

Linking the Human and Ecological in the Ecosystem: A Comprehensive Assessment to develop Co-operative Resource Management Frameworks in Africa

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Abstract

The ecosystem concept was coined by Tansley in 1934, and has become a widely used, but poorly understood concept in science for sustainability. The ecosystem approach has been proposed for the management of a wide variety of resources including biodiversity, fisheries, agriculture, forestry and others. In its application the ecosystem is understood to include the natural environment (habitat), and the organisms (inhabitants) that it contains, including humans, and their social systems (norms, rules, values).

The interaction of the human and natural systems contained in the ecosystem approach is important. This is because it fosters a move towards a more comprehensive assessment of project alternatives and impacts. It does so by building on the specific relationships that exist between people and natural resources and the linkages between social and ecological system components.

In Africa local and regional economic development are seen as essential pre-conditions for the African continent to break out of its pervasive cycle of poverty and under development. In this developmental stage the ecosystem approach provides and opportunity to implement an approach that develops co-operative resource management frameworks in Africa. These frameworks, developed on the comprehensive understanding of the human and ecological linkages in the ecosystem, can be used to maximise the potential economic and social benefits and minimise environmental and biodiversity costs of economic development projects in Africa.

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Key Words

Ecosystem Approach, Environmental Assessment, Cumulative Effects Assessment, Regional Development, Trans-boundary projects, Africa, NEPAD

Disclaimer

This paper has not been published in print nor is being submitted elsewhere.

Introduction

Environmental Assessment professionals periodically evaluate and re-engineer their tools to make them applicable, relevant and utilised. SEA, sustainability appraisal and integrated assessment all attempt to rise to the challenge for sustainable development. The need to jointly address and balance the goals of economic growth, social development and protection of ecological functioning and resilience is a tough one. However human well being as an integral part of ecosystem well-being is dependant on these interlinked ecosystem goals jointly receiving urgent attention.

The dire state of ecosystem and human well-being has been drawn into focus by the findings of the Millennium Ecosystem Assessment and the elaboration of the Millennium Development Goals, respectively. There is now an urgent need for a new look at how we assess the world as economists, social and environmental scientists. This paper suggests that taking the ecosystem approach is a reminder to us all that the contextual system or situation we live, grow and die in is integrated. The tools of appraisal and assessment do not integrate; the reality we are assessing is integrated. The economic, social and environmental tools we use merely assist in identifying, examining, analysing and assessing the feedback that occurs in the multilevel and integrated system.

The application of the tools requires that a joint understanding of the existing integrated context is formed. From this common understanding a 'constructed' ecosystem framework, with limits of acceptable change and capacities can be negotiated. This description should incorporate the knowledge of the economist, ecologist and social scientist. The caution again is that the tools do not integrate, and should not be expected to be a magic wand that leads to integrated development. Rather our contextual reality is integrated, and to deal with its complexity we have been educated to look at reality in disciplinary (discrete) term. We are trained to acknowledge and describe contextual reality guided by the field we are trained in, and ignore or devalue the fields we are not trained in. A social scientist will focus on the human drivers and consequences of, for example, the AIDS pandemic. The economist the financial cost and the natural scientist the environmental drivers of the pandemic. The diverse scientists however can be encouraged to recognise the integratedness inherent in the system, choose and apply their tools responsibly to work in the complex environment.

Disciplinary based education sees social, economic or natural scientists using the language, concepts and models from their discipline to understand the world. Sustainable development requires that we translate and construct a common language as a constructive glue that helps us to recognise the integratedness of the systems we investigate. Economic, social, natural, computer and management scientists already use the ecosystem as a concept to explain interaction in a complex system^a. The ecosystem concept can become a constructive glue to envision and describe the integrated framework in which various assessment tools and models can be applied to ensure sustainable development^b.

The Convention on Biological Diversity (CBD) describes the 'ecosystem' as 'a dynamic complex of plant, animal and micro-organism communities and their non-living environment acting as a functional unit' (www.biodiv.org/decisions). The ecosystem approach^c of the CBD, therefore, seeks to reach a balance between biodiversity conservation and sustainable use of the components of biodiversity, and the fair and equitable sharing of benefits arising from the use of genetic resources. A key component is recognising that this occurs within a dynamic environment, that includes humans, as part of a functional unit, along with plants, other animals and micro-organisms and the non living environment.

Within this dynamic environment, ecosystem management seeks to manage natural resources at the ecosystem level (Pirrot *et al.*, 2000), recognising that the spatial extent of an ecosystem often crosses administrative, political and international boundaries. To assess progress or success in ecosystem management, specific ecosystem "endpoints" are selected or set that will reflect the desired future state of the ecosystem. In Africa these ecosystem endpoints need to consider both the Millennium Development Goals (MDG's) and National Biodiversity Strategy and Action Plans (NBSAP's). This is important and sees the expression of the limits of acceptable change as including both the desired social and biodiversity state of the ecosystem and the desired state of change of those interlinked functional units in the dynamic environment.

The MDG's and NBSAP's need to be included as part of the state of the ecosystem framework recognises that the selection of the ecosystem 'endpoints' and 'limits of acceptable change' are social constructs. It is then acceptable that these constructs

^a Look for examples to include

^b What is SD here

^c In using the term ecosystem approach here, it is accepted that the approach may be referred to by various other terms. Therefore, "bio-regional planning"¹, "ecosystem-based utilisation" etc are taken to be terms for the ecosystem approach. The key is that a comprehensive assessment of project alternatives and impacts is called for. That is an assessment that builds on the specific functional relationships that exist between people and their resources, as well as the natural linkages between different ecosystem components (IUCN, 2000). This is taken to refer to what is termed the ecosystem approach in this paper.

vary according to the development needs and current economic state of the constructor of these two vital aspects of total ecosystem functioning. That is both human and ecological well-being. It is therefore important to remember that the desired future state of the ecosystem is most likely a function of the development status of the society in which it is constructed. It should not be surprising therefore that the developing and least developed countries in Africa^d have limits of acceptable change that are ecologically and socially different from a developed world. These have wider thresholds where the ecological footprint is small and the social needs greater. In this context there is a twin challenge of meeting the millennium development goals and protecting largely un-utilised biodiversity in Africa. There is an inherent challenge in this context of recognising that economic development is important and this has biodiversity and environmental impacts. Therefore a measured balancing act is required to ensure that the social and biodiversity action plans play an important role in integrated development planning.

This paper looks at how the ecosystem approach may assist in integrated development planning. Firstly it focuses on the evolution of ecosystem as a concept. This is to better understand how the ecosystem approach can be used in local and national resource^e management to promote economic and social development, alongside conservation, sustainable use and protection of natural and cultural resources. The linkage of the human and ecological aspects of the ecosystem are seen here as an essential part of the ecosystem approach. Secondly collaboration as a mechanism to achieve human and economic development can also be leveraged to achieve ecological management. These development and management goals can be advanced by taking an ecosystem approach.

The Ecological History of the Ecosystem Concept

The word ecosystem was coined by English ecologist Tansley 1935, and presented as a concept in an article entitled the ‘Use and Abuse of Vegetation Concepts and Terms’ (Golley, 1993, 254). The history of the ecosystem concept in ecology, the title of a book by Frank Benjamin Golley (Golley, 1993, 254) contains a detailed and informative account of the concept. Its subtitle ‘more than the sum of the parts’, aptly describes the ecosystem concept in theory and practice to the present day. The view of the ecosystem as an interaction of the parts, including between the ecological, societal and economic, and the feedback reverberations it creates in the system is important. The ecosystem is a conceptual construct and not a unit of nature. The phenomena described in the natural system are also observed in the social and economic system. These phenomena include competition, specialisation, co-operation, exploitation, learning, growth, extinction and succession. These are dynamic system concepts that are observed in social, ecological and economic relations and functioning.

The overview of the history of the ecosystem concept in Golley (1993), presents in detail the reasoning, and debate that led to the term ecosystem being coined. Golley notes that in its formative period, the ecosystem concept incorporated an operational approach of the study of ecosystems as an object of nature. This approach saw ecosystems existing as discrete objects in nature that had a characteristic structure and function and could be studied directly. This rigid and structural view of the ecosystem was considered untenable.

Golley notes that the ecosystem concept later became increasingly employed as representing a point of view, and a philosophy of nature. In this philosophical view the components of the system were linked, and interacted, as a whole. It was then necessary to think about the way the world is organised, emphasising the interconnection and integration of systems at various scales, co-operation and synergisms and symbioses rather than dialectical opposition, competition and conflict (Golley, 1993, p116). This later view of the ecosystem lends itself to scientists in diverse fields adopting the usage of the concept. It follows that this latter approach is considered as taking an ecosystem perspective (Cortner and Moote (1999, p42)). This means looking at ecological, social and economic processes, and recognising that a process may be the result of many interactions, and that an action can cause numerous interactions to reverberate throughout a system.

The integrated aspect of the ecosystem is emphasised by Van Dyne (1969), discussing implementation of the ecosystem approach. He uses Tansley’s definition of the ecosystem as a system resulting from integration of all living and non-living

^d Africa contains most of the least developed countries in the world, and a few developing countries like South Africa

^e Financial, natural and human resources

factors of the environment. He interprets that Tansley's uses the term ecosystem as a concept, and should not be confused with the use of the term as a unit of landscape or seascape, a common interpretation. The emphasis might, therefore be that the biologist look beyond his particular biological entity, and must consider the interrelation among the components and their environment (Van Dyne, 1969, p.329)^f. This may be extended to the disciplinary based scientist looking beyond her particular entity to consider the interrelation among the components and their environment. The conceptual nature of the term ecosystem advances its use across disciplines. It is important however to revisit the conceptualisation of the term ecosystem, as it is located within the hierarchy of the biological and ecological sciences.

The stimulation for Tansley's paper, the treatise on vegetational terms and concepts, where the ecosystem concept was coined, was a series of four articles by the South African ecologist John Phillips. These articles of Phillips were concerned with the biotic community, succession, development, the climax, and the complex organism (Golley, 1993, p11). Phillips related in his work as an ecologist to concepts of the American ecologist Frederic Clements^g. Clements espoused the philosophical concepts of the biotic community as a complex organism and as a philosophical whole. In turn Clements followed the ideas of Jan Christian Smuts^h, a South African politician. In Phillips first article on the biotic community, he included both plants and animals as members of the community. The creative element in all the four Phillips articles was the connection of thought between Clements and Smuts, defending Clements concept of the community as a complex organism, and Smuts holism. He firstly asserted that **development** causes integration to occur among the biota within the community. Secondly the **climax** is set by the regional climate, and there is ideally a single climax where the climax community is in a dynamic equilibrium with the climax habitat, but the equilibrium is not static or permanent (Golley, 1993, p13). Supporting the non static and permanent nature of the equilibrium, Phillips defended the concept of emergence, and the complex organism. Therefore communities are not the mere summation of individual organisms, but are integrated wholes with particular emergents (Phillips, 1935b, p490 referenced in Golley, 1993, p13).

Tansley did not agree with concept of the community as a complex organism, and distanced himself from these interpretations. He was particularly against the view of the community as an organism, developing through the process of ecological succession as described in these articles. He felt they were based on extreme speculation, and not on field evidence. The former he attributed to be the terrain of philosophy, and the latter of science in which ecologists were involved. This was his stimulus for the concept of ecosystem. In the ecosystem concept, Tansley identified a system that was, firstly, an element in a hierarchy of physical systems from the universe to the atom, secondly, the basic system of ecology, and lastly, composed of the physical environmental complex (Golley, 1993, p9). In coining the ecosystem concept, he was attempting to defend ecology from, what he perceived as, too extreme philosophical speculation. Instead he wanted to affirm its connection as arising from within mechanistic reductionist science, and preserve its reputation within biology (Golley, 1993, p15.) as a science.

In Tansley's conceptualisation of the ecosystem he was defending Ecology from philosophising, and attempting to affirm its positivistic, naturalistic and reductionist tradition as a science. As stated previously Tansley's ecosystem concept was concerned mainly with terms and concepts reviewed in Phillips 1934 Articles. Tansley wanted to stress the physical character of the ecosystem, and its relation to physical systems in general. That it was based on the concept of equilibrium, and emphasising the interaction of the physical chemical and biological components of the ecosystem. He wanted to distance the ecological community being viewed as a complex organism, developing and emerging.

^f The division of ecology into autoecology, concerned with experimental and inductive approaches, and synecology, which is characteristically more philosophical and deductive (Van Dyne, 1969, pp5). He goes on to ruminate that man is part of the ecosystem, even economic man, but only some economics seem ecological (Van Dyne, 1969, pp13). The problems arise when the ecosystem approach as used in natural resource management problems mistakenly treats man/person as external, or a constraint, to the 'eco' system – when eco is taken to mean ecological. However eco means home, and the ecosystem is home to plants and animals including man

^g Golley, 1993, p 25 cites a study of Clements done by Ronald Tobey where he comments that the use of the organism metaphor for human society by Herbert Spencer probably influences Clements to use organism metaphor for his climax community

^h Jan Smuts presented his philosophical thought in a 1926 book Holism and Evolution where he referred to the synthesis of matter, life and mind based upon science as holism. He stressed that wholes are not additional to parts, but wholes are the parts in a definite structural arrangement with reciprocal activity and function (Golley, p.25)

There is a tension between the reductionist and systems paradigm in the conceptual foundations of the ecosystem. This is apparent in the current development and application of the ecosystem approach. To understand the current diverse and disparate usage of ecosystem as a concept, it is instructive to be reminded that the term was founded as a bridge between reductionist and holistic materialism. This previously divided ecology into two irreconcilable parts and in ecology circles Phillips was known as a holistic materialist and Tansley as a reductionist materialist. Tansley therefore avoided biological and organismic theories in developing the ecosystem concept, and presented instead a physical theory founded on the concept of equilibrium (Golley, 1993, p29).

Was the ecosystem an *object of nature*, where the ecosystem is a discrete object in a mosaic of nature? Was the ecosystem an *event focused physical orientation*, where the ecosystem is an event in a physical field of dynamic process? Tansley never used the ecosystem concept in his studies, but only in conceptual writing. Because he did not use and elaborate but only alluded to the physical field concept in his presentation of the ecosystem concept, this left the development of the term open to misuse and mis-interpretation (Golley, 1993, p 34). This led to the term ecosystem increasingly being proposed as a basic unit of ecological study (an object of nature rather than event focused physical orientation) by (Evans, 1956 and Odum, 1959). Since then many ecologists have been using the ecosystem concept even if not explicitly using the word ecosystem (Van Dyne, p 14) and therefore ecologists have been trained, versed and practiced in using ecosystem as a concept that applies to ecological matters.

The ecosystem concept as adopted by the CBD, to be interpreted, and implemented, appropriately, needs to include the human –ecological linkage of the ecosystem as a key component. In this interpretation the physical ‘field of dynamic process’ may be the development activities that form an emergent ecosystem with an ‘event focused physical orientation’. The focused orientation may include the Millennium Development Goals, National Biodiversity Strategy and Action Plans (NBSAPs), and sustainable development goals of economic growth and environmental protection goals of a country. The field of dynamic process must aim to achieve these interrelated goals in the emergent ecosystem as an event focused physical orientation.

The Ecosystem Concept in Natural Resources Management

To advance sustainable development and management of natural resources the ecosystem approach was adopted as the primary framework for action under the Convention on Biological Diversityⁱ in 1992. To inform this framework, the principles of the ecosystem approach to biodiversity management, termed the Malawi Principles were outlined in 1998. Further to this the description of the ecosystem approach, and operational guidance, was endorsed^k in CBD Decision V/6 of 2000. The application and operationalisation of the principles and other guidance on the Ecosystem Approach was recommended as part of decision V/6.

The development of the ecosystem approach principles has occurred through case study applications. However, the Convention on Biological Diversity has renewed calls for the implementation of the ecosystem approach, years after the ecosystem approach was formally proposed for natural resource management. This may be because there is recognition of a caveat in the application thus far. The caveat that may be preventing the ecosystem approach with its human-ecological link being holistically applied in sectors like forestry, fisheries, agriculture, wildlife management, tourism, and other land use sectors. It may be that the ecosystem approach with its broad definition is amenable to any existing practice or approach being labelled an ecosystem approach. This has both positive and negative consequences. A positive may be that it allows the alignment of current activities to the three tiers of sustainability and improves practice. Conversely, it may encourage business as usual by providing a non-accountable means of appeasing the nagging environmentalists, labelling existing practices in their terminology, with little effort to change them.

The operating principles of the ecosystem approach may be constrained by the lack of agreed philosophical foundations and a common conceptual understanding. In this blurry environment existing practices are easily labelled as an ecosystem approach by merely incorporating elements of the broad principles of the ecosystem approach. The current status is that there is a clear

ⁱ CBD COP Decision V/6 Ecosystem Approach

^k The Conference of the Parties, at its Fifth Meeting, - these two footnotes may be the same

recognition of the broad, and all encompassing, nature of the principles, but there is a lack of clear guidance on implementation. Therefore parties agreed in 2004 that the priority at this time should be on facilitating implementation of the ecosystem approach and welcomed additional guidelines to this effect (Decision/VII/2)^m. The caution here is that the call for more guidelines may entrench a technocratic blueprinting of existing approaches under the umbrella principles of the ecosystem approach. The development of a shared understanding and conceptualisation of the ecosystems approach focusing on the human-ecological linkages, and increasingly on the human-ecological-technological linkages may be the way forward.

The recommendation is that the conceptual and philosophical foundation of ecosystem approach be elaborated. This requires revisiting of the original tension between reductionist, and holistic, materialism contained in the concept. Initiating a dialogue that encourages a fuller analysis of the tension to come to a contemporary agreement. Within this environment of shared understanding and conceptualisation, implementation is facilitated through a recognition of the values, benefits, ethos and vision of the ecosystem approach. The dialogue should focus on man as part of the ecosystem and not a separate observer of the ecosystemⁿ. Here the species, structure and function of ecological systems, and the social organisation, institutions, and rules and norms in social and economic systems need to be considered as events in the ecosystem. In this way the interlinking ecological and social aspects of the ecosystem can be described, and understood.

This interlinked human-ecological ecosystem approach can aid in poverty alleviation alongside biodiversity conservation, by providing a relevant focus on humans as part of the ecosystem as part of overall systems well being. It is an important, but neglected principle of the ecosystem approach. This linkage needs to become more integrated into theorising, conceptualisation and practice of the ecosystem approach by looking at the humans as part of the ecosystem.

Humans as part of the ecosystem

In the ecosystem approach the inter-relationships between people, and ecological systems, exist across a range of livelihoods and lifestyles. The levels of importance range from the basic subsistence, to the sophisticated technological level. In Africa the majority of people depend directly on ecological systems for their survival. The ecosystem approach offers a comprehensive approach focusing the assessment on the relationships and linkages at different levels. This comprehensive approach allows a big picture view that effectively looks at the maintenance, and improvement of the productive capacity of essential ecological, economic and human system goods, and services, and the as an essential element of equitable and sustainable development.

The description and analysis of human in nature systems, which is required for the linking of social, and ecological systems reveals a deficiency in scientific concepts of ecosystems, (Berkes and Folke, 1998). However, there should not be a search for a single universally accepted way of formulating the linkage between social and ecological systems. Instead cross fertilisation of ideas in ecological, physical, social and economic sciences should be explored. A review of ecosystem case studies refers to a forestry development case (Van Dyne, 1969, p194) that can be used to illustrate how cross fertilisation can occur. In this case the author refers to Clements (1909) as stating ‘the application of the methods of forest types to forestry brings it into harmony with the fundamental principles of ecology...reproduction, development and succession are the bottom of the same great processes and this process can be accurately and thoroughly connected with the habitat factors which are its causes, just as the functional structures are its results’. Using a cross fertilisation the fundamental principles of society may also be argued to be reproduction, development and succession. These processes in society are connected with the developmental factors prevalent in the habitat (community, nation, region), which are its causes. These may include overpopulation, underdevelopment and poor succession in economic and governance spheres; just as the functional structures (poor governance) are its results. This social and ecological cross fertilisation may be explored in more detail and analysis of political and social economy explored in ecosystem science. This may lead to an integrated understanding of the interactions and interconnections between the ecological, social and economic system.

A review of ecosystem case studies point to a neglect in the analysis of the human in nature systems as an element in ecosystem management This was evident in a review of two volumes focusing on the ecosystem approach, the Ecosystem Concept in Natural Resource Management (1969) and Biodiversity and the Ecosystem Approach (2003). Within these cases

^m in 2004 The seventh meeting of the Conference of the Parties

ⁿ The activities of man that directly impact on the natural environment also need to be considered.

it is noted that humans might be 'interesting' to look at in the ecosystem study being described and analysed. However, there is a retreat to a complete focus on the physical ecological (form, function, structure) aspects of the ecosystem, and none on the human social aspects of the ecosystem. An illustrative example is the first paper reviewed in the FOA book on Biodiversity and the Ecosystem Approach. In a case study of a poor rural area of South Africa, the Eastern Cape Province the author introduces the articles by noting that the Eastern Cape 'is home to a large population that is rural, poor and has experiences little development'. In this context it probably means that the population are subsistence crop farmers, or pastoralists, directly dependant on natural resources for their survival. They also mention that 'wise use of resources requires a good understanding of the ecological processes that maintain the resource base', and further that it is essential to understand the 'complex relationships between the social order and the natural environment'. However, besides a description of the total population numbers, and gross employment statistics, and a reliance on natural resources being confirmed, the analysis of the 'complex relationship' between the 'social order', and the 'natural environment', is done in relation to pressures and impacts on the landscape, and biodiversity, of commercial and communal farming. A cross fertilisation of pressures and impacts on the people (and of the people) on these different modes of farming were not analysed. This cross fertilisation may add valuable insight, advancing the human-ecological link in the ecosystem analysis, making it a more comprehensive assessment of impacts.

In summary it is important that the Millennium Development Goals relate to a sections of population in all countries, that are in many cases directly dependant on natural resources for their subsistence, and livelihoods. The achievement of these goals therefore make it necessary to examine human-ecological linkages, as part of the ecosystem analysis in natural resource management for human and ecosystem well being as part of integrated development.

The Ecosystem Approach and Co-operative Resource Management Frameworks in Africa

Economic development, for sustained human development is recognised as a priority for Africa. This is because in the African context, poverty alleviation is an essential element for the achievement of sustainable development². Africa's natural resource wealth, and biodiversity, underpins its current drive towards sustainable development, and provides an opportunity to benefit from natural wealth without destroying the biological basis on which it depends. Importantly, the aim should not be to preserve our continent simply as a sightseeing destination, but rather to choose those development options that will ensure that resources are developed systemically and in a sustainable way, so that Africa's people can prosper within its rich natural heritage. Taking an ecosystem approach provides a framework for holistic development planning that advances ecological protection alongside human development. To advance human development the African Region succeeded in including the special needs of Africa, focusing on the practical implementation of commitments made by nations at the Millennium Summit, commonly know as the United Nations Millennium Development Goals. To emphasize their importance the World Summit on Sustainable Developments and the Johannesburg Plan of Implementation (JPOI) stressed the importance of the achievement of the MDGs goals. It stressed that this requires concerned and concrete measures at all levels, from international to local. The New Partnership for Africa's Development (NEPAD) is a programme of action to take forward sustainable development (SD) in the African region provides a framework within which this challenge is addressed. The New Partnership for Africa's Development is a pledge by African leaders to eradicate poverty and to place their countries, both individually and collectively, on a path of sustainable growth and development (NEPAD, 2001).

To achieve the above the inclusion of people as part of ecosystems that is at the heart of the ecosystem approach of the CBD is the key. This is important in Africa where livelihoods are dependant on natural resources and ecological systems and biodiversity in Africa continue to be essential to the cultural, economic, physical and social well being of indigenous people and their communities. Therefore it is clear that 'human development and human security are closely linked to the productivity of ecosystems' (WRI 2000-2001; 2001) in Africa. The ecosystem approach may be seen as critical to taking a capacity based, long-term perspective on impacts and comprises the middle tier linking EIA and SEA in an integrated approach to environmental assessment Sadler (1996). The Convention on Biological Diversity (Decision v/6) adopted the

² In Africa a variety of mechanisms, including at a local level Integrated Development Planning (IDPS), Environmental Management Frameworks (EMFs) at a national level Poverty Reduction and Strategy Papers (PRSPs), the New Partnership for Africa's Development (NEPAD), Regional Development Strategies, and country-specific strategies, to facilitate the achievement of sustainable development objectives.

ecosystem approach for the sustainable use of biodiversity³. The continental vision contained in the New Partnership for Africa's Development (NEPAD) calls for a recognition that Africa has provided productive natural, and human, capital that; has contributed to developed world progress during colonisation. Africa's leaders in the NEPAD, therefore call for a "new relationship" of partnership between Africa and the international community to overcome the development chasm. That is a partnership founded on a realisation of common interest, benefit and equality.

The ecosystem approach provides a relevant means for achieving the vision of the CBD, for sustainable use of biodiversity, and the NEPAD, for sustainable human and economic development. This is because it provides a means for taking a 'capacity based, long term perspective to impact'. Furthermore it can foster collaboration through the development of co-operative resource management frameworks, and partnerships to facilitate the drawing up, implementation, management and monitoring of these frameworks. These co-operative frameworks for resource management can then be used as a basis for, or feed into, existing global frameworks, for example the Millennium Ecosystem Assessment. This will also provide a collaboratively defined context under which cumulative, and trans-boundary, impacts can be evaluated, and applied to good effect in a regional setting (Sadler, 1996).

At a strategic policy level, Africa has existing strategies, policies, plans and agreements corresponding to the apex of Sadler's hierarchy of assessment (Figure 2). At a national level, many African countries have prepared Biodiversity Strategy and Action Plans as called for by the CBD. It is the middle tier, where ecosystem approaches are used in planning and programming land use and natural resource management plans that a caveat exists. The cooperative resource management frameworks proposed here can address this gap. In this middle tier, the co-operative frameworks can serve to link individual project developments at the local level to the policies at the national, regional and global level. The cooperative framework for resource management can provide for an integrated, co-ordinated and uniform approach to biodiversity, and natural, resource management for promotion of poverty alleviation and human and ecosystem well being in African countries. The cooperative framework should seek to be consistent with existing national and regional development plans, and environmental and socio-economic principles, and ratified international agreements. These regional frameworks must be informed by, and can inform, norms and standards for national sustainable development strategies (mandated by the Earth Summit) and national biodiversity strategies and action plans (mandated by the Convention on Biological Diversity). Most importantly, the achievement of the Millennium Development Goals (MDG's) as a minimum, and individual national development goals as a maximum, should inform the development of the co-operative resource management frameworks. In taking forward the human-ecological link of the ecosystem approach, it is important to ensure the social, and economic, development of people and poverty alleviation is maintained as a priority, alongside the protection and conservation of biodiversity.

Framework for the integration of Biodiversity in Impact Assessment

The co-operative resource management frameworks proposed share the conceptual framework described in Slootweg et al. (2001). The conceptual and procedural framework for the integration of biodiversity considerations within national systems for impact assessment (Slootweg and Kolhoff, 2001) was presented. This comprehensive conceptual framework is designed to provide an understanding of the causal chains by which activities lead to impacts, through biophysical and social pathways. The framework is intended to accommodate all conceivable biophysical and social impacts, but the framework has been elaborated in detail for the identification of biodiversity-related impacts. They state that the use of an all-encompassing framework is deliberate. This is to make sure that biodiversity is an integral part of existing impact assessment procedures, and legislation, and provides a way of thinking on how biodiversity can be better embedded in existing EIA systems. This is also necessary for embedding human development as an integral part of existing impact assessment procedures.

In the paper the authors distinguish between *change*, and *impacts*. They note that the 'magnitude and direction' of biophysical, and social, *change* are determined by the combined characteristics of the intervention, and the recipient

³ Various African countries are signatories to the convention and Africa is home to a rich array of the world's biodiversity, including many endemic species and ecosystems, for example within the Cape Floral Kingdom.

involved. However, biophysical and social *impacts* are considered to be context-dependent. They suggest that the type of ecosystem, or land-use type, determines the functions of the natural environment, and this is where biophysical changes occur. Further, the exact nature of the ecosystem where biophysical changes occur and the use that society makes use of these functions needs to be known (Slootweg and Kolhoff, 2003).

This framework recognizes the biophysical, and social nature of the ecosystem and focuses on the ecological-human linkages that the cooperative natural resource frameworks are calling for. They suggest that outside experts will be capable of defining most functions of known ecosystems. However, whether these functions of ecosystems in the regions are actually valued by society, and thus should be included in EIA studies, is completely dependent on the societal context. These in turn relates to the norms and values system of a society, represented by its laws and regulations (customary rules or formalised legislation) (Slootweg and Kolhoff, 2003). In the cooperative resource management frameworks the functions of ecosystems and their value to society in the African context, and their relationship to the norms and values systems of African society as represented by its laws and regulations is important to consider.

The Ecosystem Approach and the African Development Challenge

The overall principles of the Ecosystem Approach integrate both societal and ecological concerns⁴. The Malawi Principles for an ecosystem approach, however, does not include ecosystems in a social context. This addition is critically needed, and included as part of this analysis of the ecosystem approach, specifically for African Regional Development (see Table 1 for The Malawi Principles). The inclusion of the societal context allows these principles to be used to guide the identification and development of regional economic integration initiatives and projects in Africa. It can also guide the assessment of the sustainability of past initiatives, and projects and the drawing up of cooperative natural resource management frameworks as discussed in the previous section

The Ecosystem Approach could promote a systematic approach to resource management in Africa. This is if it looks at multiple pathways and levels, working to clearly defined broad objectives. It should also consider the causal chains by which activities lead to impacts, through biophysical and social pathways. The achievement of African Regional Development Objectives, National Biodiversity Strategies and Action Plans, and Millennium Redevelopment Goals, is a dynamic multidimensional desired state that needs to look at these multiple pathways and levels, and causal chains that include natural and societal processes (see Figure 2). This dynamic multilevel view of the ecosystem allows for assessment, management and monitoring of change in the biophysical and social system at a national and regional level (scaling up), while measuring environmental and societal impact at a local level (scaling in).

⁴ These include that and include that: management objectives are a matter of societal choice; management should be decentralised to the lowest appropriate level; ecosystems must be managed within the limits of their functioning; the ecosystem approach should be undertaken at the appropriate scale

Table (i) The Malawi Principles for an ecosystem approach (Adapted from UNEP, 1998).

Ecosystem in an economic context –

1. Aligning incentives to promote sustainable use, and internalising costs and benefits.

Ecosystem in a Ecological Context

2. Conservation of ecosystem structure and functioning.
3. Limits - Ecosystems must be managed within the limits of their functioning.

Own Addition - Ecosystems in Social Context

A focus of activities must be the happiness, upliftment and development of the communities subsisting on the ecosystem.

Scale⁵

4. The ecosystem approach should be undertaken at an appropriate spatial scale.
5. Varying temporal scales and lag effects characterize ecosystem processes, therefore objectives for ecosystem management should be set for the long-term.

Balance

6. Appropriate balance between conservation and use of biodiversity.

Participation

7. Consider all forms of relevant information, including scientific, indigenous and local knowledge, innovations and traditional practices.
8. Involve all relevant sectors of society and scientific disciplines.

Management

9. Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems.
10. Management must recognize that change is inevitable.
11. Management should be decentralized to the lowest appropriate level.
12. Management objectives are a matter of societal choice.

In the cooperative resource management resource management frameworks the economic, social, environmental interactions between social and biophysical environment occurs as part of the ecosystem. The chosen geographic scale provides the study boundaries for analysis of the functional interactions between the economic, social institutional and ecological levels. Although institutional/administrative boundaries may provide the best management scale, it is important to remember that these boundaries are in many cases arbitrary, shifting and contested⁶. A participative delimitation of boundaries may constitute a important part of the cooperative resource management framework taking the ecosystem approach. This allows for development and conservation to be addressed from ecological and social and economic perspective. In this instance resources (or functions of ecosystems) and resource users (stakeholders) together define the ecosystem boundaries⁷. This is necessary because some adverse impacts of projects have effects beyond the limits of particular habitat/ecosystem or national boundaries. The draft guidelines for incorporation biodiversity related issues into impact assessment therefore states (cautions!) that environmental management plans and strategies contained in the environmental impact statement should consider regional, and transboundary impacts, taking into account the ecosystem approach (Decision VI/7, Reference).

Existing development planning at the local and regional level can benefit from the drafting of co-operative resource management frameworks and are examined in the next section.

⁵ Twelve principles or characteristics of the ecosystem approach to biodiversity management were identified in a workshop organized in Malawi in January 1998, in association with the Fourth Conference of the Parties of the United Nations Convention on Biological Diversity (UNEP, 1998)

⁶ Administrative boundaries are imposed and often socially contested. The carving up of Africa by the Berlin Treaty after World War 11 has left a legacy of civil wars, and in South Africa the provincials and municipal boundaries legislated by government is contentious.

⁷ Pers comm. Roel Slootweg 15.10.2003

Examination of Ecosystem Scale Initiatives in Practice

Local

The Ekurhuleni Municipality in South Africa is a local government that According to Sections 152 and 153 of the Constitution, local government is responsible for the development process in municipalities, which includes municipal planning. The constitutional mandate that relate its management, budgeting and planning functions to its objectives gives a clear indication of the intended purposes of municipal integrated development planning to: Ensure sustainable provision of services; Promote social and economic development; Promote a safe and healthy environment; Give priority to the basic needs of communities; and Encourage involvement of communities.

The section 25 of the Municipal Systems Act calls for Integrated Development Planning(IDP) at the local level. This is a 5 year rolling plan that in many cases is primarily used to allocate the budget for development planning. Ekurhuleni has looked at the related legislation that the municipality is governed by and sought to align these to achieve the stated integrated development planning. The Environmental management framework (EMF), that is called for by form the building block for this integrated planning. The EMF identifies environmental constraints and information is used in the Spatial Development Framework (SDF), that is what is the status quo information. The EMF is also used to assess the SDF after the fact. This information is then used to get the budget for development in the IDP, aligned to the goals of different department towards a common vision of the metro.

It must be stressed that the EMF is not a prescriptive document but is a guideline document that can be used as a tool in guiding development⁸. The EMF and SDF set the vision based on information available, the setting to determine where development should and should not occur.

The Growth and Development Plan is a longer term 20 year rolling plan that is being developed to overcome some of the shortcoming identified with the shorter timeframe of the IDP. This longer rolling plan may allow the municipalities to plan for the future well being of the community. Currently, the times pressures of the IDP budgeting cycle direct local government to plan in order to spend the budget allocated. This lead to un-cordinated and non-coperative planning that can compromise the well being of the communities.

The comprehensive resource management frameworks are in essence the EMF for the longer term Growth and Development Plan.

Regional

The Greater Limpopo Transfrontier Conservation Area (GLTFCA) is considered an ecosystem management initiative in Africa. The vision of this ecosystem management initiative is to achieve inter state collaboration in the conservation of transboundary ecosystems and their associated biodiversity. The natural resources in the areas are of importance to the local communities, and the governments therefore want to integrate, and collaborate, to create an economy of scale to leverage additional benefits to the communities.

The extended vision is that alongside the promotion of the sustainable use of natural resources, the aim is to improve the quality of life of the people of Mozambique, South Africa, and Zimbabwe (Anon, 2000). This focuses specifically on the communities that live, and depend, on these natural resources contained in, and surrounding, areas of the targeted national parks in the three countries. These are predominantly poor communities that rely directly on natural resources for their livelihoods. Some also rely indirectly on natural resources, via the tourism, and support industries, for their employment.

Examination of the property rights (and proposed land tenure reform) must be the starting point for any ecosystem initiative. In much of Africa the management of natural resource is dependant on property rights. In many areas natural resources are communally held allowing for open access. In the past traditional systems where used to protect natural resources, but with the increase of human populations, emergence of a cash economy, and centralised government these traditional structures have been eroded. The political boundaries and fences have bisected ecosystems with major implications for social systems,

⁸ Elisabeth Olivier, July 2006, Pers Comm.

traditional agricultural practices, rural livelihoods and migratory wildlife (SAIEA, 2003). The also has implication for property rights, where boundary conflicts and civil war have resulted in movement of people and loss of traditional land rights.

The emerging, and changing, property rights regimes has created a need for alternate forms of joint natural resource management initiatives, with specific operating principles like the trans frontier conservation areas. The scale of transfrontier initiatives provides opportunities to maximise the use of resources in areas of low to marginal economic potential. It also allows the government in the region to capitalise on ecosystems of the scale necessary for wildlife tourism development, which in turn can promote broader socio economic development in the region.

The regional policy framework for making the TFCA's a reality is contained in three key agreements between Heads of State in the Southern African region⁹: The common operating principles (DEAT, 2000) for management, and utilisation, of resources in the transfrontier conservation area are related to the principles of the ecosystem approach. They include the:

- Integrated environmental management of all developments in the designated areas. This is taken to include societal and ecological and economic developments.
- Managing limits of acceptable change within the ecosystem. In this regard a threshold of potential concern is being developed for wildlife management in Southern Africa;
- Adaptive management processes that react and respond as the ecosystem changes, and evolves via multiple pathways;
- Development and management objectives that are appropriate to regional values and priorities; and
- An equitable framework for benefit sharing.

These principles reveal that the Transfrontier Conservation Areas initiatives represent more forward-looking objectives for sustainable use, conservation and benefit sharing of resources. This is to manage the natural resource within the ecosystem to improve quality of life of the people living in the area. This by adopting a system of adaptive management, the most appropriate management system to achieve this objective is chosen. The management procedure is then recorded and evaluated and the results are monitored against the assumptions on which the choice of management system was based. This is taken to include both traditional and scientific knowledge and practice. Greater understanding of the system is captured through divergence from expected results of a particular intervention. This can prompt either a review of the management procedure, or re-setting the objectives (GLTP Joint Management Plan, 2002).

Critiques of current trans-boundary initiatives in southern Africa are that they, even though their vision states otherwise, they are primarily economically driven and often appear to have little or no "social conscience". Further, that they are based on environmental protection and biodiversity conservation as core ideals rather than sustainable social development (IUCN, 2001).

This critique may point to commonly held misconception or view that economic and social development, and environmental conservation and protection are mutually exclusive and unrelated objectives. What is needed then is for an understanding the linkages and interactions between the economic, social and ecological facets of the system to valued and expressed. In this regard, the regional resource management frameworks developed using the ecosystem approach, may be used to frame the complex goals and aspirations of multiple constituents and advocacy groups operating in a regional setting with diverse political, economic, ecological and social levels, and goals. In this view the natural resources, people and economy created are part of the same ecosystem that is constructed by them. Therefore the most valid mediation point for achievement of their goals is the ecosystem itself.

⁹ Southern African Development Community (SADC) Wildlife Policy signed in 1997 (SADC, 1999a). This promotes the establishment of Transfrontier conservation areas as a means of promoting inter-state co-operation in the management and sustainable use of ecosystems that transcend national boundaries; The SADC Protocol on the Development of Tourism (SADC, 1998), to promote the collaborative expansion of tourism as a key sector in all SADC countries; and the SADC Protocol on Wildlife Conservation and Law Enforcement signed in 1999 in Maputo by the SADC Heads of State (SADC, 1999b). This promotes regional co-operation in the development of a common framework for the conservation of natural resources, as well as improved enforcement of national laws governing these resources and their sustainable use.

Elaborating the Co-operative Resource Management framework

Central to the ecosystem approach is that the ecological framework contains the natural resources that are the basis of life. This supplies the economic system, which is constructed, to fulfil societal needs as contained in their development goals (individual to global) to achieve a desired quality of life. This desired state starts with the achievement of basic needs and are broadly captured by the Millennium Development Goals and Biodiversity Plans. At the individual, community, national, regional and global level our systems are dependant on the structure, form, function and agency of the biophysical and social system, and the norms and rules laid down by the institutions of society. There is a complex interaction between these system components (social, economic and biophysical), and the pathways between them. These pathways include supply and demand, impact and vulnerability and describe the dynamic ecosystem. Using the ecosystem approach to develop the co-operative resource management frameworks for development planning in Africa must incorporate examination and analysis of these pathways between the social and ecological and economic components (See Figure 3). In the framework represented here the ecosystem is a constructed according to desired states as expressed in the development, biodiversity and other goals. Here the ecosystem is not an *object of nature* occurring as a discrete object in a mosaic of nature. What it is an *event focused physical orientation*, occurring as an event in a physical field of dynamic process that is the development process. The view of the community (social and biophysical) as a complex organism where development causes integration among the components. The status quo, current needs and future vision are of importance in developing the cooperative resource management frameworks.

We are all interested in the well being of the system we study, economic, social or ecological. The tools we use to allow us to assess the well being of our systems have been developed separately and used separately. In the ecosystem framework approach proposed here, the tools and models from each discipline are important and necessary. The construction of the ecosystem, with its multilevel feedback mechanism, is what is lacking to situate the assessment. The local, national and global governance net of current management systems in the social, economic and ecological domains captures the goals of these systems. At the global level the Millennium Development Goals, Biodiversity Convention, Ramsar and World Trade Regime provide separate but interlinked frameworks that should be referred to when constructing the cooperative resource management frameworks for development planning. The cause and effect relationships within the ecosystem should be unravelled. The concepts, language and models of the three systems lend themselves to ecosystem concepts as constructive glue.

Natural Science	Social Science	Economics
Concepts	Concepts	Concepts
Ecological Poverty Sustained	Community Literacy Change	Money Exchange Growth
Paradigms	Paradigms	Paradigms
Acid Rain Desertification Fuelwood Crisis Greenhouse Effect	Population Growth	Market Boom/Crash
Tools	Tools	Tools
Precautionary Principle Sustainability Tool Biodiversity Red List Assessment Guidelines		Econometric Analysis Comparative Analysis Economic History Political Economy

Discussion

The Challenge of Ecosystem Management

The level of social development and values and norms, guides the relationship between man and nature. In the developed world the view may be of preserving nature for future generations to enjoy. In the developing world it may be a view of nature being used and shared so present generations can survive and prosper, to produce and sustain future generations. These views are not mutually exclusive, and instead represent a spectrum that reflects the diverse development needs and idea of well-being. In the developing world there may be a more direct relationship based on necessary value, for example food to survive especially for those that are poor. In the developed world the relationship may be more indirect based on perceived value, for example the aesthetic value of having mega-diverse fauna to view as a de-stressing activity.

The ecosystem frames the complex goals and aspirations of multiple constituents and advocacy groups operating within diverse political, economic and social levels. The development goals, environmental strategies and action plans, and socio-economic priorities and targets form part of the complex goals that need to be balanced as part of the cooperative resource management frameworks. The conceptual development and practical experience, and social and biophysical relationships determine the ecosystem functioning. Co-operation is important to ensure that the process does not marginalize, or antagonize, potential participants. The ultimate aim is to ensure that political, and scientific discourses, and initiatives, complement, influence and support each other in the drive to create wealth, improve people's quality of life, and protect Africa's unique environmental wealth. The ecological or ecosystem requires that we develop, and apply, suitable ways of monitoring, and valuing, the continent's ecosystems. This will allow us to sense, and react, promptly to the conditions and trends of change in ecosystem components, and the processes that link them together. To be fully meaningful, the information also needs to be interpreted carefully and included in decision-making processes at all levels from local to global.

When considering the ecological versus the human and economic dimensions it is suggested here that the co-operative resource management framework should be seen as a theoretical "blueprint", to be jointly negotiated by administrator and stakeholders. The principle that management objectives are matter of societal choice is important and management should be decentralised to the lowest possible level is important. The framework can explicitly identify and combine multiple goals, ecological objectives, and the necessary actions needed to manage the three facets of the system towards an agreed end-point. The agreed endpoints are a matter of societal choice from the local to the global level. These endpoints must progressively join along a path that leads to an African continent (and world) free of poverty and to a more equitable distribution of wealth between developed, developing and under-developed regions globally.

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