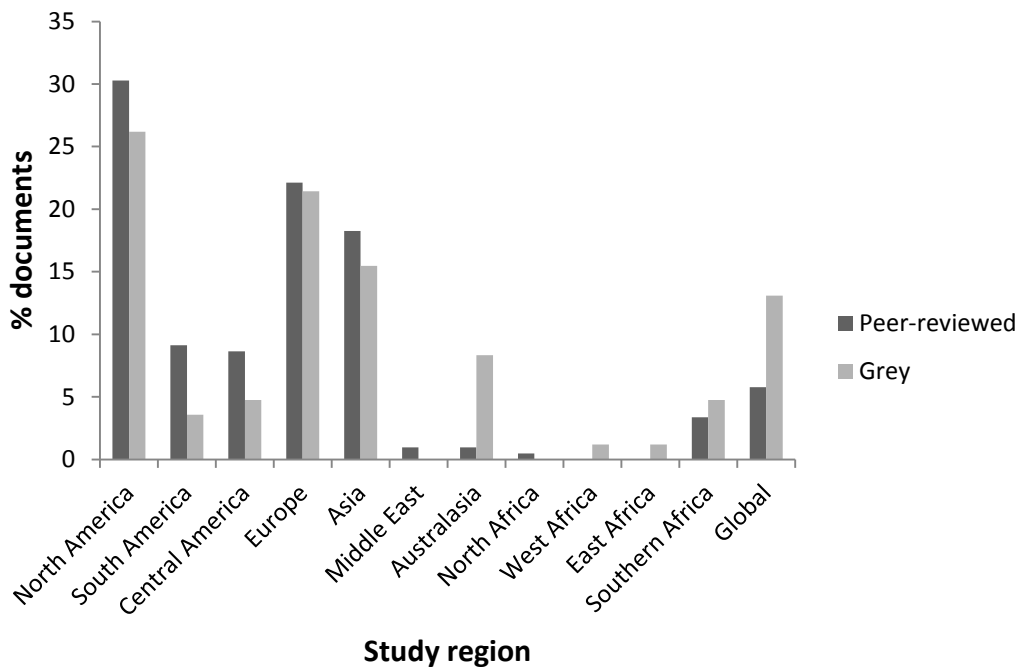


Figure 2.1: The percentage of documents in the peer-reviewed and grey literature reporting on work in the various regions of the world. "Global" represents documents that had a global context, or documents that were not specific to any region, as was the case with some essays and reviews

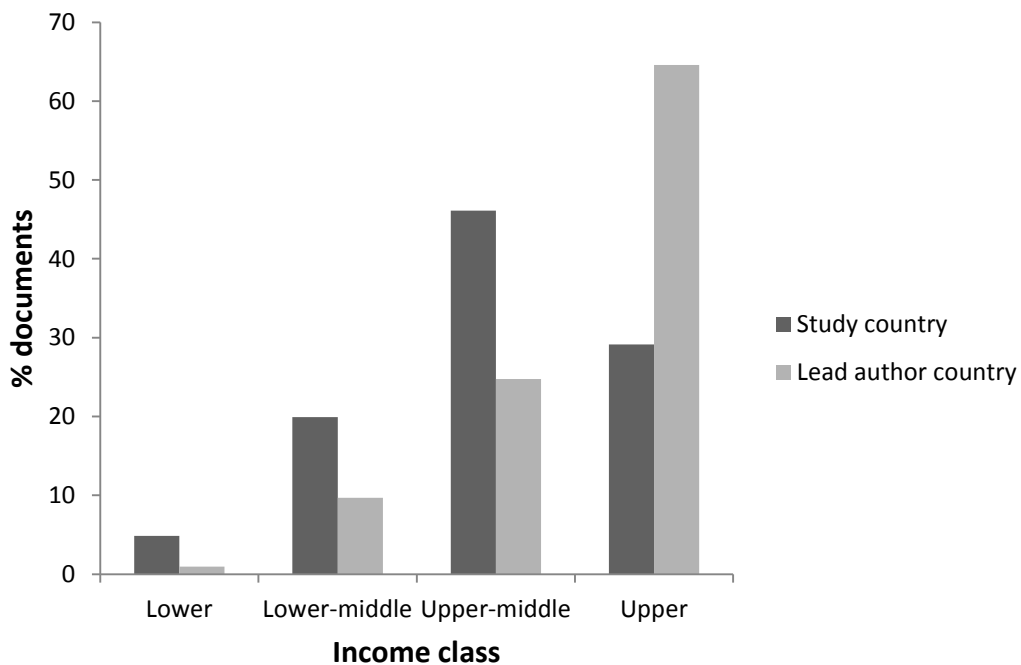


Figure 2.2: The percentage of publications and lead authors per country income class in the peer-reviewed literature. The grey literature results were not included in this graph as 38% of these authors were unknown. Countries were divided into income classes based on The World Bank categories.

Most authors in the peer reviewed literature were affiliated with an academic institution (59.0%, 181 authors), 18.2% (56) with government and 8.5% (26) with non-government organisations (NGOs). Only 2.6% (8) of authors were reported to be associated with the BR within which the study was conducted. Funding was primarily sourced from government (39.7%, 108 sources) and academic institutions (17.6%, 48 sources), with NGOs and private funders comprising 9.5% (26) and 8.4% (23), respectively. Only 3% (2) of funding sources were BRs. Grey literature author and funding information was not captured, as 37.8% (41) and 76.1% (67) of the documents respectively did not include this information.

2.4.2 Types of Monitoring and Evaluation Studies

The peer-reviewed literature consisted mainly of documents with ecology as their main topic (49.0%, 101 documents), with documents encompassing ecological, social and economic topics comprising 25.2% (52) of the documents. A large proportion (89.3%, 75 documents) of the grey literature documents had a combined ecological, social and economic focus (Fig. 2.3).

Of the peer-reviewed documents that conducted a monitoring and/or evaluation study, 51.7% (75 documents) conducted short-term monitoring, while 25.5% (37) conducted an evaluation. With regards to the grey literature documents that conducted a monitoring and/or evaluation study, 95.2% (20) conducted evaluations, and the one document reported on short-term monitoring with an associated evaluation (Fig. 2.4). Just under a quarter of these documents (23.4%, 39 documents) in the peer-reviewed literature did not explicitly state whether or not they applied an existing method or developed their own method. Monitoring and/or evaluation using an existing approach was conducted by 46.1% (77) of the studies, while 17.4% (29) developed a general monitoring and/or evaluation approach. Indicators were developed by 7.2% (12) of the studies. A general monitoring and/or evaluation approach was reported on by 44.6% (33) of the grey literature documents, 28.4% (21) developed indicators and 12.2% (9) conducted monitoring and/or evaluations using an existing approach (Fig. 2.5).

2.4.3 Reported impact

Of the documents in the peer-reviewed literature that produced research outcomes, 56.5% (100) produced outcomes that had the potential to be implemented by practitioners, and 30.5% (54) of studies were conducted specifically to be implemented. Only 10.7% (19) of the documents stated that the research outcomes were implemented (Fig. 2.6).

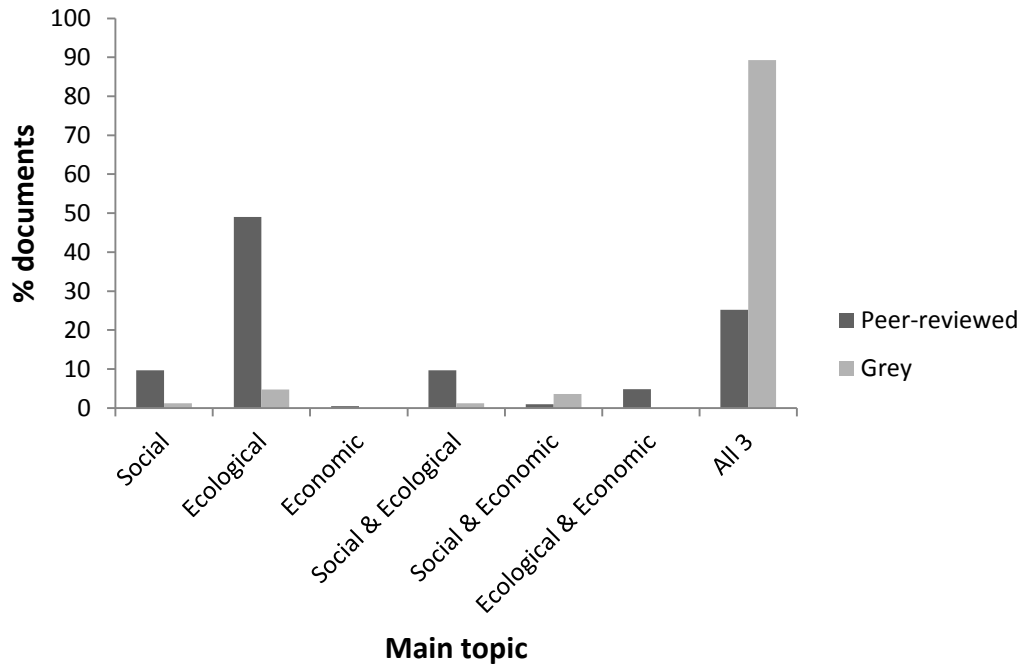


Figure 2.3: The percentage of documents per topic and combinations of topics in the peer-reviewed and grey literature

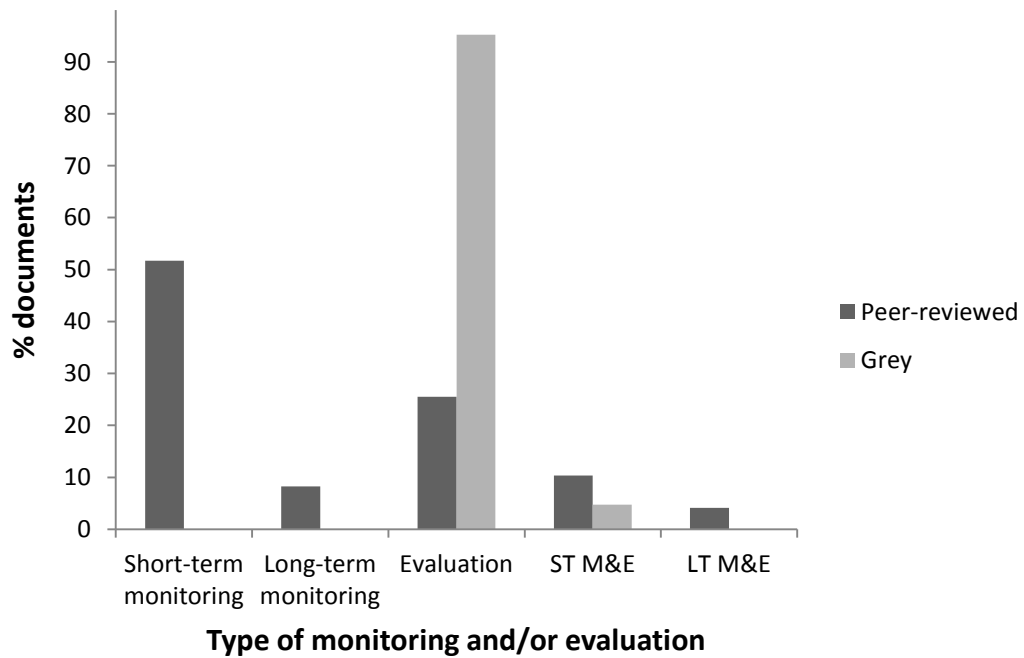


Figure 2.4: The percentage of documents that conducted short or long term monitoring or evaluation or combinations thereof in the peer-reviewed and grey literature

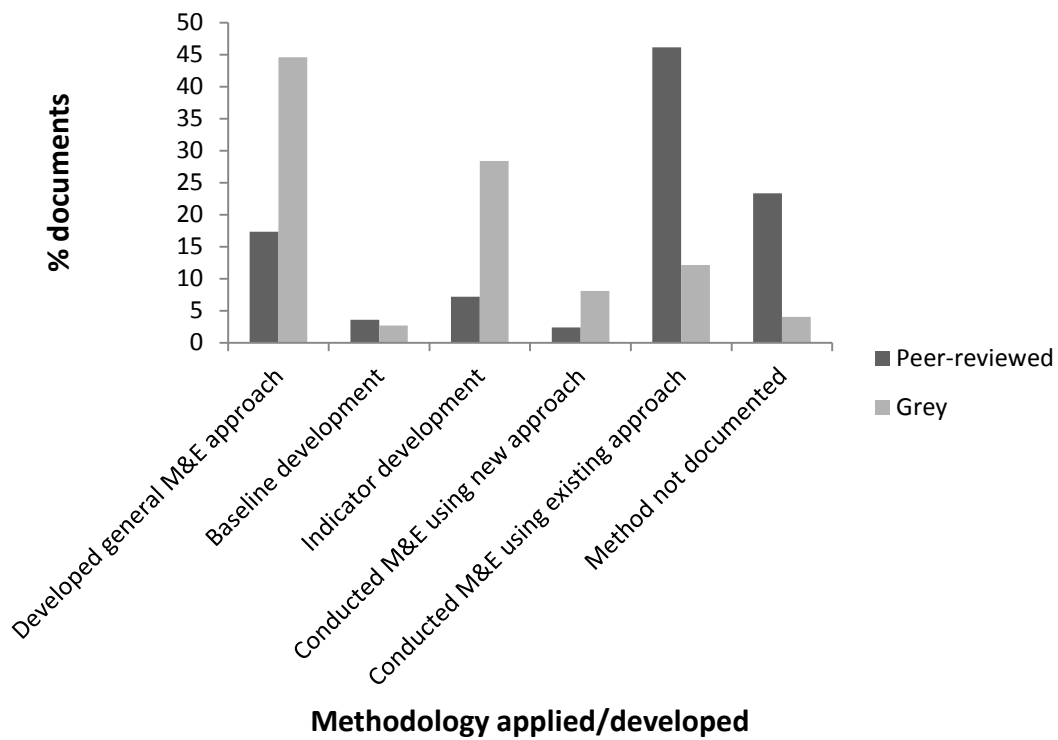


Figure 2.5: The percentage of documents per methodology that was developed and/or applied

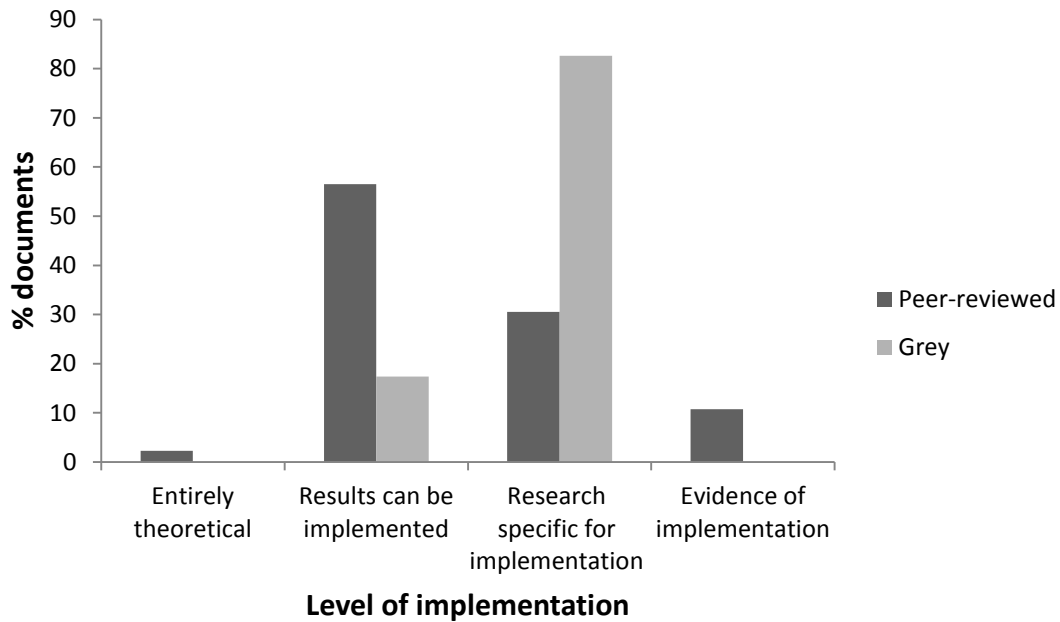


Figure 2.6: The percentage of documents in the the peer-reviewed and grey literature according to the degree to which the results were implemented

Of the documents in the grey literature that reported on studies that produced research outcomes, 17.4% (4) produced results that had the potential to be implemented by practitioners, and 82.6% (19) of studies were conducted specifically to produce results for implementation. None of the documents stated that the research outcomes were implemented (Fig. 2.6).

2.4.4 Indicators

Just over half (158) of the indicators that were developed in the peer-reviewed literature were ecological indicators, with fewer social (28.3%, 89 indicators) and economic indicators (21.3%, 67 indicators). Of the social indicators, those measuring internal BR management, and stakeholder collaboration comprised 7.0% (22) and 7.6% (24), respectively. Indicators measuring aspects of the landscape, and environmental planning and management comprised 20.1% (63) and 15.3% (48), respectively. Most economic indicators were designed to measure ecosystem services (12.7%, 40 indicators) (Table 2.2).

Social indicators were most commonly developed (56.4%, 486 indicators) in the grey literature, followed by ecological (24.1%, 208 indicators) and economic indicators (19.5%, 168 indicators). Of the social indicators, those measuring internal BR management made up 18.3% (158) of all the indicators, followed by indicators of societal well-being (11.1%, 96 indicators). The majority of the ecological indicators measured environmental planning and management (17.3%, 149 indicators). Tourism (9.5% 82 indicators), and income and employment indicators (5.9%, 51 indicators) comprised the majority of the economic indicators (Table 2.2).

Table 2.2: The total number and percentage of the indicators from the peer-reviewed and grey literature within each indicator category. The categories and values in italics are the main themes, thus these represent the total of the indicators below them

Indicator category	Peer-reviewed literature		Grey literature	
	Total # of indicators	Total % of indicators	Total # of indicators	Total % of indicators
<i>Social</i>	<i>89</i>	<i>28.3</i>	<i>486</i>	<i>56.4</i>
Demographics	11	3.5	9	1.0
Culture	0	0.0	48	5.6
Internal BR company management	22	7.0	158	18.3
Stakeholder collaboration	24	7.6	79	9.2
Societal well-being	19	2.1	96	11.1
Human	3	1.0	28	3.3
Education, training & awareness	8	2.6	63	7.3
Research	2	0.6	5	0.6
<i>Ecological</i>	<i>158</i>	<i>50.3</i>	<i>208</i>	<i>24.1</i>
Species	26	8.3	18	2.1
Landscape	63	20.1	29	3.4
Environmental planning & management	48	15.3	149	17.3
Anthropogenic impacts	21	6.7	12	1.4
<i>Economic</i>	<i>67</i>	<i>21.3</i>	<i>168</i>	<i>19.5</i>
Income & employment	17	5.4	51	5.9
Goods & services	5	1.6	12	1.4
Tourism	5	1.6	82	9.5
Ecosystem services	40	12.7	23	2.7
Total	314		862	

2.5 Discussion

It is essential that M&E is implemented within BRs as they need to report on evidence of their progress to UNESCO through the periodic review process, as well as to donor institutions. Indicators can be a useful tool for this purpose.

The main findings of this study were that most of the M&E taking place within BRs is being conducted by academics and funded by government, with very little of either being done by the BRs themselves. Also, there seems to be a tendency in the peer-reviewed literature towards ecological research and indicator development, with the grey literature having many more documents that incorporated all of these aspects.

The findings of this study raise two important questions: 1) why are BRs generally not undertaking and documenting M&E activities, and 2) when M&E is conducted within BRs, what is measured and what are the shortcomings?

M&E is widely regarded as essential for measuring the progress of conservation and sustainable development interventions, including biosphere reserves (Brunckhorst 2000), towards achieving their goals (Folke et al. 2005; Kleiman et al. 2000; Margolius and Salafsky 1998; Sayer and Campbell 2004). With reference to the first question in the previous paragraph, it is probably unlikely that BR co-ordinators do not recognise the importance of M&E, which is supported by the relatively high number of studies whose indicators were management-focused. Our findings suggest that research is poorly targeted, as it so often is in natural resource management (Knight et al. 2006; Linklater 2003; Rholf 1991; Tear et al. 1993). This can likely be attributed to the greater proportion of lead authors being academics. This high proportion of academic lead authors is to be expected for the peer-reviewed literature as their drive to produce publications supersedes the need to implement conservation and sustainable development and land managers generally do not engage this literature (Roux et al. 2006; Whitten et al. 2001). This situation is probably worsened because most funding is provided by governments or academic institutions, and not the BRs themselves (Smith et al. 2009).

These results raise two major points. Firstly, are academics mainstreaming their research? The number of M&E documents in the peer-reviewed literature founded in BRs increased throughout the 1990s, with the proportion of articles increasing considerably from 1998 onwards. This mirrors the findings of previous reviews (Ferraro & Pattanyak, 2006; Legg & Nagy, 2006). However, these

results should not be compared directly, as the databases used for this review (Scopus and Web of Science) will include more recent documents. The implementation of research that informs practice to ensure evidence-based conservation and sustainable development within BRs is stipulated in the Seville Strategy (UNESCO 1996). However, the high proportion of studies from the peer-reviewed literature that apparently have implementable results, and the relatively low proportions that were conducted specifically for implementation or reported evidence of implementation is further evidence of the much-cited research-implementation gap (Arlettaz et al. 2010 Knight et al. 2008; Pfeffer & Sutton 1999, Prendergast et al. 1999). Of the grey literature documents that produced research outcomes, there was no evidence that these results were implemented, even though over 80% of the documents conducted research specifically for implementation. These results are perhaps to be expected, as consultants are generally only hired to conduct a study and submit the results in a report, with the institutions being the ones who implement the outcomes of the study. Alternative views on the lack of reporting of M&E implementation could be that biosphere reserves have no adaptive planning or management framework to help them deal with this issue or that the publishing of the results may be delayed because of the iterative process of monitoring leading to practitioners feeling that they are in a continual process of development.

Secondly, if BRs are contracting out M&E to consultants, a lack of, and failure to develop, expertise is being demonstrated. The Seville Strategy states that BRs should develop local capacities through involving local stakeholders in research and monitoring activities. This does not appear to be happening. The high proportion of studies funded by government (and low proportion of funding directly from BRs themselves) confirms the finding of May (1998). This is likely attributable to the majority of research reported in the reviewed documents not being specifically conducted to improve the management of BRs. In the grey literature many authors were not identified, however the appearance of the documents suggests that many of the authors were consultants.

Overall, only half the lead authors conducted research in their own country. Corresponding with the results from Fazey et al. (2005), the proportion of M&E studies conducted in BRs in lower, lower-middle and upper-middle country income classes is about twice that of lead authors from these countries. Most studies conducted in developing countries are led by authors from developed countries. For example, Mexico and the USA contain high proportions of the world's BRs and many articles document Mexican examples, but few Mexicans are lead authors, in contrast to the USA, where few studies have been conducted, but from where a high proportion of lead authors originate. The high number of lead authors from the USA is perhaps also to be expected, as it has the

highest scientific article output in the world (May 1997). The local capacity of BRs should be enhanced through funding for training and the provision of resources for M&E, ideally from local sources so as to encourage BR staff to conduct M&E. As far as possible, BRs should provide funding for local authors to conduct research within their boundaries. This would enable BRs to align studies with their goals and objectives. Stronger, long-term, and formal collaborations between BR staff and researchers will be essential.

With regards to the second of the two questions that were asked earlier in the discussion, important points to highlight include the topics of the documents, the methods used and the types of indicators that were developed.

The high percentage of documents with an ecological theme is evidence that many studies in the field of conservation science still tend to focus mainly on the ecology of a system (Balmford & Cowling 2006; Mascia et al. 2003). A high proportion of the grey literature documents included social, ecological and economic themes, which is perhaps an indication that the non-academic world is recognising the importance of transdisciplinarity. The absence of social indicators in the peer-reviewed literature is perhaps the product of social scientists not being motivated to publish (this requires validation through future research).

Of the studies in the peer-reviewed literature that conducted monitoring, most performed short-term monitoring conducted solely for research purposes. Monitoring data can be used to test hypotheses, which is a common approach in the scientific peer-reviewed literature. Most of these short-term monitoring periods would have been shorter than the periods of social-ecological processes. Only a quarter of the studies performed evaluations, which is not surprising as these are assessments, not experiments, and are used to report progress rather than test hypotheses. In contrast, the high proportion of evaluations that were performed in the grey literature studies may indicate that BRs and their stakeholders recognise the importance of tracking progress towards their goals.

BRs are conceptually intended to be landscape laboratories (Lass & Reuswigg 2001), but the low number of peer-reviewed studies developing new methodologies gives the perception that BRs are not progressing towards this goal. The number of studies that are not documenting the sources of their methodology needs to be reduced so that this progress can be determined with a higher level of accuracy.

With regards to the indicators that were developed by studies in the peer-reviewed literature, indicators measuring ecological phenomena dominated, thus following a similar trend to that of the overall peer-reviewed literature, again showing that many scientific studies focus primarily on ecological aspects (Mascia et al. 2003; Balmford & Cowling 2006). Failure to adequately measure, or even include the social and economic variables within a system, may create the impression of effectiveness regarding the natural environment whilst masking social and/or economic problems, such as declining public health or household income. This is problematic as the illusion of effectiveness of the BR achieving its goals is created. The fact that most of the social indicators measured internal BR management and stakeholder collaboration may indicate that BRs recognise the need to measure the effects of both their internal and external activities if they are to be effective. These typically were institutional scale indicators, measures which are lacking in many sustainable development frameworks (Spangenberg 2002). The high proportion of landscape-scale indicators that were developed suggests scientists doing research in BRs recognise that the landscape-scale is most appropriate for measuring sustainable development, which is in contradiction to Naveh (2007) who postulated that this concept has generally not been recognised. Indicators of ecosystem services comprised the highest proportion of the economic indicators. There has recently been an exponential increase in the number of studies researching ecosystem services, with the Millennium Ecosystem Assessment possibly being one of the main drivers of this increase (Fisher et al. 2009; MA 2005).

The majority of the indicators from the grey literature were measures of social aspects of BRs, particularly with regards to the effectiveness of the BR management. We suggest the authors of most studies aimed for implementation and so perceived BR management as the most important aspect to measure. One of the main concepts of BRs is the integration of humans and nature (UNESCO 1996), thus indicators of societal well-being were some of the most common measures. Most of the indicators within the ecological categories were measures of environmental planning and management, which to be effective, must be integrated with socio-economic indicators (Venturelli & Galli 2006). Many of the indicators in the economic category are tourism related, which perhaps reflects tourism being the world's largest industry, driving the growth of many economies (Gee & Fayos-Sola 1997).

When developing indicators, there are several criteria that need to be taken into account to ensure that the indicators can be effectively implemented. Indicators need to be accurate, reliable, cost-effective, feasible, and appropriate (Margoluis & Salafsky 1998). They also need to be easily

measured, the data should be readily available and the wording of the indicators should be unambiguous and easily interpretable (Reed et al. 2006). Many of the indicators from both the peer-reviewed and grey literature failed to meet many, sometimes all, of these criteria. In some cases, indicators were designed to measure aspects which are in essence impossible or extremely difficult to measure (e.g. “vitality and cohesion”), whereas in other cases, more than one measure was included in a single indicator (e.g. “determine the status of capture fisheries and reef-based fisheries in and near the park, and determine the beneficial vs. destructive changes in resource use patterns”). Furthermore, some of the indicators were too vague (e.g. “tourism”).

With regards to the main limitation of this study, it is possible that a more comprehensive set of literature could have been secured due to the limitations of the keywords used. The trialling of the diverse suite of keywords broader than those used suggested that the keywords used were the most effective (see Appendix 1 for a list of the keywords that were tested).

2.5.1 Conclusion

The majority of the studies that were included in this review did not conduct their research specifically for the BRs which contained the study sites, particularly those in the peer-reviewed literature. Within BRs, better targeted, more integrative and implementable research needs to be conducted in line with the goals of the MAB programme. The development of M&E tools and plans within BRs should be encouraged, as most BRs do not know if they are effective. Our study confirms the findings of other studies that many monitoring, evaluation, and indicator frameworks are poorly developed and implemented (Stem et al 2005, Legg & Nagy 2006, Reed et al. 2006). Further studies are needed to implement these systems so that they can be tested and there is a desperate need for the training of BR staff in M&E techniques. Given the general absence of problem-focused research and the apparent lack of collaboration between diverse stakeholders (e.g., biosphere reserve staff, government officials, NGO staff and researchers), a transdisciplinary approach that collectively defines conservation and sustainable development problems and collaboratively conducts social, economic and environmental research to design solutions to these challenges is urgently required. Long-term monitoring and evaluation frameworks should be proactively developed by BR managers through research collaborations with other institutions to provide evidence-based decision-making processes. Sustainability indicators would thus be a useful tool for this purpose. A study on the extent to which sustainability indicators are generic across BRs is needed to determine whether a top-down or bottom-up approach is needed to develop these indicators.

Chapter 3: Monitoring and Evaluation throughout the World Network of Biosphere Reserves and Within South Africa

Abstract

Natural capital, which is the sustainable flow of ecosystem services and goods that is yielded by natural ecosystems, is being lost at a rapid rate due to anthropogenic activities. Sustainable development initiatives attempt to enhance the socio-economic dimensions of society while mitigating the loss of natural capital. UNESCO biosphere reserves are examples of such initiatives, and are designated by the Man and the Biosphere Programme to demonstrate sustainable development on a landscape scale. Monitoring and evaluation is needed in biosphere reserves to ensure that they are progressing towards the achievement of their goals. We investigate monitoring and evaluation trends, capacities and challenges within South African biosphere reserves and the World Network of Biosphere Reserves. Additionally, the use of sustainability indicators in the World Network of Biosphere Reserves was investigated. This information was gathered by conducting face-to-face interviews with representatives of the management of five of South Africa's six biosphere reserves and a web-based questionnaire survey of the World Network of Biosphere Reserves, which was responded to by 58 biosphere reserve representatives. It was found that the majority of the biosphere reserves identified in this survey do conduct monitoring and evaluation, however only a few have developed sustainability indicators. Many of the challenges with regards to monitoring and evaluation, both within South Africa and globally, are similar. The main challenge is limited capacity, particularly with regards to funding. It was, however, found that some biosphere reserves navigate this challenge by either getting external institutions to implement monitoring and evaluation for them, or by using the data from research that is being conducted by other institutions within the biosphere reserve. A sustainability indicator framework can be useful for biosphere reserves, with most of the data that is fed into this framework coming from stakeholders and other institutions conducting monitoring and research within the biosphere reserve.

Keywords: sustainable development, protected areas, Cape Floristic Region, Fynbos, effectiveness, global survey

3.1 Introduction

The Man and the Biosphere (MAB) programme was established by the United Nations Environmental Scientific and Cultural Organisation (UNESCO) in response to growing international concerns over increasing global environmental challenges (UNESCO, 1996). A primary activity of the

MAB programme is the designation of Biosphere Reserves (BRs). BRs are established to explore, promote and demonstrate a working example of a balanced relationship between humans and the biosphere, achieving conservation and sustainable development on a regional/landscape scale (UNESCO 1996; UNESCO 2012b) through interdisciplinary ecological and social research (Wangari 1997). There are currently 610 BRs in 117 countries (UNESCO 2012). BRs are required by UNESCO to fulfil three functions: 1) the conservation of natural capital; 2) economic development that is culturally, socially and environmentally sustainable; and 3) logistical support for research, monitoring and education (UNESCO 1996). BRs worldwide are managed by a variety of organisations, including local, regional and national government (e.g. India) and not-for-profit companies (e.g. South Africa). Sustainable development can be defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987). The purpose of BRs is to provide examples of sustainable development at the landscape scale (UNESCO 2012b). BRs are divided into core, buffer and transition zones. Core areas are predominantly protected areas; buffer zones are normally adjacent to core areas and constitute conservative land uses such as sustainable resource use. Transition zones constitute areas such as agricultural lands and urban areas (Gregg 1999; UNESCO 1996).

To ensure their effectiveness, BRs are expected to provide a periodic review report to UNESCO documenting their progress every ten years (UNESCO 1996). Additionally, progress reports need to be submitted to funders and other organisations that require reports. BRs thus require a monitoring and evaluation (M&E) framework in order to measure their effectiveness at achieving sustainable development and other goals.

Monitoring and evaluation are terms often used together, though they are two distinct but related activities, where monitoring involves the development of indicators, periodically collecting and analysing information through multiple measures over longer time frames, and using this information to make management decisions (Hellawell 1991; Margoluis & Salafsky 1998; Sheil 2002), and evaluation is usually a short, once-off or sometimes periodic activity that involves comparing the impacts of a project or decision against the explicitly stated strategic goals of an activity or organisation, including assessing the cost-efficiency of inputs (e.g. funding, training of staff) and outputs (e.g. projects, community awareness) and the effectiveness in reaching goals (Margoluis et al. 2009; Salzer & Salafsky 2006; Shapiro 2011). Together, M&E is the process of periodically collecting and evaluating data in line with project objectives, goals and activities (Keene & Pullin 2011). This process provides information on the state of a system, measures the outcomes of

management actions, and detects the effects of disturbances (Margoluis & Salafsky 1998; Stem et al. 2005). In a survey of 204 BR managers, Stoll-Kleeman and Welp (2008) found that “monitoring and evaluation for adaptive management” is the fifth most important factor (out of 27 factors) influencing BR effectiveness. Adaptive management can be defined as “a process that integrates project design, management, and monitoring to provide a framework for testing assumptions, adaptation, and learning” (Margoluis & Salafsky 1998).

Indicators can be developed to measure a diverse range of entities or phenomena. Sustainability indicators are evidence-based monitoring and evaluation tools that aim to assess the progress of economic and social development as well as the preservation of ecological systems, or in other words, sustainable development (Environment Australia 2002). They are thus ideally suited to form the basis of an M&E framework for BRs, and have been used for this purpose (e.g., Level & Boumrane 2008).

This paper presents a review of the World Network of BRs (WNBR), with a focus on South African BRs. The global review was undertaken to inform a larger study developing sustainability indicators for the Cape West Coast and Kogelberg BRs in the Western Cape Province of South Africa. The objectives of this review were to investigate within BRs: 1) trends in the application of M&E; 2) institutional capacity to conduct M&E; and 3) the challenges facing BRs in implementing M&E.

3.2 Materials and Methods

3.2.1 Study areas

World Network of Biosphere Reserves (WNBR)

Globally, all BRs form part of the WNBR. There are currently 610 BRs in 117 countries, which include 12 transboundary BRs, which span across multiple countries. BRs occur on six continents and between the latitudes of 77° N and 54° S. As a result of this wide geographical spread, BRs also encompass a vast diversity of biomes, landscapes and cultures. Within the WNBR, North-South and South-South collaborations between BRs are encouraged to promote the sharing of experiences and knowledge, capacity building and best practice (UNESCO 2012b).

South African BR Network

South Africa has a high ecological, socio-economic and cultural diversity (Republic of South Africa 2005). This diversity, and hence complexity, presents substantial challenges in achieving sustainable development (Republic of South Africa 2011). Ecologically, it includes three biodiversity hotspots

(Mittermeier et al. 2004) and 20,456 vascular plant taxa, which represent 6.0% of the world's plant diversity (Raimondo et al. 2009). In terms of its fauna, South Africa contains 5.8% of the world's mammal, 4.6% of reptile and 8.0% of bird species (Republic of South Africa 2005). The ecosystem services within the country of national importance include the supply of water and regulation of its flow, carbon storage, soil accumulation and soil retention (Egoh et al. 2009). The population of South Africa is about 51,770,560. Approximately 30.0% of people 20 years and older have completed school, with about 12.1% of the population having some kind of tertiary education. Almost 9.0% of households do not have access to piped water, while candles and paraffin are still being used by 11.0% and 9.2% of households for lighting (Statistics South Africa 2012a). The average household income across population groups ranges from 69,632 rand p.a. to 387,011 rand p.a. (Statistics South Africa 2012e). South Africa has 11 official languages (Republic of South Africa 1996), all of which have their associated culture. This cultural diversity was perhaps most apparent during the apartheid era, when the segregation of cultural groups was enforced (Republic of South Africa 2005). The effect of these cultural differences on conservation management has presented many challenges and opportunities. Conservation management during the Apartheid era involved forcibly removing people from their land so that nature reserves and game parks could be established, ensuring that conservation transgressed human rights (Brockington and Igoe 2006). After the country's first democratic elections in 1994, conservation management shifted its focus towards socio-economic development, social justice, the maintenance of ecosystems, and the involvement of citizens in decision-making processes (Cadman et al. 2010). The globally-important biodiversity within South Africa has delivered substantial international investment (Knight et al. 2006), that has also been linked to job creation (Cadman et al. 2010). South Africa currently has six BRs, which are located in two of its nine provinces. A seventh BR, the Gouritz Cluster BR, is currently in the process of being established. Details regarding the five BRs that were investigated in this survey are given in Table 3.1.

3.2.2 Survey methods

World Network Survey

A web-based questionnaire survey (Appendix 2) was conducted using Survey-Gizmo (<http://www.surveygizmo.com>). A request to fill out the online questionnaire was sent by e-mail to BR representatives identified through the UNESCO MAB BR directory (<http://www.unesco.org/mabdb/br/brdir/directory/database.asp>). These representatives included BR managers, coordinators, directors, scientists and other BR staff. The online questionnaire comprised 16 items, including open-ended and closed-ended questions and Likert statements, and

was designed to be quick to complete to encourage participation. The questionnaire remained accessible on the web for ten months, from January to October 2011. Reminders were sent on two separate occasions to those that had not responded. For those e-mails that were not operational, alternative e-mails were sought on BR websites and other sources.

South African Survey

Face-to-face, semi-structured interviews with an individual directly involved in the management of five of South Africa's six BRs were conducted (Appendix 2). Staff from the Vhembe BR were not interviewed as a managing company had yet to be established. The interviews were conducted by the primary author at various locations in the Western Cape. The interview protocol included open-ended and closed-ended questions, a choice-like experiment, and Likert statements. The choice-like experiment was used to rank the budget priorities of BR management. Scales were developed from grouped Likert statements for a range of factors related to M&E including monitoring uptake, evaluation uptake, capacity to uptake M&E, perceived effectiveness of M&E, and willingness to engage research. If an interviewee stated that no M&E was conducted within the BR, items relating to the implementation of M&E were not presented to the interviewee for a response. Documentation such as management plans and strategic framework plans were also used to gain additional, detailed information regarding the management structures and plans of the BRs (Table 3.2).

3.2.3 Data analysis

Wherever possible, responses to open-ended questions in the World Network survey were categorised according to the trends that were identified in the responses. For the responses to the South African survey's open-ended questions, this was not possible due to the low sample number (n=5), however these responses were discussed and compared with the findings of the WNBR survey. Descriptive statistics were used to analyse the data in Microsoft Excel.

Table 3.1: Details of the South African biosphere reserves whose co-ordinators were interviewed (Mucina & Rutherford 2006; UNESCO 2012c). The Vhembe biosphere reserve was not included in this analysis

Biosphere Reserve	Province	Designated	Extent (ha)	Major Vegetation Types	Dominant land use
Kogelberg (KBR)	Western Cape	1998	103 629	Sand Fynbos; Shale Renosterveld; Granite Renosterveld	Agriculture
Cape West Coast (CWCBR)	Western Cape	2000	378 240	Shale Fynbos; Sandstone Fynbos	Agriculture
Cape Winelands (CWBR)	Western Cape	2007	322 030	Sandstone Fynbos; Alluvium Fynbos	Agriculture
Waterberg (WBR)	Limpopo	2001	414 571	Central Bushveld Bioregion	Privately owned game reserves and game farms
Kruger to Canyons (K2C BR)	Limpopo	2001	2 474 700	Lowveld Bioregion; Mopane Bioregion	Natural resource use and protected areas

Table 3.2: Details of documents gathered from South African biosphere reserves

Biosphere Reserve	Document title	Year Published	Developed By
Kogelberg	Strategic Management Framework	2007	Consultant
Cape West Coast	Business Plan	2004	Consultant
	Strategic Plan	2004	Consultant
Cape Winelands	Spatial Development Plan	2009	Consultant
Waterberg	Management Plan Report	2011	Consultant
Kruger to Canyons	Environmental Management Plan	2008	Provincial government
	Strategic framework	2012	BR staff

Table 3.3: The survey-effort of the World Network of Biosphere Reserve web-based survey

BR and Response Details	Total
Total listed BRs	610
Total identified BRs	574
Working E-mail addresses located	348
Responses	58
BRs sampled	63
Countries sampled	28
Response rate (% of total sample of total identified BRs)	10.2
Response rate (% of total working E-mail addresses)	16.7

3.3 Results

3.3.1 World Network Survey

Excluding the South African BRs, 574 BRs were identified. A total of 58 responses were received. The details of the World Network survey effort are presented in Table 3.3. Most respondents (65.5%, n=38) were BR managers or coordinators. Remaining respondents included directors, scientists and other BR staff.

Monitoring is conducted in 84.5% of BRs (n=54) and 72.4% had been evaluated (n=42) (Fig. 3.1). A higher proportion (96.9%, n=31) of BRs in higher income than in upper-middle income countries (73.7%, n=14) conduct monitoring (Fig. 3.2), with similar results for evaluations within higher income and upper-middle income countries (Fig. 3.3). Only ecological monitoring is conducted in more than two-thirds (68.0%, n=34) of the BRs, with far fewer conducting social and economic monitoring (Fig. 3.4). In both higher and upper-middle income countries, high proportions of BRs (60.7%, n=17 and 71.4%, n=10 respectively) conduct only ecological monitoring, while 25.0% (n=7) of BRs in higher income countries conduct social, ecological and economic monitoring (Fig. 3.5).

Of the 14 (24.1%) BRs that had never been evaluated, the main reasons given for this lack of an evaluation were that the BR had only been designated recently (42.9%, n=6), the BR had evaluations that were still in the planning stages (21.4%, n=3), and two (14.3%) of the BRs gave limited capacity as a reason (Fig. 3.6). The majority of BRs (66.7%, n=22) use the results of evaluations to refine management practices. Far fewer (9.1%, n=3) engage a process of stakeholder consultation to implement the results of their evaluations (Fig. 3.7).

More than half (55.1%, n=32) of all BRs had not developed sustainability indicators, while 37.9% (22) had reportedly developed sustainability indicators. Of the respondents who stated that their BRs apply sustainability indicators, 68.2% (15) stated they are actively measured, while 31.8% (7) stated that they are not. The proportion of BRs not actively measuring their sustainability indicators is higher in the upper-middle income countries (68.5%, n=13) than in the higher income countries (53.1%, n=17) (Fig. 3.8). Reasons why sustainability indicators were not actively measured included limitations with regards to capacity limitations (33.3%, n=11), stakeholder cooperation (30.3%, n=10) and difficulties in selecting appropriate indicators (27.3%, n=9) (Fig. 3.9).

The most substantial challenge to implementing effective M&E was reportedly limited funding, with 45% of respondents saying this was a “highly significant” challenge, followed by staff skills and

capacity, with 45.8% of respondents saying this was a “very significant” challenge. “Staff knowledge” and “time” rank equally in the “highly significant” (16.7%) and “very significant” (41.7%) categories, however the latter appears to be a more important challenge, with 35.0% of respondents saying that time is of “moderate significance”. “Importance of M&E” was found to be the second least substantial challenge, followed by a low return-on-investment (ROI) (Fig. 3.10).

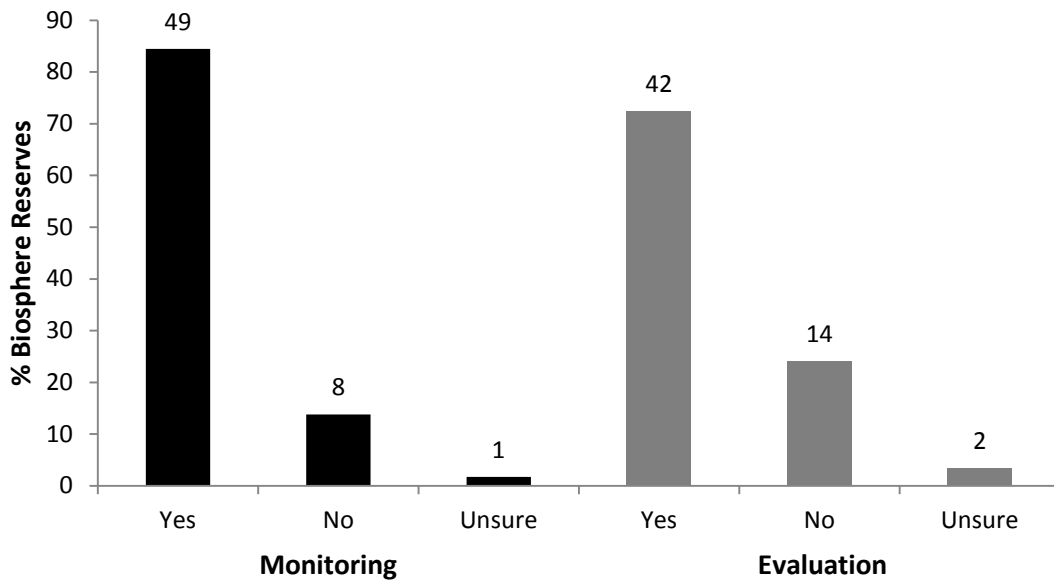


Figure 3.1: The proportion of biosphere reserves conducting monitoring and/or evaluation identified from the web-based survey of the World Network of Biosphere Reserves. The figure above each column is the number of biosphere reserves

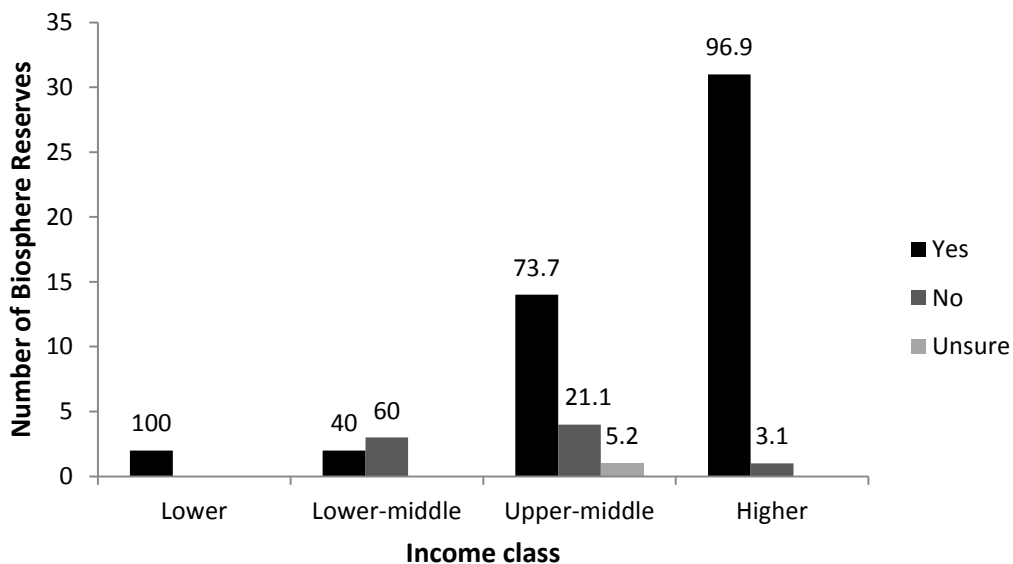


Figure 3.2: The number of biosphere reserves per income class conducting monitoring within biosphere reserves identified from the web-based survey of the World Network of Biosphere Reserves. Countries were divided into income classes based on The World Bank categories. The figure above each column is the percentage within that income class

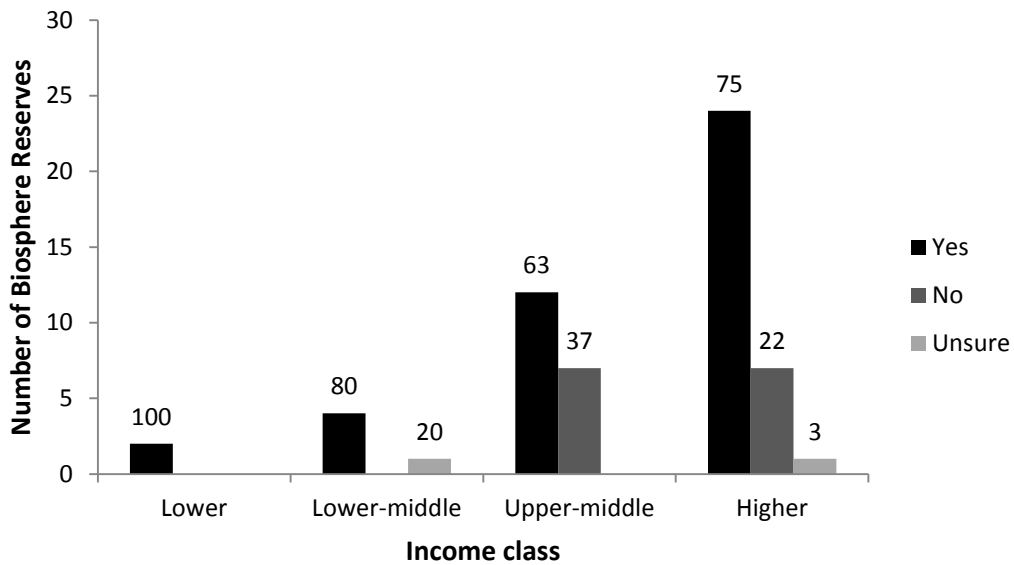


Figure 3.3: The number of biosphere reserves per income class that have been evaluated as identified from the web-based survey of the World Network of Biosphere Reserves. Countries were divided into income classes based on The World Bank categories. The figure above each column is the percentage within that income class

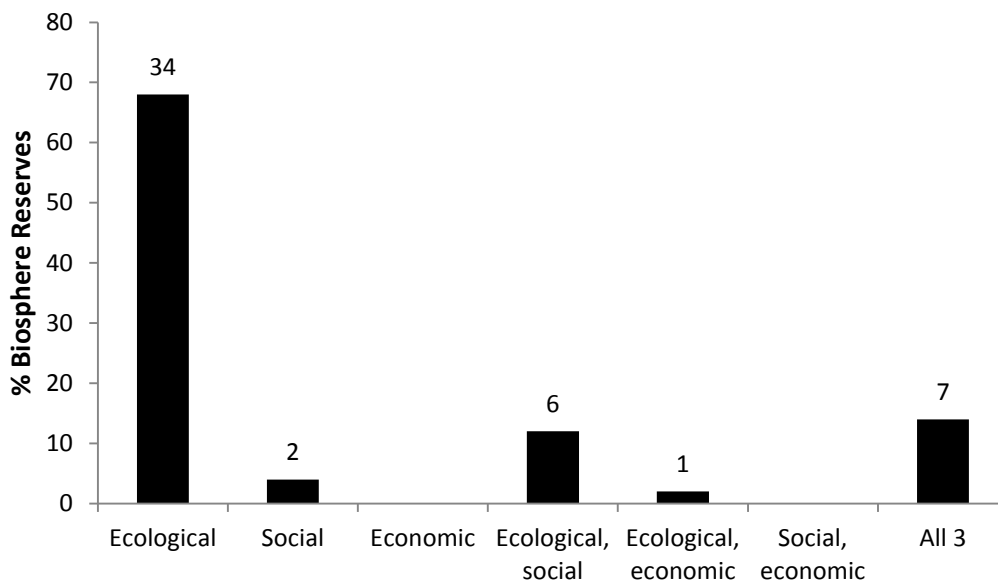


Figure 3.4: The types of monitoring conducted within biosphere reserves identified from the web-based survey of the World Network of Biosphere Reserves. The figure above each column is the number of biosphere reserves

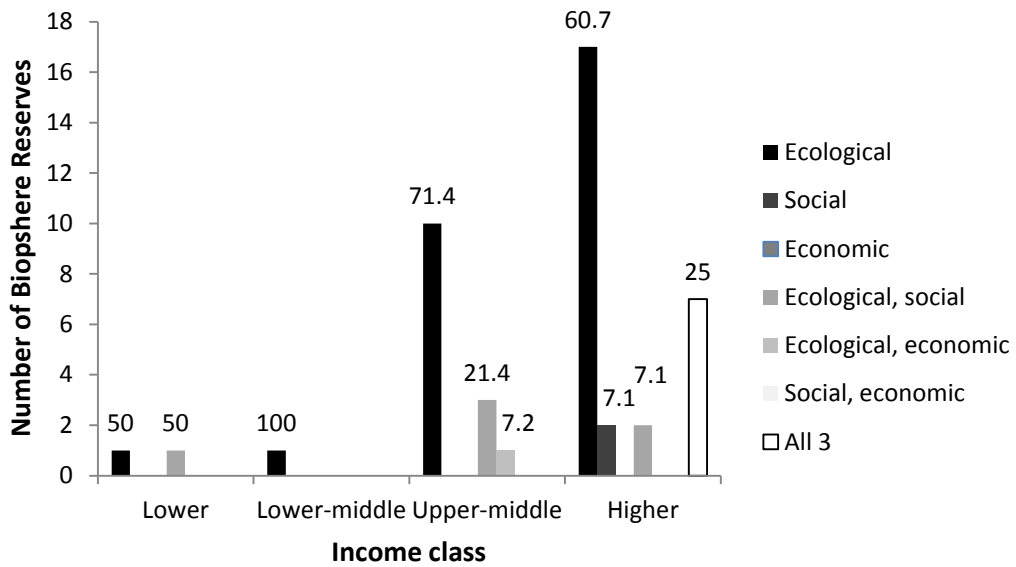


Figure 3.5: The types of monitoring conducted within biosphere reserves per income class as identified from the web-based survey of the World Network of Biosphere Reserves. Countries were divided into income classes based on The World Bank categories. The figure above each column is the percentage within that income class

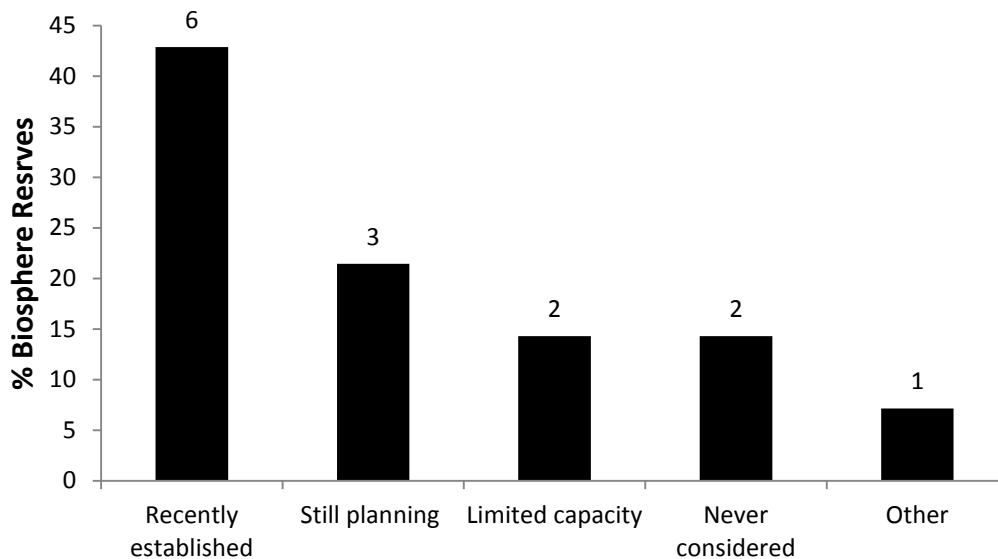


Figure 3.6: Reasons why evaluations are not conducted within biosphere reserves identified from the web-based survey of the World Network of Biosphere Reserves. The figure above each column is the number of biosphere reserves

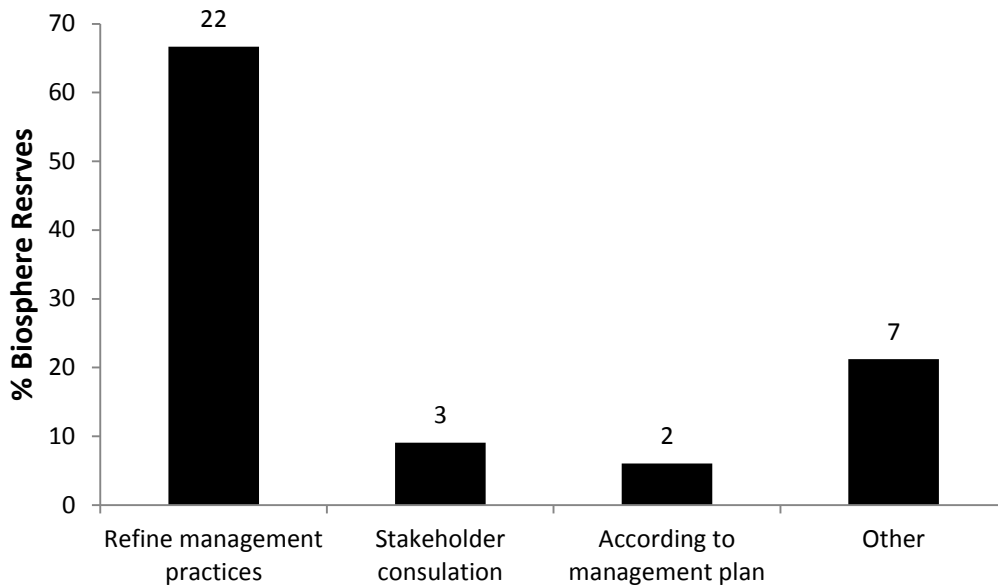


Figure 3.7: The ways in which the results of evaluation are implemented within biosphere reserves identified from the web-based survey of the World Network of Biosphere Reserves. The figure above each column is the number of biosphere reserves

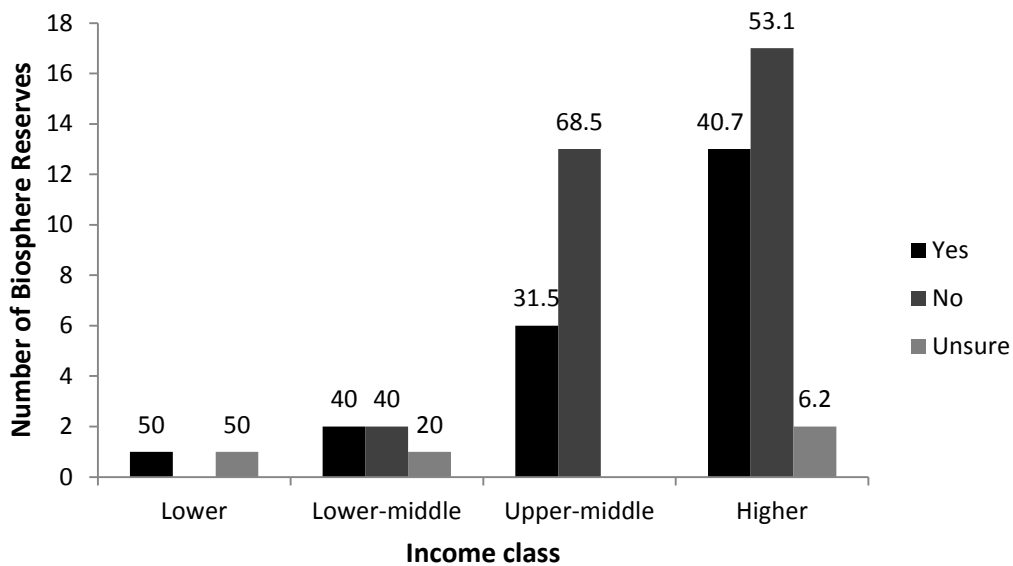


Figure 3.8: The number of biosphere reserves that have developed sustainability indicators per income class as identified from the web-based survey of the World Network of Biosphere Reserves. Countries were divided into income classes based on The World Bank categories. The figure above each column is the percentage within that income class

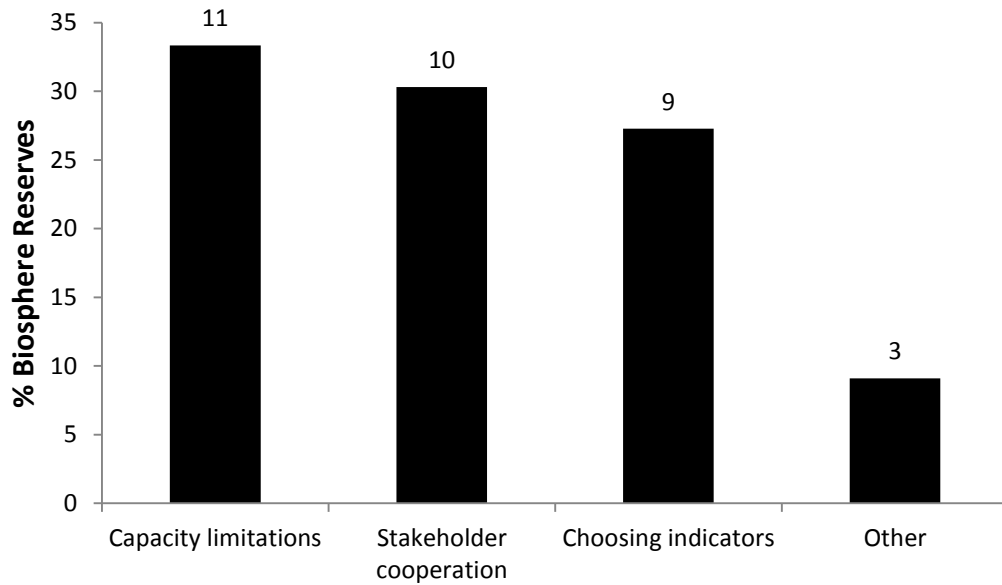


Figure 3.9: Reasons why sustainability indicators are not actively measured within biosphere reserves identified from the web-based survey of the World Network of Biosphere Reserves. The figure above each column is the number of biosphere reserves

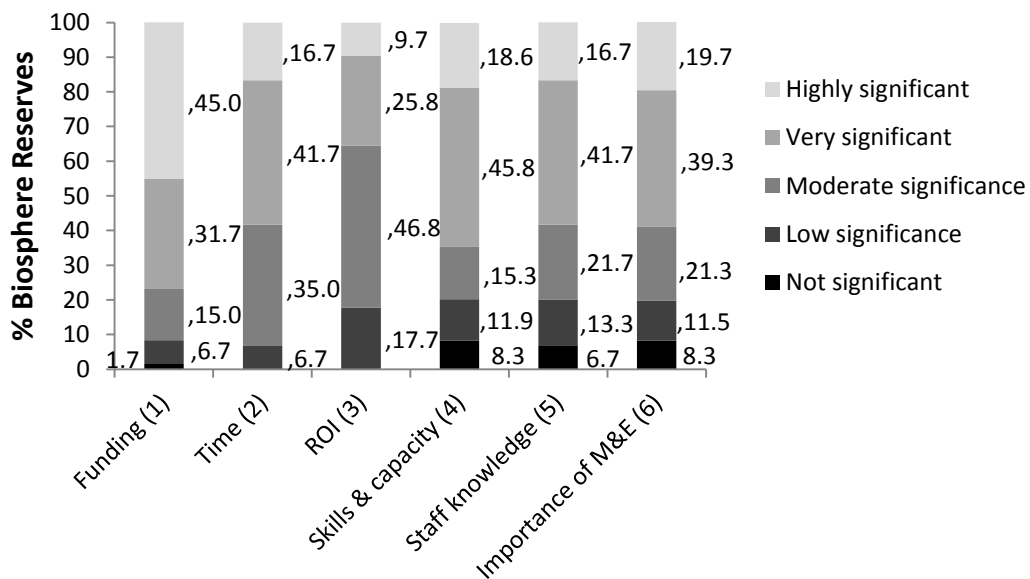


Figure 3.10: Challenges to the effective implementation of monitoring and evaluation systems within biosphere reserves identified from the web-based survey of the World Network of Biosphere Reserves. 1) Funding needed to implement M&E, 2) Time available for M&E activities, 3) Return-on-investment, 4) Skills & capacity of staff regarding M&E, 5) Staff knowledge of M&E, 6) Recognition by staff of the importance of M&E

3.3.2 South African Survey

The CWBR interviewee was the only BR management representative that said that the BR does not carry out any M&E. For this reason, only certain items of the interview protocol were applicable for this interview. Most notably, only the “willingness to engage research” and “capacity to uptake M&E” indices were applicable. The choice-like experiment and other questions related to the implementation of M&E were also not applicable.

The CWCBR interviewee scored the highest in all indices except for “willingness to engage research” and “evaluation uptake”, in which they were second highest. The highest in the latter two categories was the KBR interviewee (Fig. 3.11).

The results of the choice-like experiment showed that project implementation received the highest priority in the budget of all of the BRs, except for the CWCBR. M&E was ranked as the lowest for all of the BRs, except for the K2C BR, for which it ranked second lowest along with advertising and travel (Table 3.4).

In terms of the most challenging aspects of running a BR, stakeholder cooperation was reported as the greatest challenge in three out of the five BRs (K2C BR, CWBR and CWCBR), while in the CWBR and KBR, funding was mentioned as the greatest challenge. The WBR interviewee said that generating the necessary capacity to implement projects is a big challenge. When asked what the most challenging aspects to M&E within their BR are, the four interviewees gave relatively diverse answers. The CWCBR interviewee said that funding opportunities often don't fall in line with the goals of the business plan because the BR must be opportunistic in obtaining funds, and so when measuring against these goals it appears that the BR is achieving less than it is in reality. Funding and capacity was mentioned as the biggest issue in the WBR. The KBR interviewee said that identifying the most crucial aspects to be monitored is difficult because of the many dimensions of a BR. Stakeholder cooperation is reportedly the most challenging M&E aspect within the K2C BR, as the different organisations within the BR use different M&E methods.

All of the interviewees agreed that adaptive management is an important strategy, but at the time the interviews were being conducted it was being implemented to varying degrees within the BRs. In the KBR, it was not being implemented owing to a lack of management. In the CWBR and WBR, the stage had not yet been reached where it could be implemented. In the CWCBR and the K2C BR, it is a very strong strategy and is being fully implemented.

Table 3.4: The number of times each South African BR interviewee selected each budget item in the choice-like experiment.

Biosphere Reserve				
Budget item	KBR	CWCBR	WBR	K2CBR
Project implementation	5	3	5	5
Salaries	4	4	1	0
Administration	3	5	4	4
Advertising	2	0	1	2
M&E	1	1	1	2
Travel	0	2	3	2

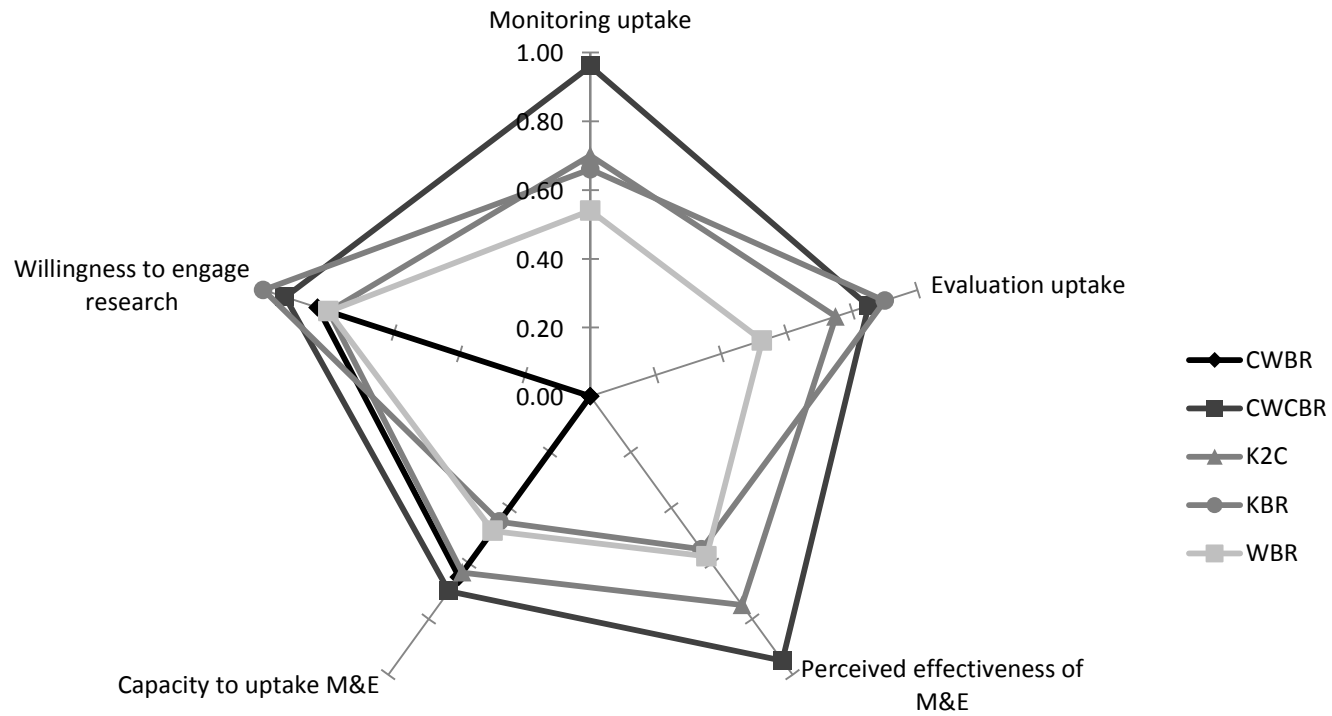


Figure 3.11: Diagram of the scale values of South African biosphere reserve’s monitoring and evaluation capacities and perceptions

3.4 Discussion

There is increasing recognition of M&E as an integral component of effective environmental management within the conservation community (Legg & Nagy 2006; Stem et al. 2005; Salzer & Salafsky 2006). BRs require M&E to provide UNESCO and donors with evidence of their effectiveness in achieving strategic goals, and to implement adaptive management (UNESCO 1996). The majority of responding BRs in the World Network survey have implemented M&E systems, but in this study, there is an absence of data on the type of M&E methods that BRs employ. This means that, although most of the responding BRs reportedly have an M&E strategy, there is a large degree of uncertainty as to whether the methods they are using are appropriate. Many of the M&E systems that have been implemented have probably been poorly designed and poorly implemented (Legg & Nagy 2006). The South African BR network and the WNBR appear to face many similar challenges with regards to the implementation of M&E. In both cases, it is clear that M&E programmes are being implemented in many BRs, but there is great diversity in the degree to which BRs have recognised the importance of M&E and incorporated it into their management plans and strategies.

In the South African survey, the CWBR interviewee stated that no M&E had been implemented. In the CWBR Spatial Development Framework, it is proposed that the BR should use an adaptation of the Environmental Indicators for National State of the Environment Reporting (Republic of South Africa 2002), which includes phases of the management process that are referred to as monitoring, corrective action and management review. The WBR ranked the lowest in both the monitoring and evaluation uptake indices. In the WBR, much monitoring is conducted by various stakeholders, but management had not begun to make use of these stakeholders for the purposes of M&E at the time of this survey. Through the interview with the CWCBR interviewee, it was clear that this BR had an effective M&E strategy in place, which is supported by the M&E scale results of a high M&E uptake, as well as a high capacity to uptake M&E. In the CWCBR, every project is monitored by the coordinator and project manager, with the board involved in the evaluation of projects.

The strategic plan of the CWCBR and the strategic management framework of the KBR both identify monitoring as a key management tool, with the latter placing emphasis on the monitoring of environmental conditions as well as the performance of the BR company. The proportionally high number of WNBR survey respondents who stated ecological monitoring was being conducted in their BR is in line with the general trend in conservation science, in that most research is ecological (Balmford & Cowling 2006; Fazey et al. 2005; Mascia et al. 2003). According to the Seville Strategy (UNESCO 1996), transdisciplinary research needs to be conducted within BRs. Social, cultural,

political and economic data needs to be gathered and developed in response to specific, stakeholder-identified challenges to provide a more holistic understanding of a BR in the context of seeking sustainable development (Stem et al. 2005). In this study, only those BRs in higher income countries conduct monitoring across these dimensions, most likely because these BRs have the necessary capacity to implement such monitoring. However, the monitoring of social and economic dimensions should be a priority in developing countries, as the level of inequality in these countries is high, with greater proportions of their population in poverty (Kuznets 1955).

The KBR company is evaluated annually in accordance with the strategic management framework, which could be the reason why this BR scores the highest with regards to evaluation uptake. The majority of respondents from the WNBR survey and the South African BR co-ordinator interviews stated that the results of their evaluations are used to refine management practices, which suggests that many BR personnel realise that evaluations are an important management tool (Stem et al. 2005). Globally, the main reasons given as to why BRs had not conducted an evaluation were primarily that the BR had only recently been established, or the evaluation process was still in the planning stages. In the WNBR survey, respondents that stated their BRs were only recently established (n=6) were from BRs that ranged from between a few months to six years since establishment prior to the survey. The three BRs whose evaluations were still in the planning stages were established a few months, four years and 43 years prior to the survey. An evaluation should be conducted as soon as possible after designation in order to develop baselines and a status quo (Ferraro & Pattanyak 2006; Nichols & Williams 2006). Those respondents who declared relatively long time periods since BR establishment may be struggling to implement M&E systems owing to a lack of funding and capacity (Ferraro & Pattanyak 2006).

Establishing an effective M&E system is dependent upon the identification and application of indicators. In the case of BRs, sustainability indicators are appropriate as BRs seek to promote sustainable development. Although none of the South African BRs have implemented sustainability indicators *per se*, several of the management documents of the BRs do propose or identify the use of indicators. The strategic plan of the CWCBR proposes a set of indicators that relates to both the “natural components” and the “socio-economic components” of the BR. The KBRs strategic plan identifies goals with associated management objectives, activities, time frames, deliverables, targets, performance indicators and implementation arrangements. One of the objectives of this plan is to develop sustainability indicators. The K2C BR environmental management plan includes a list of implementation indicators, which is a list of aspects that need to be monitored for the effective

implementation of the BRs strategy. This BR also has a strategic framework for the operations of the K2C BR Non Profit Company. This includes indicators that are related to the goals, objectives and key activities of the company. This document also states that sustainability indicators need to be developed. The fact that 22 of the BRs identified in the WNBR survey have developed sustainability indicators is surprising, as a search of the peer-reviewed and grey literature only produced examples of sustainability indicators for a few BRs (Chapter 2). BRs in developed countries would have a greater capacity to measure their indicators than those in developing countries, as is reflected in the results of this study. Capacity limitations, lack of stakeholder cooperation and choosing the most essential and appropriate indicators were the main reasons stated in the global survey as to why a few of the BRs identified in the WNBR survey are not actively measuring their sustainability indicators, which are all general challenges also identified in the South African interviews. Capacity and stakeholder cooperation are two dimensions that are extremely important for the achievement of the goals of a BR (Schultz et al. 2011; Stoll-Kleeman et al. 2010). As stated by the KBR interviewee, choosing indicators is challenging because there is so much that could be measured, but what can be measured is limited by capacity. Indicators need to be few in number, otherwise they will not easily be absorbed by decision-makers (Hammond et al. 1995).

Examining why M&E has not been implemented in individual BRs may offer insights useful for improving future uptake of these important activities. Both M&E need to be undertaken for BRs to operate effectively (Keene and Pullin 2011). BRs implementation of *both* M&E in the WNBR and the South African BR network was reported in 37 and 4 cases respectively. A system that measures the success of a BR should involve a framework which consists of M&E as well as sustainability indicators. Indicators are tools which are useful to summarise the information gathered through M&E processes and can be used to communicate this information to stakeholders (Beratan et al. 2004; Levrel & Bouamrane 2008). The integration of indicators into an M&E system can be effectively achieved by making use of an adaptive management framework (Levrel & Bouamrane 2008; Reed et al. 2006).

All of the South African BR interviewees, except for the CWBR, stated that adaptive management is a strategy that has been or will be implemented. The CWBR interviewee stated that adaptive management will probably be a strategy, but a management plan and explicit goals are yet to be drafted. However, the CWBR Spatial Development Plan (a statutorily-required land-use plan) states that adaptive bioregional management will be the management approach that is used in the CWBR, describing this concept as the incorporation of long-term monitoring to assess the effectiveness of

management policies at the bioregional scale as a guide to taking ever-improving actions. The CWCBR interviewee stated that every project that is implemented by the CWCBR Company has an M&E system in place for adaptive learning and written progress reports are regularly provided to the board and donors. The WBR interviewee stated that they have not established an M&E process yet, but that it is very important to do so. There are plans to have constant monitoring of projects and the organisational structure so that priorities and management structures can be refined annually. The management plan of the WBR identifies a desired state in which the BR is “a repository of all relevant existing research” and management “is consistently improved through ongoing monitoring and the application of new and relevant research”. Strategies to achieve this desired state include establishing a research and monitoring committee, keeping up to date with all relevant research, and implementing a research and monitoring database. The K2C BR interviewee stated that adaptive management is a very strong strategy within the BR. The environmental management plan of the K2C BR states that regular monitoring of the status quo should be guaranteed so that corrective actions can be taken if the objectives of the BR are not being met. The Kruger National Park (which forms the core of the BR) is well-known for its adaptive management strategy (Mcloughlin et al. 2011; Roux and Foxcroft 2011; Venter et al. 2008), which appears to have had a major influence on the BRs management strategy. According to the KBR interviewee, adaptive management is an ideal that should be happening in the BR, but it doesn’t happen because of limited management capacity. These findings show that adaptive management is a strategy within all of the South African BRs, but certain BRs are struggling to implement this strategy owing to capacity limitations.

As is often the case for conservation and sustainable development initiatives, funding was identified as the most important limitation (Balmford et al. 2002; James et al. 2001). As a result of this limited funding, it becomes even more imperative for BRs to prove that they are using this funding effectively. Effective M&E activities are therefore essential for ensuring that limited funding is used in the most cost-efficient way (Nichols & Williams 2006). Adequate funding is required to generate the necessary capacity to implement M&E programmes. This should include developing the internal capacity within BRs to design and implement M&E systems as a long-term goal, and/or the development of relationships with organisations, such as universities, that can cost-efficiently assist with M&E. In the field of conservation it is often challenging to calculate the optimal level of resourcing that should be allocated towards M&E (Salzer & Salafsky 2006). The application of decision theory can assist in this regard (McDonald-Madden et al. 2010). Unfortunately, a general response to optimising scarce resources is to channel funding to the implementation of projects, rather than the measurement of outcomes (Kapos et al. 2008). This study found that project

implementation is indeed the budget item that was determined to have highest priority in three of South Africa's BRs. The low importance of the return-on-investment challenge suggests BRs would carry out more M&E if they had sufficient capacity available regarding staff skills and knowledge, as well as more funding and time. Through the evaluation of BRs, more evidence for their effectiveness will be produced which potentially could encourage greater support and funding for BRs (Ferraro & Pattanayak 2006). The challenges to M&E that the South African BR interviewees identified were stakeholder collaboration, funding and capacity, aligning funding opportunities with the timeframe of the business plan, and identifying the most crucial dimensions of their social-ecological system to measure. The K2C BR interviewee mentioned that different organisations within the BR use different M&E methodologies, thus it is a challenge to align these different M&E plans. The same M&E language and systems should be used to enhance communication and understanding between organisations (Stem et al. 2005).

Collaborations between organisations are essential for ensuring effective adaptive co-management (Berkes, 2009). Examining four BR case studies, Whitelaw et al. (2004) found that collaborations between BRs and civil society organisations can provide several advantages, including the use of research data for BR management, and the use of these organisations to implement monitoring programmes. In a global survey, Schultz et al. (2011) found that 46 out of 146 responding BRs have effective collaborations with local inhabitants, scientists and government bodies. Willingness to engage research was found to be high amongst all respondents of the South African survey. All of the South African interviewees mentioned that collaboration with other institutions is a strategy of their BR. The WBR interviewee stated that they plan to partner with other organisations such as LEDET (Limpopo Department of Economic Development, Education and Tourism) so that they can increase their monitoring capacity, as most funding will go towards the implementation of projects. Partner organisations can provide personnel with the necessary skills to conduct M&E for BRs. According to the CWCBR business plan, the BR board recognises that data from research activities that are conducted within the BR can be used for monitoring and that this can lead to opportunities to collaborate with other institutions. The environmental management plan of the K2C BR includes comprehensive information on the indicators currently being monitored within the BR by other stakeholders and includes strategies for the use of this monitoring data by the BR. The K2C BR interviewee stated that there is an integrated regional monitoring and evaluation plan between different institutions. The KBR interviewee stated that substantial monitoring is conducted within the BR, but the absence of a coordinator (there is no funding to pay someone to fill this position) means the BR cannot utilise this monitoring data. This is reflected in the KBR being ranked lowest

regarding the capacity to uptake M&E. As other studies have found, a champion is essential to drive not just M&E systems, but sustainable development initiatives more generally (Cadman et al. 2010).

Although the majority of World Network survey respondents stated some form of monitoring and/or evaluation was conducted in their BR, it is likely that implementation of *effective* M&E systems has been over reported, as the reliability of respondents' information can vary substantially (e.g., St. John et al. 2010). Firstly, both interview and survey respondents tend to over-report their effectiveness when questioned about topics reflecting their personal performance (Babbie 2012). Secondly, both monitoring and evaluation are activities which are often misunderstood and poorly defined (Salzer & Salafsky 2006). As the majority of respondents were unlikely to have been M&E experts, there are probably activities thought by BR coordinators to constitute effectively-designed and implemented M&E activities which would not be classified so by M&E experts. If M&E is to be implemented effectively, a set of definitions for key terms needs to be decided upon (Stem et al. 2005). Accordingly, our study is likely to have over-estimated the degree to which M&E has been implemented in the BRs identified in the WNBR survey. A substantial danger where M&E has been implemented ineffectively is the appearance of a positive achievement being created, when in fact, it is not. Poorly conceived or implemented M&E systems may produce erroneous results that create the impression of effectiveness. The irony of this situation is that tools designed to improve the effectiveness of BR operations actually disguise and promote ineffectiveness.

One major limitation of the World Network survey was the small proportion of BRs that responded to the survey, meaning that the results cannot be extrapolated across the WNBR. A possible reason for this low response is the language barrier. The survey was only distributed in English. This has several potential implications, including: 1) respondents might not have fully understood the questions, and thus not answered correctly, as was the case with some of the responses; 2) non-English speaking people receiving the questionnaire might not have responded to the questionnaire because they could not understand it.

With regards to future research, an attempt should be made to survey more BRs across the WNBR. In depth case studies are needed to compare the M&E systems of selected effective and ineffective BRs worldwide, focusing on the way in which M&E is implemented and how decision-making processes utilise the information that is generated. Innovative solutions to the capacity limitation challenge of BRs are also needed.

BRs require innovative means to generate the necessary capacity to achieve their goals. For this reason, it is essential that BRs implement M&E systems that measure the key aspects of their ecological, social and economic dimensions. Most of South Africa's BRs have adequate M&E strategies, but limited funding is preventing some of them from performing their operational functions. A lot of monitoring is done by stakeholders within BRs and other institutions, but not much by the BR companies. To quote the K2C BR interviewee, these activities are being done "anyway", so by partnering with these institutions, BR companies don't have to spend a lot of money on M&E. Given the large extent of, and considerable investment in, BRs, M&E is essential for ensuring that they are effective. Sustainability indicators would be an effective tool for this purpose, as a well-designed framework will be able to measure the effectiveness of all these dimensions of a BR, with most of the data that is fed into this framework coming from stakeholders and other institutions conducting monitoring and research within the BR.

Chapter 4: Collaborative Development of Sustainability Indicators for the Kogelberg and Cape West Coast Biosphere Reserves in the Cape Floristic Region Biodiversity Hotspot

Abstract

Natural capital is defined as the sustainable flow of ecosystem services and goods that is yielded by natural ecosystems. Sustainable development, a concept which encompasses socio-economic growth and the conservation of the natural environment, has been adopted by many initiatives worldwide in an attempt to mitigate the loss of natural capital that is being caused by anthropogenic activities. Biosphere reserves, which are designated by UNESCO's Man and the Biosphere programme, aim to involve their stakeholders in a collaborative effort to meet landscape-scale sustainable development goals. Biosphere reserves require evidence-based monitoring and evaluation frameworks to measure their progress towards sustainable development. Sustainability indicators have been identified as an appropriate tool that can be used for this purpose. The Kogelberg and Cape West Coast Biosphere Reserves of the Cape Floristic Region expressed an interest in collaboratively developing sustainability indicators. Sustainability indicator sets were compiled through a participatory process that involved workshops with local stakeholders and focus groups with specialists in fields related to sustainable development. The local stakeholder workshops produced large sets of indicators, with many that were immeasurable, while the specialist focus groups produced substantially smaller sets with a higher proportion of indicators that could be feasibly implemented. Local stakeholder's area specific knowledge was integrated with the specialist's knowledge of sustainable development and indicator concepts to produce a sustainability indicator set for each biosphere reserve. There was considerable overlap in the categories of the indicators between the final sets for each biosphere reserve. Thus, a core set of indicators could potentially be developed for all the South African biosphere reserves, however, the development of indicators on a case-by-case basis should be encouraged to account for variations in the circumstances and needs of biosphere reserves. The outputs of this study will be used in the formulation and implementation of a national protocol for the development of sustainability indicators for biosphere reserves.

Keywords: monitoring, evaluation, local stakeholders, specialists, experts, sustainable development, conservation

4.1 Introduction

Natural capital is the sustainable flow of ecosystem services and goods that is yielded by natural ecosystems (Costanza & Daly 1992). Maintaining the earth's natural capital is fundamental to the maintenance of ecosystems and human well-being. Natural capital is declining owing to pressures such as climate change, overharvesting, habitat destruction, freshwater extraction, pollution and industrialisation (Daily 1997; MA 2005; Pimm et al. 1995). Evidence-based measures of effectiveness of conservation and sustainable development activities are required to quantify the positive or negative changes to social-ecological systems when attempting to mitigate these pressures (Keene & Pullin 2011).

The practice of utilising scientific tests to confirm or deny the effectiveness of actions taken to influence a system or entity originated in the medical field, and became known as evidence-based practice, a concept resulting from concerns that expert opinion – which lacks evidence – was the primary source of information informing decisions and recommendations (Keene & Pullin 2011; Sutherland et al. 2004). Similarly, the fields of conservation and sustainable development are driven primarily by decisions based on 'common sense' or 'personal experience' and not scientific evidence (e.g., Sutherland et al. 2004). Ensuring that evidence-based practice is adopted to achieve conservation and sustainable development goals requires the implementation of monitoring and evaluation (M&E) frameworks which can provide a foundation for adaptive management (Keene & Pullin 2011).

Monitoring and evaluation are terms often used together, but are two distinct but related (and often confused) activities, with monitoring involving the development of indicators, periodically collecting and analysing information relating to these indicators, and using this information to inform management decisions, a process usually involving longer time frames and repetitive measures (Hellawell 1991; Margoluis & Salafsky 1998; Sheil 2002). Evaluation involves comparing the impacts of a project or decision against the explicitly stated strategic goals of a project or organisation, including assessing the cost-efficiency of inputs (e.g. funding, training of staff) and outputs (e.g. projects, community awareness) in reaching goals, and is usually a shorter, once-off or sometimes periodic process (Margoluis et al. 2009; Salzer & Salafsky, 2006; Shapiro 2011). Together, M&E forms a process of periodically collecting and assessing data in line with project objectives, goals and activities (Keene and Pullin 2011). This process provides information on the state of a system, measures the outcomes of management actions, and detects the effects of disturbances (Legg & Nagy 2006; Margoluis & Salafsky 1998; Stem et al. 2005).

Indicators are required for conducting monitoring and provide information on the current state of a system and whether it is moving away from or towards a desired state, or being maintained at a particular state (Bell & Morse 2008; Ukaga & Maser 2004). Indicators are essential tools for adaptive management in that they underpin feedback mechanisms and early warning systems, and allow information to be easily summarised for communication and interpretation by decision-makers and other stakeholders (Levrel & Bouamrane 2008; Mitchell 1996).

Sustainable development can be defined as the growth of human societies that satisfies the needs of the present generation without jeopardising those of future generations (WCED 1987), or development that enhances the quality of human well-being while not exceeding the carrying capacity of ecosystems (Munro & Holdgate 1991). Sustainability indicators (SIs) are evidence-based monitoring and evaluation tools that aim to assess the progress of economic and social development, as well as the conservation of ecological systems, making them popular tools to use for the M&E of sustainable development initiatives (Beratan et al. 2004; Bowen & Riley 2003; Morse et al. 2001). Resources allocated to sustainable development are relatively limited compared to development more generally (James et al. 2001), meaning the application of evidence-based approaches (such as SIs) is imperative to ensure that these limited resources are used effectively (Ferraro & Pattanayak 2006; Stewart et al. 2005).

Biosphere reserves (BRs) are established with the aim of creating landscape-scale examples of complementary suites of instruments and institutions that aim to achieve sustainable development and conservation (UNESCO 1996, 2012b). BRs, as designated under UNESCO's Man and the Biosphere (MAB) programme, have three primary functions: to 1) conserve natural capital; 2) promote economic development that is sustainable in terms of cultural, social and environmental needs; and 3) provide logistical support for education, research and monitoring. UNESCO requires BRs to submit a periodic review every ten years in order to track their effectiveness (UNESCO 1996).

SIs have been developed using a variety of methods which can be categorised according to the level of stakeholder involvement. These range from top-down approaches using national- or international-level data to locally-driven initiatives identifying issues that are important to local communities (Reed et al. 2006). The input of expertise from a diverse range of stakeholders functioning at different scales is generally regarded as the most useful and effective approach to decision-making when managing natural capital (Ostrom 1990; Plummer & FitzGibbon 2006;

Wondolleck & Yaffee 2000). The term 'expertise' is generally restricted to those people who are professionals in a specific field, such as scientists, and their knowledge is often seen as superior to the knowledge of stakeholders or the general public – however, expertise is context specific (Burgman et al. 2011). Experts are generally viewed as specialists with a background in a particular subject area and having the necessary knowledge to provide answers to questions relating to that subject area (Meyer & Booker 1990). Expert knowledge can take a variety of forms, including formal and informal knowledge, structured and unstructured knowledge, tacit and explicit knowledge, and situated knowledge (De Jong & Ferguson-Hessler 1996). Accordingly, local people who are not professionals can also be considered experts (Burgman et al., 2011; Fazey et al. 2006). Involving local stakeholders in projects aiming to achieve conservation and/or sustainable development goals is highly important. This ensures that stakeholders: 1) gain a good understanding of how the project affects their lives and that of their communities; 2) gain a sense of ownership; and 3) become more committed to the project and willing to take responsibility for it (Margoluis & Salafsky 1998; Reed 2008). The involvement of specialists in the SI development process is important, because local stakeholder outcomes can be refined and improved by specialist knowledge and skills (Reed et al. 2006).

South Africa has high cultural and socio-economic diversity, but achieving sustainable development is challenging owing to high levels of poverty, with many approaches being used to address these challenges (Cadman et al. 2010; Republic of South Africa 2005). The establishment of BRs is one approach that is being used (Rabie 2012). There are currently six BRs in South Africa. The Cape West Coast and Kogelberg BRs (CWCBR and KBR) are both situated in the Cape Floristic Region (CFR), which is a biodiversity hotspot (Mittermeier et al. 2004). No South African BRs currently implement SIs but they are being recognised by the BRs as essential tools to measure their effectiveness.

The aims of this study were to: 1) develop sets of pragmatic and locally relevant SIs for use by the Kogelberg and Cape West Coast Biosphere Reserves; 2) compare the two sets of SIs to determine if distinct processes are required for developing SIs for individual BRs; and 3) trial an approach for developing SIs for application with other South African BRs.

4.2 Methods

4.2.1 Study Areas

The Biosphere Reserves

The KBR and CWCBR are both run by not-for-profit companies. The companies are run by a board who are advised by a technical committee (Cape West Coast Biosphere Reserve 2004; iKapa

Envioplan 2007). The KBR was designated in 1998, making it South Africa's oldest BR, and is approximately 103,629 ha in size. The CWCBR was designated in 2000 and is about 378,240 ha in size (UNESCO 2012c). See Table 4.1 for more details on these BRs.

Ecological characteristics

The KBR and CWCBR are located within the Cape Floristic Region (CFR), which is located predominantly in the Western Cape Province in the southern Cape of South Africa. Due to its exceptionally high plant species diversity, the CFR has been identified as a biodiversity hotspot and is the smallest of the world's six floral kingdoms (Mittermeier et al. 2004; Rebelo et al. 2006). The CFR has a Mediterranean-type climate with rainfall and cold temperatures in winter and dry conditions in summer (Cowling 1992). About 22.0% of the CFR is formally protected (IUCN categories I-IV), while about 75.7% has been transformed, mostly by cultivated lands, urban areas and alien vegetation (Cowling et al. 2003; Heijnis et al. 1999; Myers et al. 2000).

Socio-economic status

In 2011, the total population of the Western Cape was 5,822,734 (11.2% of South Africa). Of persons over the age of 20, 28.2% had completed secondary school and 2.7% had no education. Just over 80.0% of the population lived in formal housing, while 18.2% lived in informal housing. Approximately 1.0% did not have access to piped water (Statistics South Africa 2012a) and 6.6% of the population did not have access to electricity for lighting (Statistics South Africa 2012c). The formal unemployment rate was 21.6% for persons between the ages of 15 and 64 (Statistics South Africa 2012a), and the average household income was approximately R 143 500 per annum (Statistics South Africa 2012b). In 2006 the infant mortality rate was 26 deaths per 1000 births (Western Cape Government Department of Health 2011) and in 2011 about 28 000 people were reported as HIV/AIDS positive (Statistics South Africa 2012d). The overall standard of living in the Western Cape is relatively higher than most of the other provinces in South Africa (Statistics South Africa 2012b; 2012d).

4.2.2 Expert groups

Two types of experts were involved in this study – local stakeholders and specialists. Collaborative workshops and focus groups were undertaken instead of interviews with individuals as group decision-making is generally a more effective method to use in planning and decision-making exercises (Hill 1982; Kameda et al. 1997).

Table 4.1: Characteristics of the Kogelberg and Cape West Coast biosphere reserves for which sustainability indicators were developed (Mucina & Rutherford 2006; UNESCO, 2012c)

Biosphere reserve	Year designated	Total size (ha)	Core areas (ha)	Buffer zones (ha)	Transition areas (ha)	Major vegetation types	Major land cover types	Population
Kogelberg (KBR)	1998	103 629	31 629	40 000	32 000	Sand Fynbos; Shale Renosterveld; Granite Renosterveld	Fynbos vegetation, coastal plains, riparian areas, lakes, marshes, lagoons, estuaries, agricultural land, residential areas	37 900 permanent, 50 000 seasonal
Cape West Coast (CWCBR)	2000	378 240	47 730	172 643	157 867	Shale Fynbos; Sandstone Fynbos	Fynbos vegetation, dune thicket, coastal plains, riparian areas, wetlands, marshes, anthropogenic old lands, agricultural land, mining, urban areas	132 000 permanent, 161 000 seasonal

Local stakeholder workshops

A workshop to develop a preliminary set of SIs was held in each BR with local stakeholders. Workshops involving local stakeholders can assist in determining SIs that are relevant at the local scale (eg., Parkins et al. 2001), and ensure that rich, diverse and representative views on a project are provided (Bell & Morse 2003). The co-ordination units of each BR invited and secured the participation of key and representative local parties operating within the BRs.

After presentation of background information on the BR and the project by the authors that included key concepts of BRs and the need for SIs, workshop participants were asked to identify themes according to which the SIs could be classified. The participants were divided into smaller working groups based on these themes. It was stressed (by the authors) that indicators needed to be measurable, feasible, appropriate and politically sensitive which are useful criteria for ensuring utility and rigour when identifying indicators (Margoluis & Salafsky 1998; Reed et al. 2006). After discussing and developing the SIs along the themes in the smaller workgroups, each workgroup presented their findings to the plenary for discussion and ratification.

Specialist focus groups

The focus group is a social research tool that explicitly utilises the interactions between a number of individuals to generate data, and they were particularly useful for this study as they are an effective way to explore the experiences and knowledge of participants (Kitzinger 1995). One focus group with specialists was held in each BR to develop sets of SIs to complementary those of the local stakeholders. The specialists that were chosen to participate in the focus groups had all worked with indicators, done research on BRs, and/or worked in a field relevant to sustainable development. The KBR focus group was held at the KBR company office. The CWCBR focus group was held at the Department of Conservation Ecology and Entomology at Stellenbosch University. After a brief introduction to the BR and the project, and a session in which questions were asked regarding the BR, M&E concepts, the SI project, and the purpose of the focus group, the agenda for the remainder of the day was structured by the participants. It was stressed (by the authors) that indicators needed to be measurable, feasible, appropriate and politically sensitive, which are useful criteria for ensuring utility and rigour when identifying indicators (Margoluis & Salafsky 1998; Reed et al. 2006). It was also emphasised that the data required to measure the indicators be readily available (see Table 4.2 for definitions of these criteria). The SIs that the specialists identified were written on a whiteboard and then transcribed. In addition to identifying their own set of SIs, the specialists attending each focus group were also provided the local stakeholder SI set and asked to identify the

data availability of each one (Fig. 4.1). If at least one specialist identified that data was available for measuring a specific indicator, this was assumed sufficient to denote availability.

4.2.3 Final sustainability indicator set development

To identify the final SI sets, the specialist and local stakeholder indicator sets were integrated (Fig. 4.1). Indicators identified by local stakeholders that addressed topics comparable to those of the specialists were extracted from the original local stakeholder set. It was done in this way because the specialist-identified SIs were generally more robust and reliable. This subset of local stakeholder indicators plus the specialist indicators were assessed by the authors according to criteria 1, 2, 3 and 5 in Table 4.2. Indicators that did not meet all of these criteria were removed. Two final sets of SIs were then refined and synthesized. The first comprised an *ideal* set of indicators from the remaining local stakeholder and specialist indicators that demonstrated a high level of precision (see criteria number four of Table 4.2). This ideal set of SIs contained additional indicators that could be measured if the data could be acquired. The second comprised a *feasible* set of indicators that were extracted from, and so comprise a subset of, the *ideal* SIs. The indicators in the feasible SI set were those from the ideal set that had data available to implement them, based on the specialists' assessment of data availability. The previous year's evaluation results are to be used as a baseline against which the SIs referring to an increase or maintenance of a measure should be assessed.

4.2.4 SI set comparisons

The SI sets were compared in order to determine the usefulness of using multiple groups of experts and to determine if SIs for BRs need to be developed on a case-by-case basis. Direct comparison of indicators, especially between the local stakeholder and specialist sets, was anticipated to be challenging, due to differing world views and terminology used by each group. A general category was assigned to each indicator by the authors (Table 4.6) and the percentage similarities between the sets were calculated based on these categories. Within each BR, the local stakeholder set, specialist set, ideal set and feasible set were compared. The comparisons that were done between the BRs were done on corresponding sets (e.g. KBR local stakeholder and CWCBR local stakeholder sets). These comparisons were done using Microsoft Excel.

Table 4.2: Criteria applied in developing useful and effective sustainability indicators (Margoluis & Salfsky 2008; Reed et al. 2005)

Criteria	Definition	Rationale
1 Appropriateness	Indicator measures a dimension of sustainable development in the BR that is key to a functional and healthy social-ecological system.	Many dimensions can be measured and applied as indicators, but fewer, accurate indicators are more desirable. Indicators should be strategically chosen for their relevance.
2 Political sensitivity	Indicator is developed cognisant of the agendas of powerful stakeholders.	The output of the indicator can be designed to: 1) be used to leverage funding from powerful stakeholders, or 2) avoid issues that are contentious with powerful stakeholders that may negatively influence the BR.
3 Measurability	The ability to quantitatively or qualitatively define a sustainability indicator sufficiently to ensure that it can be effectively operationalized.	Ideally, empirical evidence should be delivered by an indicator to demonstrate changes effected by an activity. The extents of these changes are required to determine the extent of the effect.
4 Precision	The indicator is clearly defined.	This criterion was applied for the final set.
5 Feasibility	Adequate capacity exists to collect and/or analyse the data informing a sustainability indicator.	Capacity to deliver a useful indicator can be defined in terms of cost-efficiency, availability of expertise and time. Return-on-investment is an important consideration.
6 Data availability	The existence and accessibility of information required for the implementation of sustainability indicators, as identified by specialists.	Indicators can be developed in theory, but are only useful if the information exists on the changes that an activity produces towards a goal or objective.

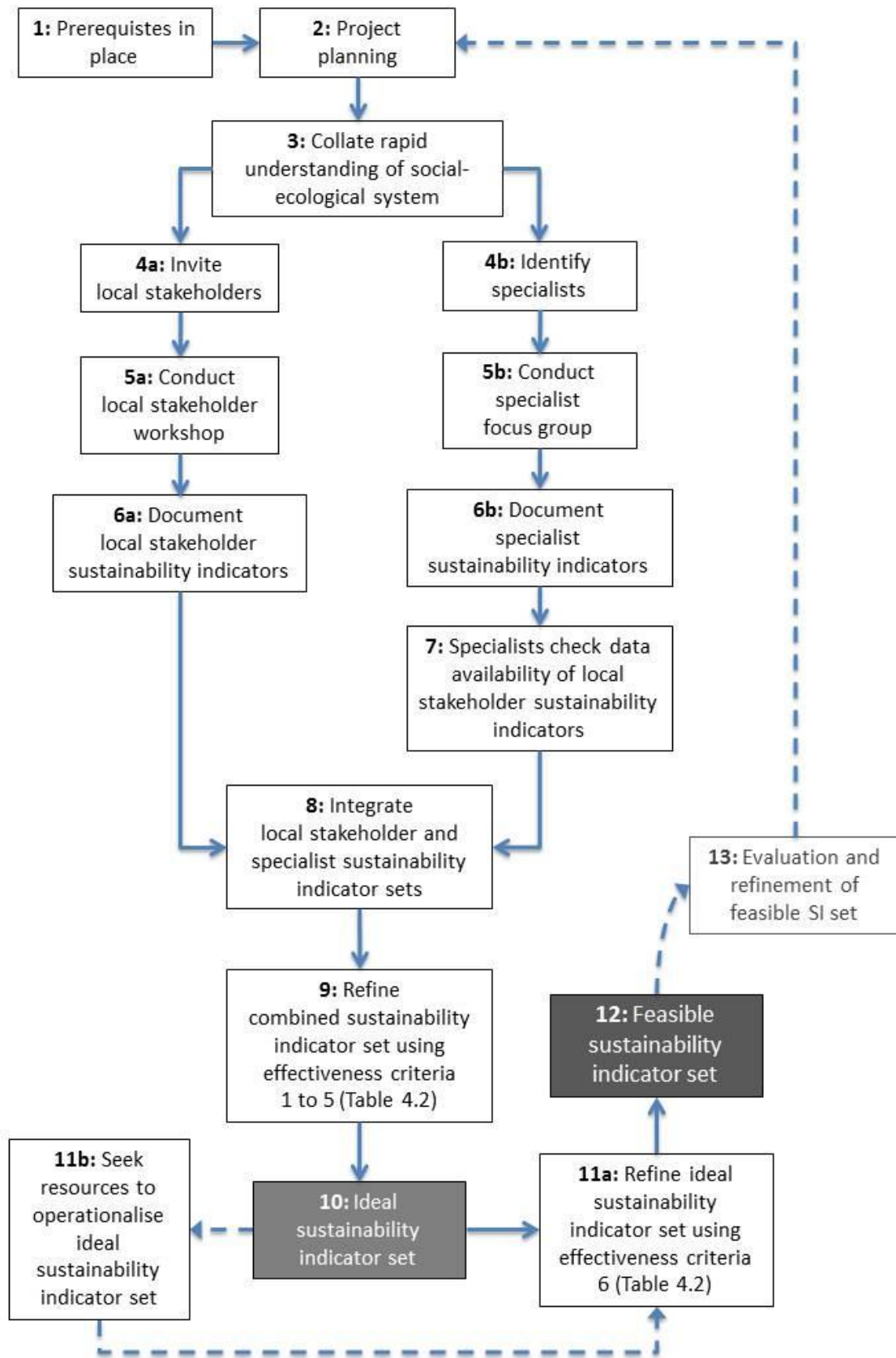


Figure 4.1: The process for developing sustainability indicators adopted by this study. Steps 11b and 13 were not included in this study, but they are recommended in the national protocol (Chapter 5)

4.3 Results

4.3.1 Local stakeholder workshops

In both workshops, fewer stakeholders were present than anticipated and not all sectors were present or represented in equal numbers, strength or capacity.

Kogelberg BR local stakeholder workshop

The KBR stakeholders agreed to use UNESCO's BR functions for framing and classifying their SIs, namely: 1) conservation, 2) development and 3) logistical support. A total of 90 indicators were identified, with 30 under the conservation theme, 32 under the development theme, and 28 under the logistical support theme (Appendix 4).

Cape West Coast BR local stakeholder workshop

The CWCBR stakeholders agreed to use the structure of the CWCBR Strategic and Business Plan according to the following themes: 1) conservation, 2) sustainable development and planning, 3) stakeholder support, 4) research and monitoring, 5) education and capacity, 6) operational and institutional governance. Owing to time constraints, the research and monitoring working group did not take place. A total of 145 indicators was identified, with 32 under the 'conservation' theme, 42 under the 'sustainable development and planning' theme, 14 under the 'stakeholder support' theme, 34 under the 'education and capacity' theme and 23 under the 'operational and institutional governance' theme (Appendix 4).

4.3.2 Specialist focus groups

Kogelberg BR focus group

There were four specialists present at the KBR focus group. At the beginning of the indicator discussion session, the specialists were tasked with the identification of themes under which indicators could be classified. One specialist listed four key aspects which, in his experience with the BRs, described the dimensions that promoted the effectiveness of the CWCBR. It was then decided to use these four aspects as a starting point for the identification of SIs, with each aspect representing a goal for achieving BR effectiveness. These goals were: 1) Increased land for conservation (area and effectiveness), 2) external leverage for conservation funds (economic viability), 3) increasing numbers of projects creating jobs, and 4) increased community awareness. A fifth goal, 'water quality and quantity' was added later in the discussions. Each goal was discussed individually and a number of indicators relating to each goal were identified. A total of 16 indicators was identified, with five under the 'increased land for conservation (area and effectiveness)' goal, six

under the 'external leverage for conservation (economic viability)' goal, two under the 'increasing numbers of projects creating jobs' goal, two under the 'increased community awareness' goal, and two under the 'water quality and quantity' goal. The focus group was ended by consensus owing to time constraints - it ran for four hours. The original intention was to have a session that ranked indicators, and also a session in which the specialists individually identified which of the indicators from the stakeholder workshops had data available. This latter exercise was conducted via E-mail correspondence.

Cape West Coast BR focus group

There were three specialists present at the CWCBR focus group. The specialists in this focus group used the goals listed in the strategic plan of the CWCBR as the objectives for which indicators should be identified. These goals were therefore the same as the CWCBR local stakeholder workshop themes. The specialists decided on this because they felt that the SIs should relate to the goals that the BR has already set for itself. As with the KBR focus group, indicators were identified for each goal. A total of 27 indicators were identified: six under the 'conservation' goal, five under the 'sustainable development and planning' goal, six under the 'stakeholder support' goal, five under the 'research and monitoring' goal, four under the 'education and capacity' goal, and four under the 'operational and institutional governance' goal. There was enough time at the end of the session for the specialists to carry out the exercise to identify which of the indicators from the stakeholder workshop had data available. The focus group ran for four hours.

4.3.3 Final sustainability indicator sets

Kogelberg BR

The ideal sustainability indicator set for the KBR consisted of 21 indicators, with five under the 'increased land for conservation (area, effectiveness)' goal, seven indicators under the 'external leverage for generating conservation funds' goal, five under the 'increased projects leading to jobs' goal, two under the 'increase in awareness' goal, and two under the 'water quality' goal (Table 4.3). The feasible SI set was exactly the same as the ideal SI set, as no indicators were removed based on the specialist data availability assessment. Accordingly, there is only one final SI set for the KBR, hereafter referred to as the final KBR set.

Cape West Coast BR

The ideal sustainability indicator set for the CWCBR consisted of 35 indicators, with eight under the 'conservation' goal, four under the 'sustainable development and planning' goal, seven under the 'stakeholder support' goal, two under the 'research and monitoring' goal, eight under the 'education/capacity' goal and six under the 'operational/institutional governance' goal. The feasible indicator set consisted of 31 indicators with two indicators being removed from the 'conservation' goal and another two from the 'sustainable development' goal based on the specialist data availability assessment (Table 4.4).

Details regarding the data sources, thresholds and proposed corrective actions of each SI are given in Appendix 5.

4.3.4 SI set comparisons

The broadest indicator sets in terms of the categories identified by the authors were the two local stakeholder sets, with 28 and 29 categories for the KBR and CWCBR sets respectively. The sets that were the least broad were the KBR specialist (11 categories) and final (10 categories) sets, while for the CWCBR, the specialist set comprised 15 categories, and the ideal and feasible sets comprised 16 and 14 categories respectively. Categories common to all sets included invasive alien species, water, stewardship, awareness, funding, BR members and BR staff (Table 4.5).

The KBR ideal and feasible sets were exactly the same, with the implication that local stakeholder and specialist sets are essentially compared to one final set. When comparing the SI sets according to these categories, it was found that there was a moderate similarity between the local stakeholder and specialist KBR sets (39.3%) and the specialist set was much more similar (90.9%) to the final set than the local stakeholder set. The CWCBR feasible set did not differ greatly from the ideal set (87.5% similarity). The CWCBR local stakeholder set was slightly more similar to the ideal set (55.2%) than the feasible set (48.3%), while the specialist set was much more similar to both of these sets (93.8% and 81.3% respectively). There was a 51.7% similarity between the CWCBR local stakeholder and specialist sets (Table 4.6).

Between BRs, the local stakeholder sets were much more similar to each other (78.1%) than the specialist sets (36.8%). The ideal and feasible sets were moderately similar (36.8% and 41.2% respectively) (Table 4.6).

Table 4.3: The final set of sustainability indicators recommended for implementation by the Kogelberg Biosphere Reserve. All sustainability indicators were found to be feasible

Goal 1: Increased land for conservation (area, effectiveness)	
1.1.1	Hectares of alien invasive vegetation
1.1.2	Average density of alien invasive vegetation
1.2	Increase in hectares of priority vegetation types under stewardship contracts and agreements ¹
1.3	Percentage clean audits of stewardship contracts and agreements
1.4	Hectares of priority vegetation types with appropriate frequencies, intensities and extents of wildfires ¹
Goal 2: External leverage for generating conservation funds (economically viable)	
2.1	3 years guaranteed funding for the funding of a coordinator
2.2	Funding secured from external donors is sufficient to cover all administration and project costs
2.3	Amount of funding received per project proposal submitted
2.4	Amount of funding from the previous year used as leverage to secure funds for current and future years
2.5	Proportion of members renewing their membership
2.6	Increase in the number of individual BR members per region
2.7	Increase in number of tourist bed nights
Goal 3: Increasing numbers of projects creating jobs	
3.1	Increase in number of people working in the core areas under Environmental Public Works programmes
3.2.1	Reduction in the proportion of positions that are occupied by a new person (turnover of board members and directors)
3.2.2	Reduction in the proportion of positions that are occupied by a new person (turnover of staff)
3.3.1	Increase or maintenance of skilled staff working for the KBRC
3.3.2	Increase or maintenance of unskilled staff working for the KBRC
Goal 4: Increased community awareness	
4.1	Increase in the number of items in the media
4.2	Farmers registered in stamp of approval programmes ²
Goal 5: Water quantity and quality	
5.1.1	Quantity of water at key sites is sufficient to meet the ecological and basic human needs reserve ³
5.1.2	Quality of water at key sites is sufficient to meet the ecological and basic human needs reserve ³

¹ Priority vegetation types according to the National Biodiversity Assessment

² E.g. Biodiversity and Wine Initiative, corridor programmes

³ Key sites need to be determined

Table 4.4: The final set of sustainability indicators recommended for implementation by the Cape West Coast Biosphere Reserve. The feasible sustainability indicators are shaded

Goal 1: Conservation	
1.1.1	Quantity of water in aquifers is sufficient to meet the ecological and basic human needs reserve
1.1.2	Quality of water in aquifers is sufficient to meet the ecological and basic human needs reserve
1.2.1	Quantity of water in the Berg River is sufficient to meet the ecological and basic human needs reserve
1.2.2	Quality of water in the Berg River is sufficient to meet the ecological and basic human needs reserve
1.3.1	Hectares of alien invasive vegetation
1.3.2	Average density of alien invasive vegetation per property
1.4	Number of visitors to protected areas meets the carrying capacity of those areas
1.5	Number of visitors to paleontological and historical sites meets the carrying capacity of those sites
Goal 2: Sustainable development and planning	
2.1	Hectares of approved developments complying with Spatial Framework Plan
2.2	Number of approved developments who comply with all aspects of the environmental management plan one year after development
2.3	Number of development applications commented on by BR committee members
2.4	Increase in hectares of biodiversity offsets obtained in priority vegetation types through the approval of developments ¹
Goal 3: Stakeholder support	
3.1	Proportion of stakeholders attending meetings is 90% of stakeholders invited to meetings
3.2	Increase in hectares of priority vegetation types under stewardship contracts and agreements ¹
3.3	Increase in number of hits on the BR website since the end of the previous year
3.4	Increase in the number of individual BR members per region
3.5	Increase in the number of corporate BR members per sector
3.6	Increase in number of BR members attending BR activities
3.7	Proportion of members renewing their membership

Table 4.4 continued: The final set of sustainability indicators recommended for implementation by the Cape West Coast Biosphere Reserve. The feasible sustainability indicators are shaded

Goal 4: Research and monitoring	
4.1	Number of civic reports of illegal environmental activities ²
4.2	Increase in number of research publications conducted in the BR
Goal 5: Education/capacity	
5.1.1	Increase in or maintenance of number of participants of social capacity development programmes
5.1.2	Increase in or maintenance of number of participants of environmental capacity development programmes
5.2	Increase in or maintenance of number of jobs created through BR projects
5.3	Increase in or maintenance of number of local people employed directly by the BR company
5.4.1	At least 95% of adults - (older than 18) attending BR initiatives across different socio-economic groups ³ were very satisfied or better with their experience
5.4.2	At least 95% of children - (younger than 18) attending BR initiatives across different socio-economic groups ³ were very satisfied or better with their experience
5.5	A sufficient portion of the budget is allocated for environmental education
5.6	Increase in number of items in the media
Goal 6: Operational/institutional governance	
6.1	Reduction in the proportion of positions that are occupied by a new person
6.2	Staff are paid based on national salary and wage standards commensurate with experience and qualifications
6.3	A reduction in the proportion of donor funding spent on administrative costs
6.4.1	All funding spent by deadlines
6.4.2	All funding spent within budget
6.5	Funding secured from external donors is sufficient to cover all administrative and project costs
¹ Priority vegetation types according to the National Biodiversity Assessment	
² E.g. Illegal harvesting of endangered plants, illegal clearing, illegal dumping of waste, illegal water abstraction	
³ Upper class, middle class, lower class	

Table 4.5: The categories according to which sustainability indicators in each set were grouped

Category	Sustainability indicator set							
	KBR Local stakeholder	CWCBR Local stakeholder	KBR Specialist	CWCBR Specialist	KBR Ideal	CWCBR Ideal	KBR Feasible	CWCBR Feasible
Air pollution		✓						
Alien invasive species	✓	✓	✓	✓	✓	✓	✓	✓
Audits	✓	✓						
Awareness		✓	✓	✓	✓	✓	✓	✓
Budget	✓	✓				✓		✓
Capacity development	✓	✓		✓		✓		✓
Collaboration	✓	✓		✓		✓		✓
Community health	✓							
Conservation	✓	✓	✓					
Demographics	✓	✓						
Development compliance	✓	✓		✓		✓		✓
Education	✓	✓						
Environmental management	✓	✓	✓		✓		✓	
Fire	✓	✓	✓		✓		✓	

Table 4.5 continued: The categories according to which sustainability indicators in each set were grouped

Category	Sustainability indicator set							
	KBR Local stakeholder	CWCBR Local stakeholder	KBR Specialist	CWCBR Specialist	KBR Ideal	CWCBR Ideal	KBR Feasible	CWCBR Feasible
Funding	✓	✓	✓	✓	✓	✓	✓	✓
Heritage conservation		✓		✓		✓		
Infrastructure	✓							
Institutional management	✓	✓		✓		✓		✓
Land use	✓	✓						
Members	✓	✓	✓	✓	✓	✓	✓	✓
Monitoring	✓	✓		✓		✓		✓
Networking	✓							
Projects		✓						
Protected areas	✓	✓		✓		✓		
Research	✓	✓		✓		✓		✓
Resource use	✓	✓						
Restoration		✓						
Species	✓	✓						
Staff	✓	✓	✓	✓	✓	✓	✓	✓
Stewardship	✓	✓	✓	✓	✓	✓	✓	✓
Tourism	✓	✓	✓		✓		✓	
Water	✓	✓	✓	✓	✓	✓	✓	✓

Table 4.6: The comparison of the various sustainability indicator sets according to the categories in Table 4.5

KBR Similarities	Local stakeholder	Specialist	Ideal	Feasible
Local stakeholder	-	39.3	35.7	35.7
Specialist	39.3	-	90.9	90.9
Ideal	35.7	90.9	-	100.0
Feasible	35.7	90.9	100.0	-

CWCBR Similarities	Local stakeholder	Specialist	Ideal	Feasible
Local stakeholder	-	51.7	55.2	48.3
Specialist	51.7	-	93.8	81.3
Ideal	55.2	93.8	-	87.5
Feasible	48.3	81.3	87.5	-

KBR vs. CWCBR Similarities	
Local stakeholder	78.1
Specialist	36.8
Ideal	36.8
Feasible	41.2

4.4 Discussion

Conservation and sustainable development require collaborative decision-making processes, and the involvement of local people in these processes is particularly important (Smith et al. 2009). In this way, the knowledge and ideas of a variety of sources can be utilised to make the most effective decisions (Wondolleck & Yaffee 2000). Making use of different types of experts in a workshop and/or focus group setting to develop SIs is useful and effective for several reasons. It allows for the capturing of numerous individual's insights and experiences which promotes a more holistic understanding of the complexities of social-ecological systems (Folke et al. 2005; Raymond et al. 2010), group dynamics to potentially produce more comprehensive and robust SIs, and the integration of multiple types of knowledge such as that between specialists, local stakeholders, scientists and managers. It also has the potential to promote a sense of inclusiveness, which better commits people to implementation (Margoluis & Salafsky 1998; Reed et al. 2006). These factors all assist in ensuring an effective set of indicators are developed and usefully applied, thus bridging the research-implementation gap (Roux et al. 2006).

BRs are required to report to UNESCO on their effectiveness every ten years, and also to various stakeholders, including funders. Given the sustainable development focus of BRs, this reporting should address ecological, social and economic goals (Giddings et al. 2002; Hopwood et al., 2005). SIs can provide a useful tool for BRs to meet these requirements (Beratan et al., 2004).

The greatest challenge in developing these SI sets was the production of indicators that were balanced, with adequate scientific rigour on the one side of the scale and user-friendliness on the other. This inevitably leads to a trade-off between objectivity and usability (Reed et al. 2005). It is relatively easy to generate ideas for SIs, but identifying the most appropriate SIs can be problematic (Custance & Hillier 1998).

During the local stakeholder workshops, there was an abundance of ideas for indicators, but the number of indicators that were appropriate and feasible was low. The local stakeholder indicator sets were lengthy and a large majority of the indicators were vague, often including multiple measures, despite strong encouragement to provide SIs that were measureable, feasible and precise. For example, "climate data monitored (sea water temperature, average temperature - min/max, rainfall)" and "sustainable management of resources in buffer zone (aliens/water/species tracked)". Many were also too general or broad, for example, "sustainability in biodiversity" and "education and awareness". Local stakeholder knowledge provided valuable information regarding

the important issues and dimensions of sustainability within the BRs, but needed to be refined to be usefully applied. Active facilitation by a highly effective individual is a prerequisite for making the most of workshops with local stakeholders. Complementing the opening information session with a participatory evaluation might assist local stakeholders to provide more useful indicators in future projects by demonstrating the strengths and limitations of their SI sets.

In contrast, during the specialist focus groups, issues surrounding the criteria (Table 4.2) were discussed at length for every SI suggested, which led to the development of precise and feasible SIs for which there was data available. One of the specialists at the CWCBR focus group commented that the more complex an issue is perceived to be, the more SIs are required. However, the limited capacity of BRs in South Africa demands that small SI sets be developed that measure key dimensions of social-ecological systems. As with Pintér et al. (2008), we found that larger SI sets generate diminishing returns and the ability to communicate the results becomes more complicated. Effective indicators should decrease the number of measures required for the M&E of a BR initiative, and simplify the communication process between managers, stakeholders and communities (Bowen & Riley 2003; OECD 2001). They are also likely to be less expensive.

In terms of their review of the data availability of the local stakeholder SI sets, the specialists indicated that they were “unsure” for many of the indicators. This response was given regarding the SIs which were outside their area of expertise, and also regarding those SIs that were poorly defined. The lack of available data is the greatest limitation to what can be measured (Gutowska 2012), which is an issue that is generally faced in SI development projects (Cole et al. 1998; Gutowska 2012). This is usually because SIs span a broad range of themes, requiring the use of datasets from multiple types of sources (Pintér et al. 2008). This also raises the challenges of expertise and funding within BRs. There is a need for BRs to build their staff capacity and relationships with universities. Such partnerships can benefit both parties, as it presents the opportunity for students to gain knowledge and experience in a real-world context (Martinich et al. 2006).

By using the specialist focus groups to develop a refined set and applying the criteria of Table 4.2, the final sets that were produced were substantially shorter than the original local stakeholder sets. Similarly, in their examination of a case study of an indicator development project, Fraser et al. (2006) found that initial community consultations produced long lists of indicators that were based on the community’s knowledge of the study areas, but the lists were shortened considerably through focus groups with community members and discussions with specialists.

The content of all indicator sets addressed environmental, social and economic indicators. This was guided by the setting of themes and goals at the beginning of the workshops and focus group sessions which focused on the primary objectives of BRs which all relate to the achievement of sustainable development (*sensu* Margoluis & Salafsky 1998). The final sets include indicators that measure both the effects of the BRs programmes on the BR region, and also those that measure the health of the social-ecological system. The latter indicators can be used by the BRs to assist them in making decisions regarding which programmes to implement. For example, if it is found that developments are not compliant with the BRs spatial framework plan, the BR board could hold workshops to raise the awareness of the plan.

Some of the most important dimensions of the social-ecological systems in which the BRs are embedded that were identified through the development process are highlighted by the common categories that appeared in all of the SI sets. The two common environmental categories, invasive alien species and water, are both highly important environmental challenges within the Western Cape that are highly promoted by government through the Working for Water programme (Joubert et al. 1997; Richardson & van Wilgen 2004), which is most likely the reason that the experts perceived these to be important issues. The promotion of social and environmental awareness, which was another common category, is one of the main objectives of BRs (UNESCO 1996). Promoting stewardship (i.e., contracts between government and landowners to protect high priority conservation land) is also important, as this could potentially be linked to the awareness and participation of farmers in conservation (Wilson & Hart 2001; Winter et al. 2007). Lastly, it is not surprising that issues of funding and staff capacity were also common between all the sets, as these are amongst the biggest institutional issues for the management of the BRs, particularly the KBR (Hyman 2003; Rabie 2012; Chapter 3).

It was anticipated that the sets of SIs from the different expert groups would differ, as other studies have found (e.g., Raymond et al. 2010) and the results of this study concurred. Local stakeholders provided a broad perspective on the issues of their social-ecological system, whereas specialists provided more focused input, a similar finding to other studies (Fazey et al. 2006; Lebel et al. 2006). A question that this raises is: who is correct, the local stakeholders or the specialists? However, the different sets of SIs can be considered complementary, as there is overlap on a core set of categories, with useful additions to the final sets from the different groups of experts. Other studies

have also shown considerable overlap between specialist and local community indicators (Fraser et al. 2006; Reed et al. 2005).

When the final SI sets of the two BRs were compared, there was considerable overlap in the core sets of categories, thus many of these indicators could potentially be applied to both BRs. This has the implication that SIs do not necessarily have to be BR specific. Perhaps a set of SIs that could be applied to all BRs could be put forward and additional indicators measuring the important aspects of a specific BR could be developed on a case-by-case basis. For example, alien invasive vegetation indicators were included in the indicator sets of both BRs. The genera *Acacia*, *Hakea* and *Pinus* pose problems throughout the fynbos biome (Richardson & Van Wilgen 2004). Alien invasive species have also been identified as an important challenge to ecosystems in many other regions of the world (MA 2005). SIs related to capacity and funding were also common to both BRs. In the previous chapters on the literature review and survey of global BRs, these were also identified as substantially important challenges (Chapter 2; Chapter 3).

However, there is still some uncertainty surrounding the translation of these results to BRs in other areas of South Africa, thus there is a need to develop SIs on a case-by-case basis. The additional benefit to this approach is that it promotes buy-in from the experts involved in the process within each BR and it broadens the knowledge of all the participants. Further research should be done focusing on identifying the dimensions and challenges of sustainable development that are common to BRs. Studies should be designed in such a way that they can compare these similarities across BRs within the same biome, region and country. In addition to the development of SI sets for the CWCBR and KBR, this study also aimed to guide the formulation of a national protocol for the development of SIs for BRs in South Africa. This document will have information on the process used in this study as well as suggestions on how the protocol should be implemented.

The indicators that were excluded from the CWCBR feasible set dealt with the carrying capacity of visitors to tourism areas and the compliance of development with planning and management frameworks. Indicators of tourist carrying capacity have been proposed by the World Tourism Organisation as important measures of sustainable development (United Nations World Tourism Organisation 2004). There are many development frameworks, policies and legislations in South Africa at national, provincial and municipal levels that can be used to enforce development compliance (Cadman et al. 2010). The BRs have also developed spatial framework plans to encourage developments within their boundaries to comply with the above tools as well as

additional sustainable development principles. Data for these indicators need to be acquired, as they are clearly important dimensions of sustainable development.

Although the final sets of both ideal and feasible SIs cover many key dimensions of the BRs social-ecological systems, some gaps are apparent. These gaps are likely due to the absence of expertise in specific areas of the participants of the local stakeholder workshops and the specialist focus groups. The most striking gap is that there are no indicators relating to the marine zones of the BRs. The CWCBR includes the Langebaan Lagoon RAMSAR site (The Secretariat of the Convention on Wetlands 2012) and Saldanha Bay, which is the largest port on Africa's west coast (Erasmus 1995). In the KBR's marine zone, the poaching of abalone is a serious problem (Hyman 2003). Future SI development programmes should include all ecosystems within the BR.

4.4.1 Recommendations

The true test of the utility of the SIs developed in this study will be the level to which they are adopted by those involved in the management of each BR. Indicator programmes should strive to create and enhance communicative networks between institutions and organisations with overlapping responsibilities and interests (Beratan et al. 2004). Implementing these indicators will be challenging owing to the limited capacity and funding of the BRs (Chapter 2). However, by building collaborations with institutions and organisations that are collecting or have the capacity to collect data for the indicators, the BRs will be able to implement the SIs more effectively. This will require that the BRs review the SI sets annually in collaboration with potential partners. The indicators should be periodically reviewed and updated in line with shifting priorities and new data becoming available or an increase in capacity to generate new data (Pintér et al. 2008).

Chapter 5: National Protocol for Developing Sustainability Indicators for the South African Biosphere Reserve Network

Executive summary

Biosphere reserves are designated by UNESCO's Man and the Biosphere Programme (MAB). They are established to explore, promote and demonstrate sustainable development on a landscape scale. South Africa currently has six biosphere reserves with several more at various stages of designation. Every ten years, biosphere reserves are required to report to UNESCO through the periodic review process. A monitoring and evaluation framework is needed to meet the reporting requirements of biosphere reserves. This need is recognised by the Department of Environmental Affairs (DEA) as well as the individual biosphere reserves. Sustainability indicators can be a useful tool to fulfil this need. This report outlines a protocol for stakeholders to collaboratively develop sustainability indicators to meet UNESCO's requirements for monitoring and evaluation. The benefit of using a collaborative approach is that the knowledge and experience of a wide range of stakeholders and specialists can be exploited. This report was developed collaboratively between Stellenbosch University, the Department of Environmental Affairs (DEA), the South African Environmental Observation Network (SAEON), and the Kogelberg and Cape West Coast Biosphere Reserves.

Sets of sustainability indicators should be developed on a case-by-case basis for individual biosphere reserves, including a core set of sustainability indicators that are likely to be of national significance. They should address ecological, economic and social dimensions of social-ecological systems, and be measurable, precise, feasible, appropriate and politically sensitive. Such criteria will better ensure that they can be implemented effectively by key stakeholders. The development process should involve holding workshops with local stakeholders and focus groups with specialists with expertise in relevant disciplines. These two groups can generate independent sets of sustainability indicators, which can then be integrated, synthesised and reviewed to deliver an ideal set of indicators that most effectively address the monitoring and evaluation needs of an individual biosphere reserve, and a feasible set of indicators. The latter set includes all of the indicators that already have data available for their measurement.

5.1 What is the South African Biosphere Reserve Network?

Biosphere reserves are designated by UNESCO's Man and the Biosphere Programme. They are established to explore, promote and demonstrate sustainable development on a landscape scale. Biosphere reserves are divided into core, buffer and transition zones. Core areas are predominantly protected areas; buffer zones are normally adjacent to core areas and constitute conservative land uses such as sustainable resource use. Transition zones constitute areas such as agricultural lands and urban areas.

The high ecological, cultural and socio-economic diversity and complexity of South Africa makes achieving sustainable development challenging. Biosphere reserves are one approach that is being used to address these challenges. The South African biosphere reserve network is currently made up of six biosphere reserves which are located in two of South Africa's nine provinces, with the first of these biosphere reserves, the Kogelberg Biosphere Reserve, being designated in 1998. A seventh biosphere reserve, the Gouritz Cluster Biosphere Reserve is currently in the process of being designated.

As a result of the wide geographical spread and extent of the biosphere reserves, the social-ecological systems within their boundaries are diverse. The major ecosystems within the biosphere reserves include fynbos, mountain and highland systems, grasslands, savannah, wetlands, estuaries, marine areas and coastal areas. Dominant land uses include agriculture, natural resource use areas, protected areas and privately owned game farms and reserves. Urban areas range from informal settlements to larger towns with formal housing.

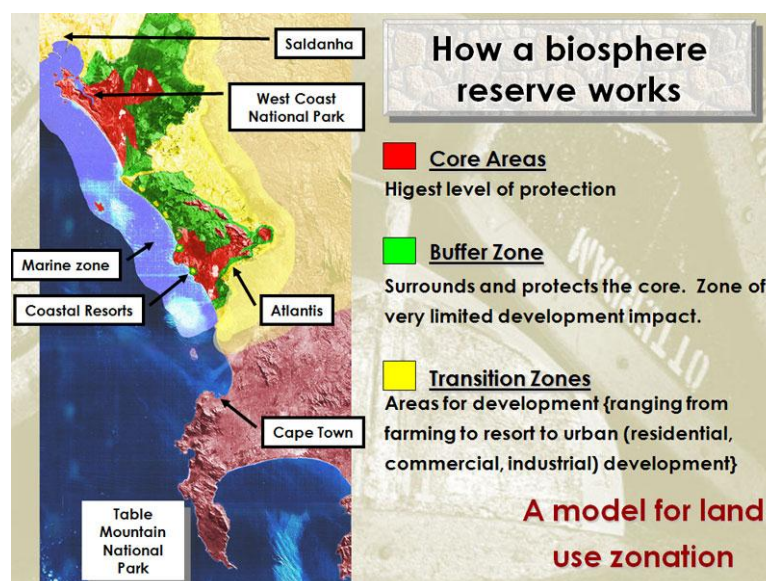


Figure 5.1: An example of a South African biosphere reserve (Cape West Coast Biosphere Reserve) (<http://www.dmp.co.za/projects/cape-west-coast-biosphere-reserve>, accessed 6 January 2013)

5.2 The purpose of this report

This document outlines a generic sustainability indicator development protocol that can be applied to all existing and proposed biosphere reserves in South Africa. This report will be useful to the Department of Environmental Affairs (DEA) and any biosphere reserve board members, coordinators and staff. It outlines a process through which sustainability indicators can be developed collaboratively with stakeholders. This process may need to be refined based on the local circumstances of a biosphere reserve. The concepts and terminology defined in this document should be used consistently when developing and implementing sustainability indicators. The terms used were selected and defined based on their usage in various disciplines by scientists and other professionals (Table 5.1).

5.3 Why do we need a national protocol for developing sustainability indicators?

As biosphere reserves are inherently complex due to the diverse social-ecological systems within their boundaries, a standardised monitoring and evaluation framework is needed, while still being flexible enough to account for local variability. The terms and methods used in the development and implementation of sustainability indicators for the South African biosphere reserve network need to be standardised so that 1) best practice can be applied and improved upon, and 2) biosphere reserves can learn from each other through comparing the outcomes and outputs of sustainability indicators. This protocol will encourage sustainability indicators to be mainstreamed within biosphere reserves.

5.4 Which stakeholders should be involved in developing sustainability indicators?

The development of sustainability indicators should be initiated by the MAB focal point, the position in DEA that is responsible for the South African biosphere reserve network. The MAB focal point should provide the necessary support to the biosphere reserve coordinators during the development process. A database for the outputs of the sustainability indicators across the South African biosphere reserve network should be housed in DEA and updated annually by the MAB focal point.

Each biosphere reserve has a coordinator that is responsible for the operations of the biosphere reserve. This person should run the sustainability indicator development process in their biosphere reserve. The coordinator should contact relevant local stakeholders and specialists at the appropriate stages of the process (a detailed explanation of this process is provided on pp. 78 to 81).

Local stakeholders are any persons who are interested in and/or affected by the decisions and impacts of the biosphere reserve. This group consists of board members, biosphere reserve staff, residents within the biosphere reserve and people working within the biosphere reserve. Specialists that should be involved in the development process should be people who have worked with indicators, done research on biosphere reserves and/or worked in a field that is relevant to sustainable development. Ideally, several of these specialists should have knowledge of the biosphere reserve for which the sustainability indicators are being developed.

Table 5.1: Definitions of key terms and concepts

Key terms	Definitions
Biosphere reserve	Biosphere reserves are designated by UNESCO's Man and the Biosphere Programme. They are established to explore, promote and demonstrate sustainable development on a landscape scale.
Buffer zone	Zones of a biosphere reserve adjacent to core areas where conservative land uses such as sustainable resource use occur.
Core area	Zones of a biosphere reserve that are predominantly protected areas
DEA	Department of Environmental Affairs.
Effectiveness	The extent to which an action produces a beneficial result.
Evaluation	Comparing the impact of a project or decision against the appropriate strategic goals of the project or organisation.
Evidence-based practice	The use of scientific tests to confirm or deny the effectiveness of actions taken to influence a system or entity.
Indicator	Provides information on the state of a system and the direction in which the system is moving.
MAB	Man and the Biosphere Programme. A division of UNESCO that is responsible for the designation of biosphere reserves.
Monitoring	The regular collection and analysis of information and the use of this information to make management decisions.
Sustainability	The continued maintenance of human well-being with regards to social, environmental and economic dimensions
Sustainability indicator	Assesses the progress of social and economic development as well as the preservation of ecological systems.
Sustainable development	The enhancement of human well-being without degrading social-ecological systems.
Transition zone	Zones of a biosphere reserve that constitute areas such as agricultural lands and urban areas.
UNESCO	United Nations Education, Scientific and Cultural Organisation

5.5 Checklist of Prerequisite Conditions for Effectiveness

The ability to develop and implement sustainability indicators is dependent upon several factors. Ideally, all of these are present:

- A clear vision is needed for the biosphere reserve. This is what all those involved in the biosphere reserve should be striving towards. Without this vision, biosphere reserve staff and stakeholders are more likely to be discouraged and lose interest, as they will not know what they are working towards.
- All stakeholders and biosphere reserve staff that are involved in the sustainability indicator development and implementation processes need to recognise the importance of the programme for the measurement of the biosphere reserve's progress towards its goals. The buy-in of these individuals is essential for the development and mainstreaming of sustainability indicators.
- An adaptive management programme involving monitoring and evaluation should be in place. The sustainability indicators should form a subset of this programme.
- Sufficient funding and capacity are needed to develop and implement the sustainability indicators. If this funding and capacity is not present within the biosphere reserve company, then collaborations with external partners and organisations such as universities should be developed.
- Social learning institutions should be implemented collaboratively with experts. These should consist of systems in which the principles of adaptive management are applied, i.e. the outcomes of evaluations should feed back into management processes.

A strategy to secure these prerequisite conditions is needed. This strategy should be framed in the context of this protocol and should guide the implementation of actions to obtain these necessary prerequisites.

5.6 What should a sustainability indicator set comprise?

A sustainability indicator set should comprise measures of the most important factors that define the health of social-ecological systems and drivers of change. The indicators should measure economic, social and ecological dimensions of the biosphere reserve. For the sustainability indicators to be effective, certain criteria need to be met (see Table 2).

Table 5.2: Criteria that should be applied when designing a set of useful and effective sustainability indicators (Margoluis & Salafsky, 1998; Reed et al., 2005).

Criteria	Definition	Rationale
1 Appropriateness	Indicator measures a dimension of sustainable development in the biosphere reserve that is key to a functional and healthy social-ecological system.	Many dimensions can be measured and applied as indicators, but fewer, accurate indicators are more desirable. Indicators should be strategically chosen for their relevance.
2 Political sensitivity	Indicator is developed cognisant of the agendas of powerful stakeholders.	The output of the indicator can be designed to: 1) be used to leverage funding from powerful stakeholders, or 2) avoid issues that are contentious with powerful stakeholders that may negatively influence the BR.
3 Measurability	The ability to quantitatively or qualitatively define a sustainability indicator sufficiently to ensure that it can be effectively operationalized.	Ideally, empirical evidence should be delivered by an indicator to demonstrate changes effected by an activity. The extents of these changes are required to determine the extent of the effect.
4 Precision	The indicator is clearly defined.	This criterion was applied for the final indicator set.
5 Feasibility	Adequate capacity exists to collect and/or analyse the data informing a sustainability indicator.	Capacity to deliver a useful indicator can be defined in terms of cost-efficiency, availability of expertise and time. Return-on-investment is an important consideration.
6 Data availability	The existence and accessibility of information required for the implementation of sustainability indicators, as identified by specialists.	Indicators can be developed in theory, but are only useful if the information exists on the changes that an activity produces towards a goal or objective.

5.7 How should the sustainability indicators be developed?

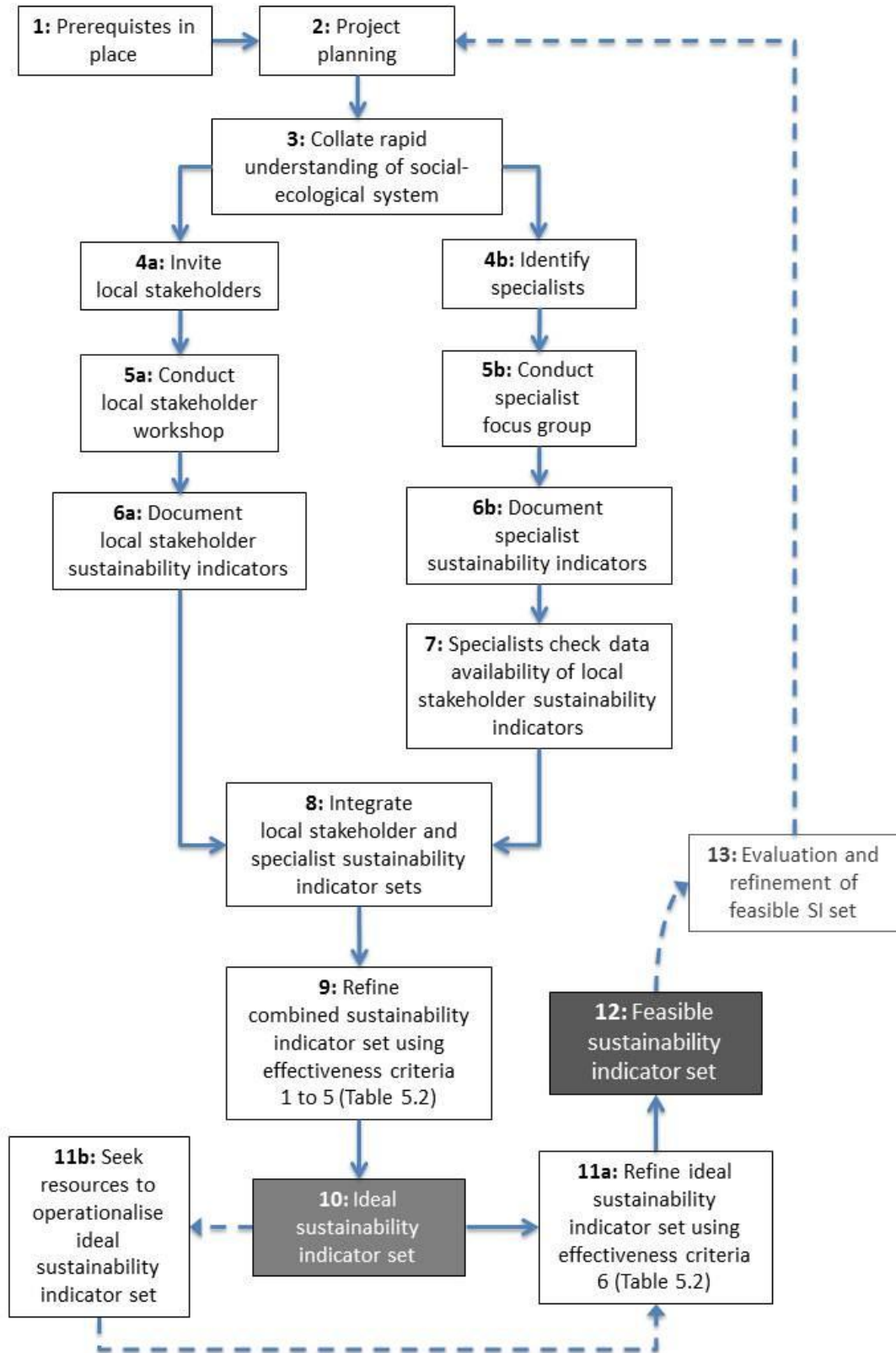


Figure 5.2: The steps comprising the protocol for developing sustainability indicators for a South African Biosphere Reserve.

5.7.1 Pre-planning stages (Figure 5.2: 1, 2, 3)

Before the sustainability indicator development process starts, the prerequisite conditions for effectiveness (see section 5.5) need to be in place. Once all of these conditions are in place, the project needs to be planned. The biosphere reserve coordinator should write a project proposal for the development of sustainability indicators by adapting this protocol to the circumstances of the biosphere reserve. This proposal should be discussed with the biosphere reserve board.

Knowledge of the social-ecological systems within the biosphere reserve is needed in order to determine the type of local stakeholders and specialists that should be invited to attend the collaborative meetings. For example, if agriculture is a major land use within the system, then the expertise of individuals such as farmers and agricultural economists will be needed at the meetings. If this information is not known, which could be the case if the individual planning the sustainability indicator development process is new to the biosphere reserve or if the process occurs soon after the establishment of a biosphere reserve, then a rapid assessment of the social-ecological systems within the biosphere reserve should be conducted. This assessment should be conducted by the biosphere reserve coordinator.

5.7.2 Conduct meetings with local stakeholders and specialists (Figure 5.2: 4a, 4b, 5a, 5b, 6a, 6b, 7)

Two groups of experts should be used in the sustainability indicator development process. Firstly, local stakeholders that are involved with the biosphere reserve and/or live within the biosphere reserve (see also section 5.4) should be invited to attend a workshop through e-mails to the biosphere reserve mailing list and advertisements in local newspapers (social media networks such as Facebook or Twitter could also be used). An effort should be made to include stakeholders from a variety of organisations and disciplines. These stakeholders will have knowledge about what is happening 'on the ground', and it is important to involve them throughout the development and implementation process. About 20 to 30 stakeholders should be present at the workshop and it should run for about five hours. The workshop should be held at a venue within the biosphere reserve at which the stakeholders feel comfortable. Somebody with experience in workshop facilitation should run the workshop.

At the start of the workshop, the goals of the biosphere reserve should be described, key concepts such as monitoring, evaluation and sustainability indicators should be defined, and the role of the stakeholders should be made clear. It should be explicitly stated that the indicators should meet the criteria listed in Table 5.2. The stakeholders should then be asked to identify themes under which

groups of sustainability indicators should be developed. For example, UNESCO's biosphere reserve functions (conservation, development, logistical support) or the goals of the particular biosphere reserve could be used as themes. After this, the participants should divide into smaller working groups according to the identified themes. These working groups should then discuss which indicators they think are appropriate under their assigned theme. One of the members of each working group should record the indicators and the rationale for their inclusion, e.g. using text on cards or using a laptop and data projector. In the final session of the workshop, all the indicators should be displayed and the plenary should then decide on which indicators should be kept and which should be removed. The indicators should then be copied into a spreadsheet. Finally, a workshop report should be compiled and sent to all those who attended the workshop, the biosphere reserve board and any other relevant role players.

The second group of experts are specialists within fields that are relevant to indicators, biosphere reserves and sustainable development (see also section 5.4). This group of experts will have more applied knowledge. These specialists should be identified through consulting the peer-reviewed literature and the websites of any relevant institutions such as provincial government departments, universities and research organisations. A contact list with e-mail addresses, phone numbers and details of expertise should be compiled on a range of specialists (social media networks such as Facebook or Twitter could also be used). Prior to contacting the specialists, a date and venue should be confirmed. The focus group should be held at a venue where the participants feel comfortable. When the specialists are contacted, additional contacts should be acquired by asking if the individual knows of any other relevant specialists that could be invited to participate in the focus group. Five to eight specialists should attend the focus group. Somebody with experience in focus group facilitation should run the focus group. In our experience, a five hour focus group has proved adequate.

At the start of the focus group, the goals of the biosphere reserve should be described, key concepts such as monitoring, evaluation and sustainability indicators should be defined, and the role of the specialists should be made clear. It should be explicitly stated that the indicators should meet the criteria listed in Table 5.2. The specialists should then be asked to identify themes under which groups of sustainability indicators should be developed. For example, UNESCO's biosphere reserve functions (conservation, development, logistic support) or the goals of the particular biosphere reserve could be used as themes. Each theme should be discussed by the experts and indicators relating to each theme should be identified through discussion between the specialists, with the facilitator ensuring that the discussion remains on topic. A scribe (who should not be any of the

specialists or the facilitator) should write the indicators down on a white board as they are identified (a laptop and data projector could also be used). These indicators should then be transcribed into a spreadsheet. In the final session of the workshop, the specialists should be given the set of indicators that were identified in the local stakeholder workshop and asked to identify which of the indicators, to the best of their knowledge, have data that is available for their measurement. For this exercise, each specialist should be given a questionnaire that consists of the indicators and three checkboxes next to each indicator that are labelled as 'data available', 'data not available' and 'unsure'. The results of this exercise should be recorded in a spreadsheet.

5.7.3 Integration and refinement of sustainability indicator sets (Figure 5.2: 8, 9, 10, 11a, 11b, 12, 13)

The final steps of the sustainability indicator development process involve integrating the local stakeholder and specialist sustainability indicator sets to produce the final sets. Firstly, the local stakeholder indicators that relate to the indicators that were identified by the specialists should be extracted. The extracted local stakeholder indicators and the specialist indicators should then be assessed according to criteria 1, 2, 3 and 5 of Table 2. Indicators that do not meet all of these criteria should be removed. An ideal set of indicators from the remaining local stakeholder and specialist indicators should then be synthesised. These indicators should be stated with a high level of precision (see criteria number four of Table 5.2). A feasible set of indicators should then be extracted from the ideal set of indicators. The indicators in the feasible set are those from the ideal set that have data available to implement them, based on the specialists' assessment of data availability. The ideal set of indicators therefore contains additional indicators that could be measured if the data can be acquired in the future. Evaluation of the feasible set of indicators should initially take place annually, with any indicators added from the ideal set added to it when data for the measurement of these indicators becomes available. These evaluations should be conducted by the biosphere reserve coordinator and board. Once all the indicators from the ideal set are in the feasible set, the time period between the evaluations of the indicators can be lengthened, perhaps to every five years.

5.8 Implementation

Data for the indicators should be stored in a database that is updated annually. It is possible that UNESCO's ten year periodic review period is too long because of the fast changes that occur in landscapes. It is suggested that these indicators be measured on an annual basis. Every year, the outputs of the indicators should be compared with the outputs of the previous year, and a report

should be compiled that highlights the trends in the dimensions that the indicators measure. Biosphere reserves should strive to form partnerships with institutions such as universities and Non-Governmental Organisations with regards to the monitoring that is required for the indicators, particularly for those indicators that are identified in the ideal set that do not have available data.

5.9 Further reading

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5.10 Useful contacts

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Colin Tucker	Stellenbosch University	ctuckersa@hotmail.com

5.11 Acknowledgements

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Chapter 6: Conclusion

Society needs sustainable development if we are to maintain biodiversity, the ecosystem services that support us, and human well-being (Elliott 2013). Biosphere reserves (BRs) are designated by UNESCO's Man and the Biosphere Programme with the aim of establishing landscape-scale examples of sustainable development (UNESCO 2012b). SIs are evidence-based monitoring and evaluation tools that aim to assess the progress of economic and social development, as well as the conservation of ecological systems, making them popular tools to use for the monitoring and evaluation (M&E) of sustainable development initiatives (Beratan et al. 2004; Bowen & Riley 2003; Morse et al. 2001).

In this study, the Kogelberg BR (KBR) and Cape West Coast BR (CWCBR) were adopted in an action research process as pilot studies for the development of a national protocol for establishing SIs. This was a user-driven process and was conducted collaboratively between researchers at Stellenbosch University and stakeholders of the BRs. The BRs need to submit a report to UNESCO every ten years and need to regularly report to funders. Most South African BRs have M&E frameworks in place, but none have developed SIs.

A large body of literature exists on both monitoring and evaluation for environmental management (e.g. Margoluis & Salafsky 1998; Salzer & Salafsky 2006; Stem et al. 2005). Substantially less, however, is available on SIs as they apply to ensuring BRs function effectively as models of sustainable development. Chapter 2 of this thesis provides a review of M&E within BRs in the peer-reviewed and grey literature, quantifying the extent and degree of adoption of M&E. The analysis of the peer-reviewed literature found that a substantial amount of research is being conducted in the developing world by authors from the developed world and that most of this research is focussed on the ecological dimension of BR social-ecological systems. About half of the indicators developed were ecological. The outcomes of the majority of documents sourced could potentially be implemented, however very few documented evidence of implementation. The findings of the grey literature found that most of the indicators developed had addressed social, ecological and economic dimensions of social-ecological systems, and more than half of the indicators that were developed measured social dimensions. Most of the documents suggested that the results were going to be implemented, but no evidence of implementation was recorded. Many of the indicators identified in both sets of literature were neither user-friendly nor measurable. The main conclusions drawn from this review (framed, also, in the context of Chapter 3) were that 1) relatively few BRs document implementation of their M&E frameworks, and 2) BRs need to improve their capacity with

regards to the implementation of M&E. These conclusions are formulated on the assumption that the reported incidence of M&E implementation accurately reflects the actual extent and degree of implementation, however, it is likely that implementation activities have been under-reported to some degree (e.g., Knight et al. 2008). Further research is required to provide more detailed insights.

Given the large number of BRs world-wide, relatively little published research documents their functioning and effectiveness, individually or as a network. Recognising the importance of both BRs for achieving sustainable development and M&E for ensuring these initiatives achieve sustainable development, Chapter 3 investigated M&E within the World Network of Biosphere Reserves (WNBR) using a web-based survey e-mailed to representatives of individual BRs globally. In addition, the extent and degree of M&E uptake in five of South Africa's six BRs was investigated through face-to-face interviews with BR coordinators. The survey of the WNBR and the South African BR Network showed that the majority of the surveyed BRs do conduct M&E (which suggests that many BRs do not document their implementation activities), however few have developed SIs. About a third of the BRs identified in the WNBR survey stated they had developed SIs, but only a third of these BRs stated SIs were being actively measured. Implementation generally appeared to be ineffective. This was primarily due to capacity limitations, difficulties in securing stakeholders to cooperate, and the challenge of choosing the most appropriate indicators for a BR. Many of the challenges that are faced by BRs within the WNBR and South African BRs are similar. The main challenges are limited capacity and funding to carry out the operational activities of the BR, including the implementation of M&E. It was found that some BRs are able to cope with this challenge by collaborating with external organisations and using the resources of these organisations to conduct M&E. These conclusions cannot be extrapolated across the WNBR, as only a small percentage of BRs responded to the questionnaire, thus further research is needed to adequately investigate M&E across the WNBR. Case studies mining deeper into the institutional and human capital constraints so as to identify potential solutions would be useful to ensure that BRs, individually and as a global network, are more effective in achieving their goals.

There are many examples in the literature of the development of SIs in collaboration with stakeholders (e.g., Bell & Morse 2003; Beratan *et al.* 2004; Gutowska 2012; Mcalpine & Birnie 2006; Parkins et al. 2001; Pintér et al. 2008). Whilst all South African Biosphere Reserves have developed an M&E framework, this study represents the first to develop SIs for any of the South African BRs. Chapter 4 presented the process of collaboratively developing SIs for the KBR and CWCBR through

local stakeholder workshops and specialist focus groups. The collaborative process applied to develop SIs for the KBR and CWCBR proved to be a useful method for the development of SIs.

The workshops that were conducted with the local stakeholders produced large sets of indicators, many that were immeasurable. The specialist focus groups produced much smaller SI sets, with a substantial proportion that could feasibly be implemented. The area-specific knowledge of the local stakeholders was integrated with the specialists' knowledge of indicators and sustainable development to produce a refined set of SIs for each BR. There was considerable overlap between the categories of indicators of the local stakeholder and specialist sets, as well as between the final sets of the two BRs. This suggests: 1) local stakeholders should not be used as the only source of information for developing SIs, unless they are extensively trained as to the criteria defining effective SIs; 2) information from different groups may be complementary; and 3) perhaps most important, given the context and goals of this specific study, a core set of SIs can be developed for BRs in the Cape Floristic Region (CFR) and, furthermore, could potentially be developed for the South African Biosphere Reserve Network as a whole. Until such time as research is undertaken to test this hypothesis, SIs should be developed on a case-by-case basis to ensure that local conditions are accounted for and to promote the buy-in of stakeholders through a collaborative SI development process. It would be useful to re-visit the KBR and CWCBR in 12-24 months' time to investigate the extent to which the SIs have been implemented, and which factors have promoted, or hindered, effective implementation. Future research could investigate whether the degree to which collaborative development of SIs influences the uptake and effectiveness of implementation. Further, comparing the effectiveness of alternative processes for collaborative development of SIs would be useful, e.g., the approach outlined by this study compared to one adopting a conceptual model (Margoluis et al. 2009) or participatory models (Sandker et al. 2010) to identify key indicators.

Ultimately, this research aimed to develop a national protocol for the South African Biosphere Reserve Network that could be used to assist members to develop SIs. The outputs, outcomes and lessons derived from Chapters 2, 3 and 4 were used to formulate this national protocol. The methods and processes used in this study are thus being presented as one potentially effective approach for the development of SIs. The national protocol is, however, flexible enough to enable individual BRs to adapt the process to their own circumstances and needs. It should not be regarded as a 'recipe' but rather as a template to be refined over time, and in the context of individual BRs, through social learning institutions with a view to making it an integral component of an adaptive management approach to sustainable development.

Making use of collaborative processes is essential for effective decision-making in conservation and sustainable development (Keene & Pullin 2011; Margoluis & Salafsky 1998). A major benefit of this collaboration is that it integrated a variety of knowledge sources to make the most effective decisions (Raymond et al. 2010; Wondolleck & Yaffee 2000). Through integrating the area-specific knowledge of local stakeholders and the specialists' knowledge on sustainable development and indicator concepts, this study produced SIs that are relevant to the social-ecological systems of the BRs, and can feasibly be measured (Chapter 4). Some of the respondents in the WNBR survey stated that difficulties with stakeholder cooperation was the reason that their BR was not actively measuring their SIs (Chapter 3). However, it is hoped that the use of this collaborative process to develop SIs will promote the buy-in and mainstreaming of the indicators amongst the BR stakeholders (Margoluis & Salafsky 1998). This will also assist in bridging the gap between research and implementation (Knight et al. 2008; Reed 2008).

The major contributions of this research to science and the South African BR network are:

- A set of SIs for the KBR and CWCBR that they can implement to measure their progress towards their goals. These SIs will assist the BRs to meet their reporting requirements, but the extent to which the SIs will be effective depends on the capacity of the BRs to implement them.
- A national protocol that can serve as a guideline for BRs in the South African BR network to develop SIs collaboratively with local stakeholders and specialists. DEA can recommend this protocol to both existing and any new BRs that are designated. If all BRs in the South African biosphere reserve network develop and implement SIs effectively, DEA will be able to compile reports to compare BRs with regards to their progress towards sustainable development.
- Further evidence that collaborative methods are effective tools that can be used in conservation planning and decision-making processes. As this evidence-base is built upon, more conservation initiatives are likely to make use of these processes.

6.1 Reflections and Lessons Learnt

When I applied to do my MSc in Conservation Ecology, my main goal was to gain knowledge and skills with regards to the social side of conservation, an aspect which is becoming more and more critical as the effects of anthropogenic activities on the environment are increasing. Conservation is not merely about the preservation of species and ecosystems, but also about viewing the landscape

from the perspective of natural resource users, coming to terms with this perspective, and finding a trade-off which satisfies both their personal needs and the goals of environmental sustainability.

While conducting ecological research, unpredictable challenges, such as field sites burning or diseases causing extensive fatalities in a study population, may occur. In social research, unpredictability takes on a completely different form. My study was not strictly focussed on analysing people *per se*, but I collected their knowledge and opinions to achieve my research goals. Some of the most valuable lessons that I learnt were about the nature of people and how this nature causes social research to be unpredictable. Firstly, I learnt that time is an extremely scarce and valuable resource, and it can be extremely challenging to get people to give of their time to, for example, be interviewed or attend a focus group. Secondly, I learnt that there is a fine line between people's knowledge (that which they know is true) and their opinions (that which they perceive to be true). This makes social research highly subjective, and the challenge is to arrive at quantifiably robust conclusions.

I also learnt a lot about monitoring and evaluation. The knowledge that I have gained on these two concepts and their implementation will be extremely useful to me in the future, particularly with regards to how to set up the foundation of an M&E system and the integration of indicators into such a system. This is something that I am going to attempt to implement in my future work.

The most challenging aspect of this research project was my literature review. Spending countless hours scouring through 289 documents, categorising and often re-categorising many of the documents and data, taught me that no matter how much patience and perseverance you think you have, these boundaries can and will be pushed passed their limits at some stage during your MSc degree. I learnt that the true test of one's character is the way in which you handle such challenges. Without a doubt, the knowledge and skills that I have gained through this MSc experience will be of tremendous value to me in my future studies and career.

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Personal Communications

Janette du Toit. personal communication, 8 February 2012

Appendix 1

List of keywords tested and the number of hits in Web of Science

Keywords	Number of hits
Biosphere reserve*	2271
biosphere reserve* AND sustainab* indicator*	22
biosphere reserve* AND monitor* AND evaluat*	26
biosphere reserve AND monitor* OR biosphere reserve* AND evaluat*	435
sustainab* indicator*	4172
sustainability indicator*	2521
monitor* AND evaluat*	94612
biosphere reserve* AND sustainab* indicator* AND monitor AND evaluat*	1
biosphere reserve* AND sustainab* indicator* OR biosphere reserve* AND monitor* AND evaluat*	47
biosphere reserve* AND sustainab* indicator* OR biosphere reserve* AND monitor* OR biosphere reserve* AND evaluat*	183

Appendix 2

UNSECO Biosphere Reserve Monitoring and Evaluation Survey

1) What is the name of the biosphere reserve that you are involved in?

2) What is your position within your biosphere reserve (e.g. coordinator, chairperson)?

3) Are any monitoring activities carried out within your biosphere reserve?

(Monitoring is defined as the collection and analysis of information and the use of this information to make management decisions)

Yes

No

Unsure

If yes, what types of activities does this entail and who is responsible for this monitoring?

If no, why are no monitoring activities performed?

4) Is your biosphere reserve ever evaluated?

(Evaluation involves comparing the impacts of a project or decision against the appropriate strategic goals of the project or organisation)

Yes

No

Unsure

If yes, how are these evaluations done, and who is responsible for conducting these evaluations?

If no, why has your biosphere reserve never been evaluated?

5) Once the results of an evaluation are known, how are these results implemented? (Only answer this question if you answered yes to the previous question)

6) Is the monitoring and evaluation of your biosphere reserve required by any of the following?

(more than one box may be selected)

- UNESCO
- The biosphere reserves management plan
- Local government
- National Government
- Other

7) Has your biosphere reserve ever submitted a periodic review to UNESCO?

- Yes
- No
- Unsure

8) Please rate the significance of the following challenges to monitoring and evaluation activities within your biosphere reserve:

Funding

- Not significant
- Low significance
- Moderate significance
- Very significant
- Highly significant

The time available for monitoring and evaluation activities

- Not significant
- Low significance
- Moderate significance
- Very significant
- Highly significant

Return on investment (cost-effectiveness)

- Not significant
- Low significance
- Moderate significance
- Very significant
- Highly significant

Staff skills and capacity

- Not significant
- Low significance
- Moderate significance
- Very significant
- Highly significant

Staff knowledge of monitoring and evaluation techniques

- Not significant
- Low significance
- Moderate significance
- Very significant
- Highly significant

Recognition by staff of the importance of monitoring and evaluation for achieving the biosphere reserve goals.

- Not significant
- Low significance
- Moderate significance
- Very significant
- Highly significant

9) Does your biosphere reserve use sustainability indicators to monitor and evaluate its effectiveness?

(Sustainability indicators assess the progress of economic and social development as well as the preservation of ecological systems)

- Yes
- No
- Unsure

If you answered "Yes" to the previous question, please continue below. If you answered "No" to the previous question, please continue from question number 15.

10) How were the sustainability indicators developed?

(More than one box can be selected)

- By NGO's
- By government employees
- By private consultants
- By academics
- By biosphere reserve employees
- By UNESCO MAB employees
- Through individual stakeholder interviews
- Through collaborative multi-stakeholder workshops
- By consulting the peer-reviewed literature
- Other (please specify)
- Unsure

11) Are the sustainability indicators actively measured?

- Yes
- No
- Unsure

If yes, who measures the sustainability indicators?

If no, why are the sustainability indicators not actively measured?

12) How regularly are the sustainability indicators measured?

(Only answer this question if you answered yes to the previous question)

- Only been done once
- Irregularly
- Annually
- Every two years
- Every three years

- Every four years
- Every five years
- Unsure
- Other (please specify): _____

13) How regularly is the sustainability indicators framework/ plan re-evaluated and/or revised so as to improve the applicability of the indicators?

- Never
- Only been done once
- Irregularly
- Annually
- Every two years
- Every three years
- Every four years
- Every five years
- Other (please specify): _____
- Unsure

14) What are the biggest challenges in implementing sustainability indicators?

If your biosphere reserve has not developed sustainability indicators, please continue from question number 15.

15) Does your biosphere reserve have any future plans to develop sustainability indicators?

- Yes
- No
- Unsure

If yes, how does your biosphere reserve plan to develop these sustainability indicators?

(More than one box may be selected)

- By NGO's
- By government employees
- By private consultants
- By academics
- By biosphere reserve employees
- By UNESCO MAB employees
- Through stakeholder interviews
- Through collaborative stakeholder workshops
- By consulting the peer-reviewed literature
- Other (please specify)
- Unsure

If no, why does your biosphere reserve not plan to develop sustainability indicators?

16) What type of knowledge is used to determine appropriate management activities within your biosphere reserve?

(More than one box can be selected)

- Common sense
- Personal experience
- Expert advisers
- Local stakeholders
- Other biosphere reserves
- Traditional knowledge (i.e. non-scientific knowledge from indigenous people)
- Collaborative decision making
- Scientific evidence
- Peer-reviewed literature
- Other (please specify)
- Unsure

Please rank the knowledge sources that you selected above in order of most frequently used, to least frequently used.

"1" represents the type of knowledge that is most frequently used. For example, if expert advisers are used most frequently, then select the "1" option next to expert advisers. If

common sense has the 2nd highest use, then select the "2" option next to common sense. Continue until you have ranked all the types of knowledge that you selected above.

_____ Common sense

_____ Personal experience

_____ Expert advisers

_____ Local stakeholders

_____ Other biosphere reserves

_____ Traditional knowledge (i.e. non-scientific knowledge from indigenous people)

_____ Collaborative decision-making

_____ Scientific evidence

_____ Peer-reviewed literature

_____ Other

Thank you for taking the time to complete this questionnaire.

Appendix 3

South African UNESCO Biosphere Reserve Survey

Interview location: _____ Interview date: _____

Interviewee name: _____

Interviewee position: _____

Biosphere reserve: _____

Questionnaire 1: General Information and Questionnaire Selection

1. Interviewee information

1.1. How long have you been working with this biosphere reserve?

1.2. What responsibilities do you have within the biosphere reserve?

1.3. What are your formal qualifications?

1.4. What is your previous work experience?

1.5. What is the most challenging part of your job?

1.6. What is the most challenging part of running a biosphere reserve?

2. *Biosphere Reserve Information*

2.1. Goals, objectives, vision of the BR

2.2. Management structure of the BR

2.3. Is adaptive management a strategy? (“A process that integrates project design, management, and monitoring to provide a framework for testing assumptions, adaptation, and learning” (Margoluis & Salafsky, 1998)). Please elaborate.

Yes		No		Unsure	
-----	--	----	--	--------	--

2.4. The reporting requirements of 1) the board, 2) UNESCO, 3) others

2.5. Funding sources

2.6. What type of knowledge is used to determine appropriate management activities (eg. stewardship, sustainable agriculture, tourism, development planning) within your biosphere reserve? Rank the selected knowledge sources in order of most frequently used, to least frequently used.

Select	Rank	Knowledge type
		Common sense
		Personal experience
		Expert advisers
		Local stakeholders
		Other biosphere reserves
		Traditional knowledge (i.e. non-scientific knowledge from indigenous people)
		Collaborative decision making
		Scientific evidence
		Peer-reviewed literature
		Other (please specify):

3. Questionnaire selection

Monitoring and evaluation are two related but different concepts.

3.1. Perceived meanings:

3.1.1. What is your understanding of the term “monitoring”?

3.1.2. What is your understanding of the term “evaluation”?

3.2. Actual meanings:

3.2.1. Monitoring is the regular collection and analysis of information and the use of this information to make management decisions (Margoluis & Salafsky, 1998).

3.2.2. Evaluation involves comparing the impacts of a project or decision against the appropriate strategic goals of the project or organisation (Shapiro, 2011).

3.3. Does your biosphere reserve carry out any such activities?

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	Unsure	<input type="checkbox"/>
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If yes, use questionnaire 2, if no use questionnaire 3

Questionnaire 2: Biosphere Reserve has M&E activities

1. What portion of your budget is spent on M&E?

2. M&E activities

2.1. What type of monitoring activities are carried out in your BR?

2.2. Who conducts these activities?

2.3. Who is responsible for these activities?

2.4. What is evaluated in your BR?

2.5. Who conducts these evaluations?

2.6. Who is responsible for these evaluations?

3. Does your BR have a monitoring and evaluation plan/strategy?

Yes		No		Unsure	
-----	--	----	--	--------	--

3.1. If yes:

3.1.1. What does this plan/strategy involve?

3.1.2. How was this plan/strategy developed? (More than one box can be ticked)

By NGO's	<input type="checkbox"/>
By government employees	<input type="checkbox"/>
By private consultants	<input type="checkbox"/>
By academics	<input type="checkbox"/>
By biosphere reserve employees	<input type="checkbox"/>
By UNESCO MAB employees	<input type="checkbox"/>
Through individual stakeholder interviews	<input type="checkbox"/>
Through collaborative multi-stakeholder workshops	<input type="checkbox"/>
By consulting the peer-reviewed literature	<input type="checkbox"/>
Other (please specify):	<input type="checkbox"/>
	<input type="checkbox"/>
	<input type="checkbox"/>

3.1.3. How often is this plan/strategy evaluated/updated?

Never	<input type="checkbox"/>
Only been done once	<input type="checkbox"/>
Irregularly	<input type="checkbox"/>
Annually	<input type="checkbox"/>
Every 2 years	<input type="checkbox"/>
Every 3 years	<input type="checkbox"/>
Every 4 years	<input type="checkbox"/>
Other (please specify):	<input type="checkbox"/>

3.2. If no:

3.2.1. Are there any future plans to develop a M&E plan/strategy?

Yes		No		Unsure	
-----	--	----	--	--------	--

3.2.2. If yes, how will this be developed?

By NGO's	
By government employees	
By private consultants	
By academics	
By biosphere reserve employees	
By UNESCO MAB employees	
Through individual stakeholder interviews	
Through collaborative multi-stakeholder workshops	
By consulting the peer-reviewed literature	
Other (please specify):	

4. In your opinion, what are the greatest challenges to monitoring and evaluation within your BR?

5. Which of the following budget items usually receive priority with regards to funding?

M&E		Administration	
M&E		Salaries	
M&E		Advertising	
M&E		Travel	
M&E		Project implementation	
Administration		Salaries	
Administration		Advertising	
Administration		Travel	
Administration		Project implementation	
Salaries		Advertising	
Salaries		Travel	
Salaries		Project implementation	
Advertising		Travel	
Advertising		Project implementation	
Travel		Project implementation	

6 M&E Likert statements	1: Strongly disagree	2: Disagree	3: Neutral	4: Agree	5: Strongly agree
Monitoring Uptake					
Ecological monitoring activities are undertaken to inform decisions in this BR by the BR board					
Ecological monitoring activities are undertaken to inform decisions in this BR by other stakeholders					
Social monitoring activities are undertaken to inform decisions in this BR by the BR board					
Social monitoring activities are undertaken to inform decisions in this BR by other stakeholders					
Economic monitoring are undertaken to inform decisions in this BR by the BR board					
Economic monitoring are undertaken to inform decisions in this BR by other stakeholders					
The monitoring results are reported to the BR board regularly					
We annually allocate funding from the budget for monitoring					
We have established a community-based monitoring programme					
We have a centralised database for storing monitoring data					
Monitoring results are used in evaluations					
Evaluation Uptake					
Ecological evaluations are undertaken to compare impacts of decisions or projects against goals by the BR board					
Ecological evaluations are undertaken to compare impacts of decisions or projects against goals by other stakeholders					
Social evaluations are undertaken to compare impacts of decisions or projects against goals by the BR board					
Social evaluations are undertaken to compare impacts of decisions or projects against goals by other stakeholders					
Economic evaluations are undertaken to compare impacts of decisions or projects against goals by the BR board					
Economic evaluations are undertaken to compare impacts of decisions or projects against goals by other stakeholders					
Evaluation results are reported to the board regularly					
We annually allocate funding from the budget for evaluation					
We have a centralised database for storing evaluation data					
Local stakeholders are involved in evaluations					
The results of evaluations are used to make management decisions					

Perceived effectiveness of M&E	1: Strongly disagree	2: Disagree	3: Neutral	4: Agree	5: Strongly agree
M&E activities within this BR have refined practices for more effective outcomes					
The return on investment of M&E activities is high					
The results of M&E are effectively implemented					
M&E has improved management					
M&E allows us to achieve our reporting responsibilities					
M&E ensures that our resources are adequately used					
M&E makes it easier for us to secure resources					
M&E has helped our progress towards achieving our goals					
Willingness to Uptake M&E					
Resources (time, funds, staff) spent on M&E are resources well spent					
I have actively encouraged the board to secure funds for M&E					
The BR board should appoint someone to coordinate all M&E activities within the reserve					
The BR should have a strategic plan/framework specifically for M&E					
If income is tight, funds available for M&E are usually spent elsewhere					
M&E results should guide all management decisions and actions					
M&E results should be discussed at every board meeting					
M&E should be performed on all projects within the BR					

	1: Strongly disagree	2: Disagree	3: Neutral	4: Agree	5: Strongly agree
Capacity to Uptake M&E					
<i>Funding</i>					
The BR board and employed staff have sufficient funding available for M&E					
It is my opinion that other stakeholders within this BR have sufficient funding available for M&E					
I believe that the BR board has the capacity to secure funding for M&E					
<i>Time</i>					
The BR board and employed staff have sufficient time available for M&E					
Its my opinion that other stakeholders within this BR have sufficient time available for M&E					
<i>Skills</i>					
The BR board and employed staff are proficient in M&E					
It is my opinion that other stakeholders within this BR are proficient in M&E					
There are opportunities for local communities to gain skills for community-based monitoring					
Professionals with M&E skills have a relationship with the BR					
<i>Knowledge</i>					
The BR board and employed staff understand how to implement a M&E program					
It is my opinion that other stakeholders within this BR understand how to implement a M&E program					
The BR board and employed staff recognises the importance of M&E for achieving the BR goals					
It is my opinion that other stakeholders within the BR recognise the importance of M&E for achieving the BR goals					
Forums exist within the biosphere reserve through which M&E results can be disseminated					
There is currently a learning mechanism in place through which lessons learnt from M&E can be shared					
Adaptive management is not important for running a BR					
Willingness to Engage Research					
Scientific information is useful					
Scientific information is essential for effective management					
I enjoy working with scientists					
I keep myself updated with scientific research that is relevant for this BR					
I regularly collaborate with scientists on BR activities					
Scientific research within the BR should be funded by the BR company					
Scientific research projects within the BR should involve BR staff					
All relevant scientific research being conducted within the BR should be used for M&E					

Questionnaire 3: Biosphere reserve has no M&E activities

1. Why has no M&E been implemented within your BR?

2. In your opinion, what are the greatest challenges to monitoring and evaluation?

3. Are there any future plans to develop a M&E plan within your BR? Explain.

Yes		No		Unsure	
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4. If yes, how will this be developed?

By NGO's	
By government employees	
By private consultants	
By academics	
By biosphere reserve employees	
By UNESCO MAB employees	
Through individual stakeholder interviews	
Through collaborative multi-stakeholder workshops	
By consulting the peer-reviewed literature	
Other (please specify):	

5. M&E Likert Statements	1: Strongly Disagree	2: Disagree	3: Neutral	4: Agree	5: Strongly agree
Willingness to Uptake M&E					
Resources (time, funds, staff) spent on M&E are resources well spent					
I have actively encouraged the board to secure funds for M&E					
The BR board should appoint someone to coordinate all M&E activities within the reserve					
The BR should have a strategic plan/framework specifically for M&E					
If income is tight, funds available for M&E are usually spent elsewhere					
M&E results should guide all management decisions and actions					
M&E results should be discussed at every board meeting					
M&E should be performed on all projects within the BR					
Capacity to Uptake M&E					
<i>Funding</i>					
The BR board and employed staff have sufficient funding available for M&E					
It is my opinion that other stakeholders within this BR have sufficient funding available for M&E					
I believe that the BR board has the capacity to secure funding for M&E					
<i>Time</i>					
The BR board and employed staff have sufficient time available for M&E					
Its my opinion that other stakeholders within this BR have sufficient time available for M&E					
<i>Skills</i>					
The BR board and employed staff are proficient in M&E					
It is my opinion that other stakeholders within this BR are proficient in M&E					
There are opportunities for local communities to gain skills for community-based monitoring					
Professionals with M&E skills have a relationship with the BR					
<i>Knowledge</i>					
The BR board and employed staff understand how to implement a M&E program					
It is my opinion that other stakeholders within this BR understand how to implement a M&E program					
The BR board and employed staff recognises the importance of M&E for achieving the BR goals					
It is my opinion that other stakeholders within the BR recognise the importance of M&E for achieving the BR goals					
Forums exist within the biosphere reserve through which M&E results can be disseminated					
There is currently a learning mechanism in place through which lessons learnt from M&E can be shared					
Adaptive management is not important for running a BR					

	1: Strongly Disagree	2: Disagree	3: Neutral	4: Agree	5: Strongly agree
Willingness to Engage Research					
Scientific information is useful					
Scientific information is essential for effective management					
I enjoy working with scientists					
I keep myself updated with scientific research that is relevant for this BR					
I regularly collaborate with scientists on BR activities					
Scientific research within the BR should be funded by the BR company					
Scientific research projects within the BR should involve BR staff					
All relevant scientific research being conducted within the BR should be used for M&E					

Appendix 4

Kogelberg Biosphere Reserve Local Stakeholder Sustainability Indicators

Theme 1: Conservation
Management effectiveness tracking tool (METT)
Status of PA management effectiveness (PA Finances)
Density of indigenous and alien species (marine and freshwater)
Density of Alien plant infestations
Change in species diversity and density
% of KBR natural area transformed (virgin soil) for core / buffer / transition
Ecosystem health status
Red data list status changes
Species linkages with other areas (corridors)
Sustainable management of resources in buffer zone (aliens / water / species tracked)
Veld age distribution in MCA
Fire frequency
Climate data monitored (sea water temperature, average temperature -min/max, rainfall)
Species interaction and competition with climate change (kreef, abalone)
Migratory bird species (re climate change)
Track sustainable production on farms linked with stewardship
% of KBR under formal protection (decrease / increase)
Monitoring of illegal activities
Expansion of core areas (ha added)
Status of important fishery species
Number of users / visitors to core area

Job creation (social benefit) through conservation area
Landscape monitoring changes (encroachment, aliens, species, developments, infrastructure, illegal activities, photo satellite)
Management plans link with local and national Climate change legislation
Dependency on ecosystem services within reserve and in other zones
Measure access and benefit sharing
Land claims - restitution status
Attitude and conservation ethic within community (participatory workshops)
Capacity building (has effected management, use and ethics)
Financial sustainability

Theme 2: Development
Natural Environment
River and estuary health (category A-E), Ecological reserve
Agricultural Pollution (water quality)
Fisheries (output)
Veld age (fire)
Agriculture / Agricultural industries
Water use / abstraction / groundwater
Volume / tons (pesticides / nutrients)
% Buffer transformed under Agriculture
% Veld cultivated
Urban / Build environment

Residential density (Du / ha)
% permanent residents
Urban sprawl / containment
% employment in urban population
% youth completing grade 12
% population employed by KBR
Number of economically active people
Health and well-being
Household income
Life expectancy
Reportable diseases
Infant mortality
% of population living in informal housing
Cross-cutting
% houses with RAW tanks
% Development overcome by sand
% households with green energy
Land-sea interaction
% off grid vs. bulk service supply
Number of approved land re-zonings
Public transport usage

% recycled waste
Number of Tourist / bed night occupancy
Tourist generated income

Theme 3: Logistics support
Governance
Number of staff employed by KBRC
Number of volunteer hours working for / in the KBR
Effectiveness of management structure and management committee
Racial representation
KBRC members and geographical spread (% of population)
Effective policing / monitoring of impacts
Education and Awareness
Awareness surveys (as a BR monitoring activity)
Number of school children reached through BR EE programme
Number of Adults that have received BR related training
Networking
Number of Marketing Interventions
Number of Partners / Stakeholders using the logo (branding)
Number of Interest group visits
Number of local, national and international events attended
Research
Research Archive (Accessibility / digital?)
Number of research projects undertaken by / linked to BR
Research Strategy (linked to CAPE)

Funding
Sustainable funding sources (ongoing)
Annual budget (increase or decrease)
Nu of Funders contributed to BR
Status of Annual Audits
Review of KBR investment into community
Securing of co-funding for KBRC
Rands spent by other strategic partners in KBR because of KBRC

Cape West Coast Biosphere Reserve Local Stakeholder Workshop Sustainability Indicators

Theme 1: Conservation
To conserve, maintain, rehabilitate Biodiversity
Sustainability in Biodiversity
Conserve, maintain, rehab biodiversity
Extent of PA (in perpetuity)
Ha and density of invasive aliens plants
Habitat Quality (level of degradation (freshwater and marine)
Species (Indicators? Threatened? Medicinal? Cut-Flowers?)
Endemic species Fauna and flora numbers and populations
Ha of restored veld
Sustainability in Ecosystem health
Sustainability in environmental health
Water quantity
Water quality (e coli, effluent, red tides, "leeny" metal)
Fresh water, estuaries, recreational beaches
Air pollution (Rust / NO2 - National Air Quality Act)
Invasive Fauna (marine / land / freshwater)
Ha of core and ha of buffer area
To maintain paleo-historical and cultural and geological heritage
Site quality (artefacts returned / management effectiveness)
Number of Declared sites (and new sites)
Visitor numbers per site
Carrying capacity of sites
To conserve non-renewable resources

Water quantity and quality
Soil (erosion and agricultural potential)
Firewood harvesting
Coastal sand management
% of species harvested that are harvested sustainable
Honeybees and eucalyptus
Extraction of marine resources
Fish - total allowable catch (MCN)
Extent seaweed cleared
Number of homes with - solar panels, composting, rain tanks
Electricity consumption and source (renewable vs. non-renewable)

Theme 2: Sustainable development & Planning Group
Measured loss of non-renewable resources
Management of resources (non-renewable - water)
Landuse change & use of tools (and Marine)
Spatial plans of status quo of landuse
% land distributed
S.F.P. Recommendations vs. actual developments
Encroachments (farms / mining / aliens vegetation / settlements)
Ensure local government participation re land-use
Positive influences on decision-making
Involvement with education - land-use
Job creation
Number of economic opportunities
Tourism numbers

R27 Hub progress (Tourism) and green tourism
Population growth and influx measured against unemployment in %
Fire prevention and veld age
Renewable energy generation (wind / sun / wave)
Green building principles (how many incorporated)
Water Desalination
Development vs. water resources
Water abstraction (use / reclamation / alternate sources)
Complying developments
How many approved development applications have construction / operation / decommission env management plans
How many biodiversity off-sets vs. development approvals
Implementation and alignment with government (all spheres) planning / policies / guidelines
Further Prioritisation
Measure loss of unrenewable resources
Tons of minerals mined per annum
Geological resources (tons of sand / stone)
Measure expansion of core areas and biodiversity corridors in ha
Measure water reserve
Measure water table in aquifers
Measure water volume
Measure water table level (quality / estuaries)
Measure biodiversity (CBA / IBA / minerals)
HUAL (Agriculture) in ha
Increase economic opportunity
Measure land-use change (retail / industrial / amount of building plans)

Amount of new manager jobs created
Measure Tourism numbers
Per Capita income
Income per household
Average income per household
Availability / access to micro-financing
Access to basic services (water / sanitation)
Sustainable resource use
Renewable energy

Theme 3: Stakeholder Support
Number of Institutions and interest groups
Number of Individual members
Number of corporates
Finances provided to CWCBR
Accreditations issued by CWCBR
Number of government
Number of government supporting programmes
Attendance in activities
New vs. renewed members
Number of people who know about the CWCBR
Number of hits on website
Database
Representativeness and geographic numbers
Sector interest involvement
Involvement in business of BR

Number of non-paid articles

Theme 4: Research and monitoring

Did not take place due to time constraints
--

Theme 5: Education / Capacity

All decision makers and developers are well informed regarding green principles

Targeted focus groups

All landowners understand what is required to meet sustainability standards

Budget allocated per year for environmental education

Number of social projects / environmental / business / economic

Member duration

Membership growth in all sectors

Number of matriculants

Change in behaviour... stewardship, developments changed their EIA,

Best practices for commercial practices

Monitoring post

Adult outreach

Schools

Budget

Number of participants of skills development & training programmes
--

Number of persons capacitated for jobs
--

Number of Partners

Number of Institutions visited

Number of staff employed

Number of stewardship agreements relative to targets
--

Number of presentations / events / open days / lecturers
Informal education
Number of projects for educational institutions
Number of programs / projects / workshops presented by CWCBR
Age groups
Info transferred
Number of schools visited
Number of children reached
Dates, times, season, activities
Feedback from participants
Number of brochures distributed and where
Interest groups
Number of hits on website
The Biosphere is well networked with eco-education initiatives and with the local schools

Theme 6: Operational / Institutional Governance
Nu of Budget sourced / amount secured as % of total budget / Increase
Financial stability (Budget vs. Actual)
Budget controls
Operational Budget
Financial audits
Unqualified audit
Environmental audits
Non-Financial Audits
Staff jobs created and skills developed (capacity building)
Measure nu of management meetings (attendance / circulation of minutes /

implementing of minutes / tasks)
Board meeting attendance / Involvement of Board
Regular attendance
Meeting attendance numbers by representatives of NGOs and Gov
Board: Representivity, attendance at meetings, geographical spread
Project funders feedback
Successful projects
Nu and budget amount of annual projects
Implementation and outcome of decisions
Strategic plan: Targets set
Performance measurement in terms of Performance agreement of staff
Performance appraisals: Goals
Partners collaboration
Optimal number of staff (equity / fair workplace)

Appendix 5

Kogelberg Biosphere Reserve Sustainability Indicators: Additional Details

		Data source	Threshold(s)	Proposed corrective action
Goal 1: Increased land for conservation (area, effectiveness)				
1.1.1	Hectares of alien invasive vegetation	Working for Water	100% of hectares meet Working for Water guidelines	Encourage land owners to contact Working for Water
1.1.2	Average density of alien invasive vegetation	Working for Water	100% of hectares meet Working for Water guidelines	Encourage land owners to contact Working for Water
1.2	Increase in hectares of priority vegetation types under stewardship contracts and agreements	Cape Nature	No landowners leaving the stewardship programme ⁴ . If stewardship agreements are established by private organisations, then an increase of 2 every year in priority vegetation types should be established	Campaign for Cape Nature to receive increased funding. Seek conservation NGOs interested in establishing a private stewardship programme
1.3	Percentage clean audits of stewardship contracts and agreements	Cape Nature	100% of audits are clean	Discussions with landowners in stewardship contracts and agreements that do not have clean audits
1.4	Hectares of priority vegetation types with appropriate frequencies, intensities and extents of wildfires ¹	Cape Nature	100% of hectares of priority vegetation types have optimal fire regimes	Run fire awareness programmes targeted at land owners

		Data source	Threshold(s)	Proposed corrective action
Goal 2: External leverage for generating conservation funds (economically viable)				
2.1	3 years guaranteed funding for the funding of a coordinator	Internal biosphere reserve company records	At least three years guaranteed funding	Seek additional funding
2.2	Funding secured from external donors is sufficient to cover all administration and project costs	Internal biosphere reserve company records	100% of costs are covered	Seek additional funding
2.3	Amount of funding received per project proposal submitted	Internal biosphere reserve company records	At least a 5% increase in the amount of funding received per project proposal submitted over the previous year	Seek additional funding
2.4	Amount of funding from the previous year used as leverage to secure funds for current and future years	Internal biosphere reserve company records	At least a 5% increase in the amount of funding from the previous year used as leverage	Seek additional funding
2.5	Proportion of members renewing their membership	Internal biosphere reserve company records	100% of members renew their membership annually	Develop and implement an effective marketing strategy. Promote and ensure the long-term funding for BR member rewards programmes.
2.6	Increase in the number of individual BR members per region	Internal biosphere reserve company records	At least a 5% increase in number of individual BR members per region over the previous year	Develop and implement an effective marketing strategy. Promote and ensure the long-term funding for BR member rewards programmes
2.7	Increase in number of tourist bed nights	Guesthouses, hotels, tourism organisations	At least a 5% increase in the number of tourist bed nights over the previous year	Discussions with tourism organisations

		Data source	Threshold(s)	Proposed corrective action
Goal 3: Increasing numbers of projects creating jobs				
3.1	Increase in number of people working in the core areas under Environmental Public Works programmes	Environmental Public Works Programmes	At least a 5% increase in the number of people working in the core areas under Environmental Public Works programmes over the previous year	Raise awareness on Environmental Public Works Programmes
3.2.1	Reduction in the proportion of positions that are occupied by a new person (turnover of board members and directors)	Internal biosphere reserve company records	100% of board members and directors maintain their positions annually	Revise contracts, position descriptions and responsibilities
3.2.2	Reduction in the proportion of positions that are occupied by a new person (turnover of staff)	Internal biosphere reserve company records	100% of staff maintain their positions annually	Revise contracts, position descriptions and responsibilities
3.3.1	Increase or maintenance of skilled staff working for the KBRC	Internal biosphere reserve company records	At least a 5% increase in the number of skilled staff working for the KBRC in the previous year	Seek additional funding. Identify and create new positions within the BR company
3.3.2	Increase or maintenance of unskilled staff working for the KBRC	Internal biosphere reserve company records	At least a 5% increase in the number of unskilled staff working for the KBRC in the previous year	Seek additional funding. Identify and create new positions within the BR company

	Data source	Threshold(s)	Proposed corrective action
Goal 5: Water quantity and quality			
5.1.1	Quantity of water at key sites is sufficient to meet the ecological and basic human needs reserve ³ Groenland Water Users Association	The quantity of water at key sites is above the ecological and basic human needs reserve	Run water use awareness programmes targeted at major water users
5.1.2	Quality of water at key sites is sufficient to meet the ecological and basic human needs reserve ³ Groenland Water Users Association	The quality of water at key sites is above the ecological and basic human needs reserve	Run pollution prevention programmes targeted at major polluters
¹ Priority vegetation types according to the National Biodiversity Assessment		⁴ Caveat: As of 2013, the stewardship programme is fully subscribed, will be expanded pending increased funding	
² E.g. Biodiversity and Wine Initiative, corridor programmes			
³ Key sites need to be determined			

Cape West Coast Biosphere Reserve Sustainability Indicators: Additional Details (The feasible sustainability indicators are shaded. Refer to Chapter 3 for the methods used to determine feasibility)

	Data source	Threshold(s)	Proposed corrective action	
Goal 1: Conservation				
1.1.1	Quantity of water in aquifers is sufficient to meet the ecological and basic human needs reserve	Department of Water Affairs	The quantity of water in all aquifers is above the ecological and basic human needs reserve	Run water use awareness programmes targeted at major water users
1.1.2	Quality of water in aquifers is sufficient to meet the ecological and basic human needs reserve	Department of Water Affairs	The quality of water in all aquifers is above the ecological and basic human needs reserve	Run pollution prevention programmes targeted at major polluters
1.2.1	Quantity of water in the Berg River is sufficient to meet the ecological and basic human needs reserve	Department of Water Affairs	The quantity of water flowing in the Berg River is above the ecological and basic human needs reserve	Run water use awareness programmes targeted at major water users
1.2.2	Quality of water in the Berg River is sufficient to meet the ecological and basic human needs reserve	Department of Water Affairs	The quality of water in the Berg River is all aquifers is above the ecological and basic human needs reserve	Run pollution prevention programmes targeted at major polluters
1.3.1	Hectares of alien invasive vegetation	Working for Water	100% of hectares meet Working for Water guidelines	Encourage land owners to contact Working for Water
1.3.2	Average density of alien invasive vegetation per property	Working for Water	100% of hectares meet Working for Water guidelines	Encourage land owners to contact Working for Water
1.4	Number of visitors to protected areas meets the carrying capacity of those areas	Data currently unavailable	The number of visitors to all protected areas is at or below the carrying capacity	Assessment of carrying capacity and monitoring of visitor numbers should be conducted by protected area managers
1.5	Number of visitors to paleontological and historical sites meets the carrying capacity of those sites	Data currently unavailable	The number of visitors to all paleontological and historical sites is at or below the carrying capacity	Assessment of carrying capacity and monitoring of visitor numbers should be conducted by the relevant site managers

	Data source	Threshold(s)	Proposed corrective action	
Goal 2: Sustainable development and planning				
2.1	Hectares of approved developments complying with Spatial Framework Plan	Data unavailable	100% of hectares approved for development comply with the Spatial Framework Plan	Raise awareness and educate developers, consultants and government officials. Ensure effective compliance monitoring.
2.2	Number of approved developments who comply with all aspects of the environmental management plan one year after development	Data unavailable	100% of approved developments comply with the environmental management plan	Raise awareness and educate developers, consultants and government officials. Ensure effective compliance monitoring.
2.3	Number of development applications commented on by BR committee members	Internal biosphere reserve company records	100% of development applications within biosphere reserves commented on by committee members	Strong communication between the municipality and the BR committee. Identify and implement a non-monetary incentive for BR committee members. Circulate application for comment to non-committee BR members.
2.4	Increase in hectares of biodiversity offsets obtained in priority vegetation types through the approval of developments ¹	Internal biosphere reserve company records	100% of hectares of biodiversity offsets in priority vegetation types are implemented effectively. 100% of each individual biodiversity offset proposed is established	Develop an ecologically meaningful set of biodiversity offset thresholds. Ensure offsets are made in priority vegetation types. The offsets are established in untransformed priority vegetation types.

	Data source	Threshold(s)	Proposed corrective action	
Goal 3: Stakeholder support				
3.1	Proportion of stakeholders attending meetings is 90% of stakeholders invited to meetings	Internal biosphere reserve company records	90% of stakeholders invited attend	Raise awareness of the BR. Ensure that meetings are informative and entertaining.
3.2	Increase in hectares of priority vegetation types under stewardship contracts and agreements ¹	Internal biosphere reserve company records, Cape Nature	No landowners leaving the stewardship programme ⁴ . If stewardship agreements are established by private organisations, then an increase of 2 every year in priority vegetation types should be established	Campaign for Cape Nature to receive increased funding. Seek conservation NGOs interested in establishing a private stewardship programme. Secure long-term funding for the CWCBR stewardship programme.
3.3	Increase in number of hits on the BR website	Internal biosphere reserve company records	At least 5% increase in the number over the previous year	Improve visibility and utility of the website
3.4	Increase in the number of individual BR members per region	Internal biosphere reserve company records	At least 5% increase in number of individual BR members per region over the previous year	Develop and implement an effective marketing strategy. Promote and ensure the long-term funding for BR member rewards programmes
3.5	Increase in the number of corporate BR members per sector	Internal biosphere reserve company records	At least 5% increase in number of corporate BR members per sector over the previous year	Develop and implement an effective marketing strategy. Promote and ensure the long-term funding for BR member rewards programmes. Strategically identify and approach corporate members. Identify incentives for attracting corporate members.

	Data source	Threshold(s)	Proposed corrective action
3.6 Increase in number of BR members attending BR activities	Internal biosphere reserve company records	At least 5% increase in the number of BR members attending BR activities over the previous year	Develop and implement an effective marketing strategy. Promote and ensure the long-term funding for BR member rewards programmes
3.7 Proportion of members renewing their membership	Internal biosphere reserve company records	100% of members renew their membership annually	Develop and implement an effective marketing strategy. Promote and ensure the long-term funding for BR member rewards programmes.

Goal 4: Research and monitoring

4.1 Number of civic reports of illegal environmental activities ²	Department of Environmental Affairs and Development Planning, Marine and Coastal Management	Increase in the number of reports and decrease in the number of observed illegal activities	Raise awareness of illegal activities. Secure funding for ensuring effective compliance. Offer incentives to citizens to report illegal activities.
4.2 Increase in number of research publications conducted in the BR	Academic databases	Net increase in the number of research publication over the previous year. 100% of all research project publish their work in scientific journals. 100% of research projects publish popular articles.	Secure funding for research. Build strong collaborations with universities. Actively encourage researchers to publish their results in peer-reviewed journals and write popular articles.

Goal 5: Education/capacity				
5.1.1	Increase in or maintenance of number of participants of social capacity development programmes	Internal biosphere reserve company records	10% increase in the number of participants of social capacity development programmes over the previous year.	Develop and implement an effective marketing strategy. Seek long-term-funding. Train participants to become trainers. Develop self-sustaining programmes.
5.1.2	Increase in or maintenance of number of participants of environmental capacity development programmes	Internal biosphere reserve company records	10% increase in the number of participants of environmental capacity development programmes over the previous year	Develop and implement an effective marketing strategy. Seek long-term-funding. Train participants to become trainers. Develop self-sustaining programmes.
5.2	Increase in or maintenance of number of jobs created through BR projects	Internal biosphere reserve company records	10% increase in the number of jobs created through BR projects over the previous year	Improve structure of BR projects
5.3	Increase in or maintenance of number of local people employed directly by the BR company	Internal biosphere reserve company records	Number of local people employed directly by the BR company in the previous year	Seek additional funding to employ more people and create additional positions
5.4.1	At least 95% of adults - (older than 18) attending BR initiatives across different socio-economic groups ³ were very satisfied or better with their experience	Internal biosphere reserve company records	At least 95% satisfaction	Revise structure of initiatives
5.4.2	At least 95% of children - (younger than 18) attending BR initiatives across different socio-economic groups ³ were very satisfied or better with their experience	Internal biosphere reserve company records	At least 95% satisfaction	Revise structure of initiatives

5.5	A sufficient portion of the budget is allocated for environmental education	Internal biosphere reserve company records	The proportion of the budget allocated to environmental education is sufficient to meet the environmental education goals	Seek additional funding and adjust the budget accordingly
5.6	Increase in number of items in the media	Internal biosphere reserve company records	10% increase in the number of items in the media in the previous year	Invite the media to attend BR activities.
Goal 6: Operational/institutional governance				
6.1	Reduction in the proportion of positions that are occupied by a new person	Internal biosphere reserve company records	100% of staff, board members and directors maintain their positions annually	Revise contracts, job descriptions and job responsibilities
6.2	Staff are paid based on national salary and wage standards commensurate with experience and qualifications	Internal biosphere reserve company records	100% of salaries and wages are paid according to NQF guidelines	Adjust salaries according to NQF guidelines
6.3	A reduction in the proportion of donor funding spent on administrative costs	Internal biosphere reserve company records	5% reduction in the proportion of donor funding spent on administrative costs over the previous year	Seek additional funding. Streamline administrative processes.
6.4.1	All funding spent by deadlines	Internal biosphere reserve company records	100% of funding is spent by deadlines	Evaluate the timelines that are proposed in funding proposals.
6.4.2	All funding spent within budget	Internal biosphere reserve company records	100% of funding is spent within budget	Adjust the budget. Evaluate the amount of funding that is spent on projects, administration, salaries and travel.
6.5	Funding secured from external donors is sufficient to cover all administrative and project costs	Internal biosphere reserve company records	100% of expenses are covered	Seek additional funding

¹ Priority vegetation types according to the National Biodiversity Assessment

⁴ Caveat: As of 2013, the stewardship programme is fully subscribed, will be expanded pending increased funding

² E.g. Illegal harvesting of endangered plants, illegal clearing, illegal dumping of waste, illegal water abstraction

³ Upper class, middle class, lower class
