MANAGEMENT AND REGULATION OF RURAL LAND USE A MODEL FOR TRADITIONAL LAND TENURE SYSTEMS IN KWAZULU-NATAL

by

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Submitted in fulfilment of the academic requirements for the degree of
Doctor of Philosophy in Geography,
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Pietermaritzburg
2000

PREFACE

The experimental work described in this thesis was carried out in the Discipline of Geography, School of Applied Environmental Sciences, Faculty of Science and Agriculture, University of Natal, Pietermaritzburg, from January 1997 to December 1999, under the supervision of Professor D.G.B Slade.

These studies represent the original work by the author and have not otherwise been submitted in any form for any degree or diploma to any University. Where use has been made of the work of others, it is duly acknowledged in the text.

Andrew David Montgomery

20 March 2000

Date

ABSTRACT

South Africa is confronted by a number of problems which include: a high and rapidly increasing population, conditions of poverty, hunger, illiteracy, unemployment, and a degraded environment. These problems are associated with inappropriate land use and development and the unwise utilization of natural resources. This work investigates the rural land use dynamic within KwaZulu-Natal and specifically where many of these conditions are most evident, namely: within traditional land tenure areas. The need for an effective, transparent, measurement-based and environmentally linked land use management and regulation system is investigated and a theoretical model is developed with sustainable development as the central focus. The proposed methodology modifies South African approaches to land use management and regulation and draws on the rationale employed within international land use management and *state of the environment* research. The model has the following aims: to strive towards the collective achievement of sustainability as the underlying goal within the planning and plan implementation process; to develop the capability of measuring the extent to which planning policies, goals and programmes are achieved; to guide their review and reformulation; to encourage the inclusion and integration of the policies and programmes of all public and private agencies; and thereby to strengthen the link between land use planning and land use management. The implementation of this model entails an iterative process of performance indicator identification, selection, application and evaluation with full stakeholder participation. The findings suggest that: the sensitive and gradual application of this system is likely to guide land use towards sustainability, initially by non-statutory means. Later, as stakeholder knowledge and understanding increases, this system has the potential to fulfil a valuable statutory function. It is proposed that the practical application of this theoretical approach will facilitate the accurate evaluation and review of policy, plans and programmes during implementation, which will enhance the management and regulation of rural land use towards sustainability within the context of the social, economic and biophysical environment.

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1. INTRODUCTION

1.1 Context

There is considerable concern surrounding Global environmental change (Daily & Ehrlich 1992; Meadows, Meadows & Randers 1992; UNPF 1993). It is contended (Walker & Steffen 1999) that these changes, if not wholly caused by human related impacts, are at least accelerated by them, through the impact of the growing human population, the increasing levels of consumption by human societies, and by changes in technology and socio-political organizations. The first of these perturbations is considered to be large-scale changes in land use and land cover (Walker & Steffen 1999).

Similarly, the degraded state of the natural environment and the increasing extent to which this degradation is continuing to occur, is an issue of increasing concern in South Africa. This condition has been ascribed to a number of factors, including inappropriately conducted and located land use and subsequent unmitigated changes in land cover (Ngobese & Cock 1995). Much of these degraded environments are situated within rural areas under traditional land tenure (Ritchken 1995), simplistically referred to as *res communes*, also referred to as traditional land tenure areas and community authority or tribal authority areas. It has been estimated that as much as 400 million tons of top soil is washing away in South Africa annually, and at a nominal cost of R30 per ton, the annual cost of soil lost from KwaZulu-Natal catchments alone is estimated to be not less than R500 million (Ngobese & Cock 1995).

> "Three decades ago, millions of Americans and Europeans imagined their first pictures of Africa from Alan Paton's portrait of the land near Ixopo, 'lovely beyond any singing of it'. Today, much of Paton's beloved country is moonscape" (Rosenblum & Williamson 1987, pp. 1-2, cite Paton 1948, p.7).

The response of the National Department of Environmental Affairs and Tourism to this degradation has included the introduction of national legislation. This has included the introduction of *Integrated Environmental Management* (IEM) as a statutory requirement in all development projects in terms of the Environment Conservation Act (Environment Conservation Act no. 73 of 1989), linked to subsequent regulations under sections 21, 22 and 26 of this Act. In theory, this legislation applies to all property under the State's jurisdiction. In addition, a draft National Strategy for Integrated Environmental Management in South Africa is under consideration for adoption (Department of Environmental Affairs and Tourism 1998). The response of the provincial legislatures to this national environmental legislation has been the review of their planning and development legislation so as to recognize the need for integrated environmental assessment and land use management. For example, the KwaZulu-Natal Planning and Development Act 1999 which replaced the original Ordinance (Lex Patria 1998) incorporates requirements for developers compliance with the national environmental legislation.

In the context of rural land use, ecological sustainability is paramount for the attainment of economic sustainability (Diesendorf & Hamilton 1997). Consequently, the inhabitants of South African rural areas, particularly those within the traditional land tenure areas, share a common reliance on the maintenance of a healthy rural environment. It is this common thread which provides for close links between rural inhabitants and the natural environment. The term sustainability is difficult to define because of the wide range of interpretations arising from the different perspectives within the various disciplines. Sustainability objectives have their basis in the desire to sustain human life, enhance standards of living, maintain culture, and protect environmental quality for generations to follow (WCED 1987). In this context, the continued sustainability of much of South Africa's natural environment and that of the rural inhabitants, is under threat. This fact has been recognised and the South African government has identified poverty as the single greatest obstacle in the quest for sustainable development (Jordan 1997a). Poverty impacts on the environment in two ways: firstly, poor rural and urban communities in a developing country such as South Africa, have little opportunity to think through the consequences of natural resource overutilization because their priority is survival. Secondly, governments in developing countries, spurred by the imperative of economic growth as a key to prosperity, are often tempted to embrace ecologically unsound development strategies (Jordan 1997a). Thus, poverty forces people to stretch the limits of the natural resource base, often beyond the system's sustainable capacity. This situation is aggravated in certain rural areas which have relatively high population densities.

Thousands of hectares of rural land in KwaZulu-Natal, particularly those settled under traditional land tenure systems, are under threat of terminal environmental degradation. This degradation includes both the disturbance and disruption of the ecological processes and the depletion of the natural resources (Ngobese & Cock 1995). The often fragile connectivity and complex interdependence between the ecological processes within the environment's system, means that the impact and knock-on effect of unsustainable resource consumption, incompatible or unsustainable activities and injudicious land use management, in one sphere is often transmitted to others so that the impacts may extend throughout the region (Kozlowski & Hill 1993).

1.2. Overview of National and Provincial Land Use Management and Regulation

The current period of transition from minority to majority rule, has involved a series of legislative changes that are destined to transform South African society and aim to bring much needed material benefits to the marginalised and the poor (Lane et al. 1998). This new era is characterised by the emergence of significant opportunities for development, with numerous regional and local plans under review, and new plans in the course of preparation by multi-disciplinary teams including agricultural scientists, conservationists, ecologists, economists, engineers, geographers, health professionals, social scientists, town and regional planners, representatives of government and non-government organizations, and a large and varied number of representatives of community-based and specialist interest groups. As planning emerges from a long period

of isolation from international contact and trends, the practice of development planning has been described as leap-frogging from a heavy-handed, repressive style of directive and physical planning, to approaches that emphasise sustainable development, participation and a range of social and cultural imperatives (Lane et al. 1998).

The emergence of new legislation has placed increased responsibility on the shoulders of local government to ensure sustainable development (Local Government Transition Act, second amendment, 1996). This legislation is designed to articulate a series of land development objectives that seek to provide a series of measurable principles for land development. In addition, this Act requires the preparation of Integrated Development Plans that have been designed to operate as management tools for local government to ensure amongst others: organizational restructuring; financial sustainability; service excellence; and sustainable development. The devolution of planning power to the local levels of government is designed to ensure that the focus of planning remains at the township, rural village and district level. Moreover, the participants in this process are required to work at a local community level and to use facilitation, community participation and empowerment, as primary tools to create sustainable development, even so, the link between the conceptual goal and the reality of it's attainment remains largely undefined (Brauteseth 1998; Marree 1998; Town and Regional Planning Commission 1998). In urban areas, land use and activities that impact on the natural resource base are subject to the provisions and regulations of a Town Planning Scheme, the principal statutory planning and development regulation instrument, prepared and enacted in terms of the various provincial Ordinances and Acts within South Africa. A Scheme usually consists of a map, demarcating *zones* or areas of land for certain purposes, together with a set of regulations which sets out specific development parameters and details the *use* or purpose (type and extent) for which land and/or structures, are arranged, designed, or intended to be used, or for which either land or a structure is occupied or maintained, within a zone. Uses are generally either permitted, conditionally permitted or prohibited within a zone, as the case may be (Froud 1989). However, no corresponding set of regulations exist to regulate land use and development activities in the areas outside of the declared urban areas i.e. in the rural areas, including within informal rural settlements.

The reason for this lack of a definitive regulation system in rural areas appears to be twofold, namely: the lower population densities than urban areas, and the fact that the homogeneous nature of rural land uses, activities and pursuits have, in the past, generally exerted less pressure on the natural resources, and therefore had less of an impact on the quality of the rural amenity, than has been the case in urban areas. However, increasing rural population densities and a change in the condition of the rural environment is now evident (Ngobese & Cock 1995). While health and amenity has been an important factor prompting land use management and regulation within urban areas (Natal Provincial Administration 1968; Lex Patria 1998), ecological sustainability has become a key concern within rural areas (Walker & Steffen 1999). Here, the fragility of the ecology of certain natural environments coupled with the dependance of rural inhabitants on these natural resources for their primary or supplementary source of subsistence and shelter, suggests that the future of millions of inhabitants of the traditional land tenure areas will

depend on the extent to which rural land use remains within the limits of *ecologically sustainable development (ESD)* (Ngobese & Cock 1995).

In KwaZulu-Natal, the nature of these land use activities and the management of resource utilization currently relies on a complex political, social and economic dynamic. This includes the little understood guiding role of indigenous knowledge and traditional resource utilization systems (Cunningham 1985). The role of these influences varies within the traditional land tenure areas and even between different wards within a traditional land tenure area (Metroplan 1997). The degraded status of these traditional land tenure environments (Ritchken 1995) and the current complexity of this land use dynamic under conditions of poverty, points to the current systems inability to cope with the development pressures and the resulting unsustainable resource utilization. The national government and the then Deputy President (now the President) of the African National Congress-led government identified the eradication of poverty as a central objective and a necessary condition for the success of the process of sustainable development (Mbeki 1997). The State, provincial and regional governments have adopted a multi-faceted, yet compartmentalised approach, to address this aim, including a revision of the education, health and housing programmes (KwaZulu-Natal Government 1996; KwaZulu-Natal Government 1997; Phahlane 1997; Robinson & McCarthy 1998). The importance of agriculture as a generator of employment and a catalyst for growth and development has long been recognised. To this end the KwaZulu-Natal Department of Agriculture is expending considerable effort and resources on developing the agricultural infrastructure to enhance the capability and capacity of rural inhabitants (Campbell et al. 1991; Eksteen, van der Walt & Nissen 1994). While the regional government is playing a central role in the rural areas through the provision and maintenance of essential services, such as water and sanitation, and through the development of capacity to manage these services (Vaughan & McIntosh 1998).

Provincial government departments and agencies have embarked on, and participated in a number of interrelated, yet separately conducted provincial and national initiatives, which aim to facilitate planning and development throughout the province (Natal Provincial Administration 1992a; Natal Provincial Administration 1992b; Ministry in the Office of the President 1995; Department of Environment Affairs and Tourism 1996; KwaZulu-Natal Government1996; KwaZulu-Natal Development Planning Committee 1996; KwaZulu-Natal Government 1997; Regional Consultative Forum on Rural Development 1997 Government Gazette 1997a; Government Gazette 1997b; Town and Regional Planning Commission 1998). However, the environmental legislation as promulgated by the Department of Environmental Affairs and Tourism has not been easy to apply to development applications within the traditional land tenure areas of KwaZulu-Natal. This is due to two principle factors, namely: the need for the prior resolution of complex issues surrounding the tribal inhabitants rights to land and related issues (Metroplan 1997) and a long history of administrative confusion (Ritchken 1995). When tribal authorities (referred to as Bantustans) were created in the sixties, the chief or *Inkosi** (*Refer to Glossary) of each area was recognised by the State as the administrator and sole legitimate political representative of the inhabitants. There was no clear delineation of administrative responsibilities between the traditional land tenure area,

comprising the *Nkosi** and his respective Councillors and *Indunas**, the magistrate's office and the Bantustans line departments. The situation under the new government system remains unclear. The *Inkosis'* appear to have largely retained their powers, although they are answerable in larger measure to the Minister of Traditional and Environment Affairs (Shabalala pers. comm., 12 May 1998). In addition, while development and land use are controlled in the remainder of the KwaZulu-Natal province, by a Town Planning and Development Act 1999, the original Town Planning Ordinance which operated until 1998 (Lex Patria 1998) did not apply to land within the traditional land tenure areas of KwaZulu-Natal (Metroplan 1997; Department of Local Government and Housing 1998).

The Development Facilitation Act (1995) aimed to bridge the legislative gaps and to facilitate development nationally, within all areas and across all spheres of government. It was this act's enabling legislation, which prompted the KwaZulu-Natal Department of Local Government and Housing to move to regulate all land use within the province through the KwaZulu-Natal provincial Planning and Development Bill (Town and Regional Planning Commission 1998) and which was subsequently enacted. Notwithstanding the existence of this new legislation, the extension of town planning control over traditional land tenure areas using the current land use regulation system may prove to be a difficult, if not impossible task in practice, given the fact that these areas are characterised by overcrowding, previously unconstrained development and land use, poverty and low levels of literacy and environmental degradation (Ritchken 1995; Metroplan 1997).

1.3 Need for Rural Land Use Management and Regulation in Traditional Land Tenure Areas

The failure of the past legislation and administration to effectively manage and regulate land use within rural areas under traditional land tenure is evidenced by the environmental degradation within these areas. In addition, following previous attempts to facilitate development in rural areas under traditional land tenure within the legislative vacuum described in sub-section 1.2, staff of the Department of Local Government and Housing raised concerns for the future ecological sustainability of the central government's *South African Spatial Development Initiatives Programme* within KwaZulu-Natal (McKenzie pers. comm., 19 February 1998).

The Spatial Development Initiative (SDI) is a strategic intervention by the State aimed at reducing poverty through the promotion of an expanding platform of employment opportunities (Spatial Development Initiatives Technical Team 1997). SDIs form an integral part of the government's Growth, Employment and Redistribution plan (GEAR), and the approach of these initiatives correspond with World Bank recommendations relating to poverty reduction strategies (The World Bank 1994a). However, the implementation of these initiatives within traditional land tenure areas has recently polarised opinion on the impact of unregulated development on the environment debate. The SDIs aim to integrate and coordinate the combined efforts of all government agencies to unlock the underutilised economic potential within specific regions by focussing investment within development corridors (Spatial Development Initiatives

Technical Team 1997). One such initiative has included the construction of a R55 million tourism access road across five Tribal Authority areas (each under separate traditional land tenure jurisdictions) situated in an area of north eastern Zululand, referred to as Maputaland, and named the Lubombo SDI. Criticism of the Lubombo SDI highlighted the uncertainties and possible negative impacts associated with the implementation of a project with the potential to cause large scale land use changes within areas which are not yet subject to efficient and effective land use and environmental regulations (Natal Parks Board 1998). On the one hand, actions which are seen by some as threatening the sustainability of both the natural environmental and the existing social structure and quality of life, have been justified by others on the basis of their potential to provide much-needed economic benefits to the local population notwithstanding the risks to the social and ecological environment (EarthPlan 1998). South Africa's new Constitution includes an environmental clause in the Bill of Rights section that entrenches the public's right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -

(i) prevent pollution and ecological destruction;
(ii) promote conservation; and
(iii) secure the ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (The Constitution of the Republic of South Africa 1996, quoted in Yeld 1997).

To achieve this end, Mountain (1990) had previously stressed the importance of integrating development and conservation planning approaches. In addition, Mountain (1990) called for the establishment of an accounting system to be built into the rural development model which would measure both development and conservation performance, since in practice it is often expedient for one to become subordinate to the other. Subsequent research aimed at interpreting and implementing the new Constitution has highlighted the procedural difficulties involved in unravelling the complex network of provisos and policy within the related legislation, and Loots (1997) concludes that the only way in which environmental management can be made effective through integration is by co-operation between the various spheres of government and organs of government.

During 1992, the United Nations Conference on Environment and Development, referred to as the *Earth Summit* (UNCED 1993), refocused global attention on the need for sustainable development and prompted the search for a model which would span all aspects of urban and rural development and evaluate environmental performance. Various international research agencies, including the United Nations Commission for Sustainable Development (CSD), the Organisation for Economic Co-operation and Development (OECD), the International Council of Scientific Unions (ICSU), and individual researchers have subsequently been engaged in research using *state of the environment* indicators. South Africa participated in the United Nation's Commission on Sustainable Development (CSD) for the first time in 1995, and established a national Sub-Committee on Sustainable Development in 1996. This sub-committee is widely representative of South Africa's government, non-government agencies, institutions and interest groups to ensure an integrated approach, and is currently involved in the testing

and selection of South African CSD indicators of sustainable development, with the view to ultimately reporting on the state of the South African environment (Walmsley & Pretorius 1996). There is clearly an urgent need to extend this research to develop a means of managing and regulating rural land use, particularly within traditional land tenure areas.

1.4 Summary

Rural areas under traditional land tenure are characterised by poverty, overcrowding and environmental degradation beyond the threshold of sustainability. Should this situation be allowed to continue, then there is a realistic prospect that certain vital natural resources may be depleted beyond the limits of their sustainable capacity. These resources may therefore cease to contribute towards the sustainability of the rural inhabitants and that these inhabitants may then be unable to sustain their continued existence on the land without substantial and costly intervention.

> "South Africa, together with other countries in the world, is confronted by numerous socio-economic problems. Increasing population, hunger, poverty, illiteracy, unemployment and a threatened and degraded environment are but a few of these. Most have been caused by inappropriate development and unwise utilization of natural resources. There is thus a need for the country's leadership to become better-informed about development and it's impacts on natural resource consumption patterns and environmental degradation" (Walmsley & Pretorius 1996, p.5).

The national government has recognised the need to reconcile sustainable development principles with land use and development, although the State is committed to promoting rapid and sustained economic growth and maximum job creation (Phahlane 1997; Jordan 1997b). The transition from minority to majority rule, has involved a series of legislative changes that aim to bring material benefits to the marginalised and the poor. These changes have included a review of the statutory planning and development system within KwaZulu-Natal. However, a statutory system to effectively guide, manage and regulate land use and development in a publicly transparent way, and in terms of the generally accepted principles of environmental sustainability has not yet been included within the current system. The implications of continuing unrestrained population growth and unsustainable development within rural traditional land tenure areas in the short term are reduced availability and quality of the natural resources. The longer term implications of the continuation of this unsustainable practice are even more serious. Government has a statutory obligation to address wide-spread degradation of the rural environment effectively. Research suggests an integrated approach to the management and regulation of land use, which includes participation by all stakeholders, both government and non-government, and the inhabitants in particular. The United Nations Conference on Environment and Development (United Nations 1992) has focussed global attention on sustainable development and South African researchers are collaborating with international initiatives aimed at selecting indicators to measure the state of the environment (Walmsley & Pretorius 1996). This work highlights the need for an effective response to unsustainable land use and development and recognises applicability of this

state of the environment research to statutory land use management and regulation. It is submitted that this sustainable focus and measurement-based rationale presents a significant opportunity in this regard.

1.5 Aim

This thesis aims to investigate, adapt and apply international land use regulation and State of the Environment research to develop a theoretical model of an effective, transparent, measurement-based rural land use management and regulation system, for application within rural areas under traditional land tenure. The model is developed within the context of the sustainability of social, economic and biophysical environments and envisages a system capable of evaluating the effectiveness of implemented policy, plans and programmes using performance indicators. A conceptual approach is adopted to the identification of critical land use related issues and the development of measures, thresholds and indicators by a process of rigorous research and stakeholder participation. The aim of this process is the selection, testing, application and monitoring of the cause-and effect relationship between the state of these environments and their response to the implementation of policy, plans and programmes. It is proposed that the development and application of such a system will guide the preparation and revision of effective management conditions and regulations for rural land use in areas under traditional tenure. The model aims to initially guide stakeholders, particularly local, resident rural communities, and land use administrators in their planning, development, application and management of land use practices that strive towards sustainable, integrated development. Ultimately, it is proposed that this model should form the basis of a statutory land use management and regulation system in terms of the KwaZulu-Natal Planning and Development Act, 1999.

1.6 Hypotheses

The hypotheses of this theoretical study are as follows:

(i) That the relative state or condition of the social, economic and biophysical environment is measurable, in terms of the principal of sustainable development, via a set of environmental performance indicators that are capable of accurately, effectively and efficiently representing the state of the environment within rural areas under traditional land tenure;

(ii) That a system which measures the relative pressure exerted on the social, economic and biophysical environment in terms of negative impacts within areas where traditional land tenure is practised, can be modelled;

(iii) That the conceptual application of the proposed theoretical model to the planning, management and regulation of land use and development within rural areas under traditional land tenure will demonstrate the potential of this model to better inform and guide decision-making in respect of existing and proposed land use planning and development, towards social, economic and ecological sustainability.

2. METHODOLOGY

2.1 Issues for Investigation

In proposing to investigate and development a system to guide, manage and regulate rural land use, a number of issues require to be addressed. The objectives of this study are as follows:

(i) Investigate the rural aspect of planning practice and research and the nature of rural development.

(ii) Investigate the definition of the term sustainable development and define it's meaning within the context of this study.

(iii) Describe the meaning of the term traditional land tenure in the context of this study and address certain misconceptions regarding common ownership arising from Hardin's (1968) original work entitled the 'Tragedy of the Commons'.

(iv) Investigate and describe the status of current rural land use management and regulation practice and establish whether there is a need for an alternative system.

(v) Evaluation of the existing content and approach of planning methodologies to ascertain the capacity of the current approach to address the management and regulation of rural land use.

(vi) Investigate whether progress towards sustainable development can be measured. Sub-sections 1.2 and 1.3 have highlighted certain State and provincial legislation, policies, strategies and programmes which aim to achieve rapid growth and sustainable development. While the rapidity and extent of economic growth and aspects such as job creation are measurable, no measure of sustainable development has been tabled, nor is the meaning of the term *growth* defined or contrasted with the term *development*. Therefore it is proposed to

- investigate examples of globally acceptable thresholds, against which the state or condition of the environment may be compared;
- investigate examples of indicators of environmental performance; and
- ascertain the applicability of this process in the context of the social, economic and biophysical environment.

(vii) Investigate the development of a model of this process in terms of the fulfilment of the criteria of :

- integration, involvement and participation of all stakeholders,
- holistic approach in respect of all aspects of sustainable development
- transparency to all stakeholders in serving the studies aims and interests,
- acceptability in terms of the public good, and
- practical implementation.

(viii) Investigate and discuss the extent to which the proposed model might succeed in guiding and informing decision-making in respect of all aspects of social, economic and ecological planning and development in the rural context. This model may function initially as a non-statutory guide and later as a statutory instrument for the management and regulation of land use towards sustainability.

2.2 Approach

The study approach is represented in Figure 2.1 and is as follows:

Phase One: The goal statement includes a statement of the problem, the study aim and the hypotheses in Chapter 1 and an explanation of the methodology in Chapter 2.

Phase Two: The topic spans many disciplines, including: the geographical, environmental, economic, social, spatial and mathematical sciences. The trans-disciplinary nature of the topic introduces terminology and concepts which require definition and context. This phase explores the issues surrounding the goal, including the definition and context of the following terms: rural planning and development; sustainable development; and traditional land tenure, within Chapters 3, 4, and 5 respectively. In addition, these chapters discuss the environmental status or condition of the rural areas under traditional land tenure. In addition, it is deemed desirable to address difficulties arising from attempts to encourage and manage ecologically sustainable development in rural areas, through the implementation of a conventional urban-style approach to land use regulation (Houston 1990; Ginsburg, Koppel & McGee 1991; Farrier 1993).

Chapter 6 addresses the management and regulation of land use within rural areas, particularly those under traditional land tenure. The current system under which land use is regulated is described, and the need for efficient and effective regulation is further outlined. In this regard, the urban land use management and regulation system is used as a point of departure, examples of rural land use regulation systems are discussed and an alternative is proposed.

Chapter 7 explores planning methodologies with the view to clarifying the role of evaluation and its role in informing the review of the planning process. These findings will be used to guide the development of the proposed model for the management and regulation of rural land use.

Chapter 8 addresses the rationale of assessing environmental performance in terms of the aims of this study. International research into the measurement of environmental performance has been conducted for more than a decade and this research is examined in terms of opportunity which it presents for adaptation and inclusion in the KwaZulu-Natal land use planning and regulation system. In particular, the rationale employed in international *state of the environment* (SOE) research is examined, with the view to designing a workable methodology for a rural land use management and regulation

system using environmental performance indicators. The status of this research is examined in the context of both South Africa, and other countries abroad with particular reference to Australia. The content and basis of a number of the Australian town and regional planning systems in the various States (Western Australia: Town Planning and Development Act 1928; New South Wales: Environmental Planning and Assessment Act 1979; Western Australian Planning Commission Act 1985; KwaZulu-Natal Planning and Development Act 1999) and certain planning and environmental legislation and the town planning scheme in particular, bears some similarity to the South African System. In addition, Australian research into rural land use management and regulation (Western Australian Planning Commission 1996; 1997b) and the *State of the Environment* has made considerable progress (Government of Western Australia 1992; Council of Australian Governments 1992; DEST 1996; Hamblin 1998; ANZECC 1996; Ward, Butler & Hill 1998; Fairweather & Napier 1998; Sanders, Margules & Hill 1998; Manton & Jasper 1998; Newton et al.1998; Pearson et al. 1998; Alexandra, Higgins & White 1998). The results of this research provide valuable information from which to draw comparisons with South African conditions.

Chapter 9 outlines the development and implementation of a deterministic model of the proposed management and regulation system. This includes the concept of modelling environmental performance using state of the environment indicators.

Phase Three: The theoretical testing of the conceptual elements of the model are addressed within this phase and the findings are presented. Chapter 10 outlines the conceptual implementation of a deterministic model and the extent to which the proposed model for the management and regulation of rural land use within traditional land tenure areas, fulfills the set criteria, and discusses the extent to which the proposed model can inform and guide decision-making on all aspects of planning and development within the rural context. Chapter 11 draws conclusions from the afore going, in terms of the extent to which the objectives have been achieved and discusses the validity of the hypotheses.

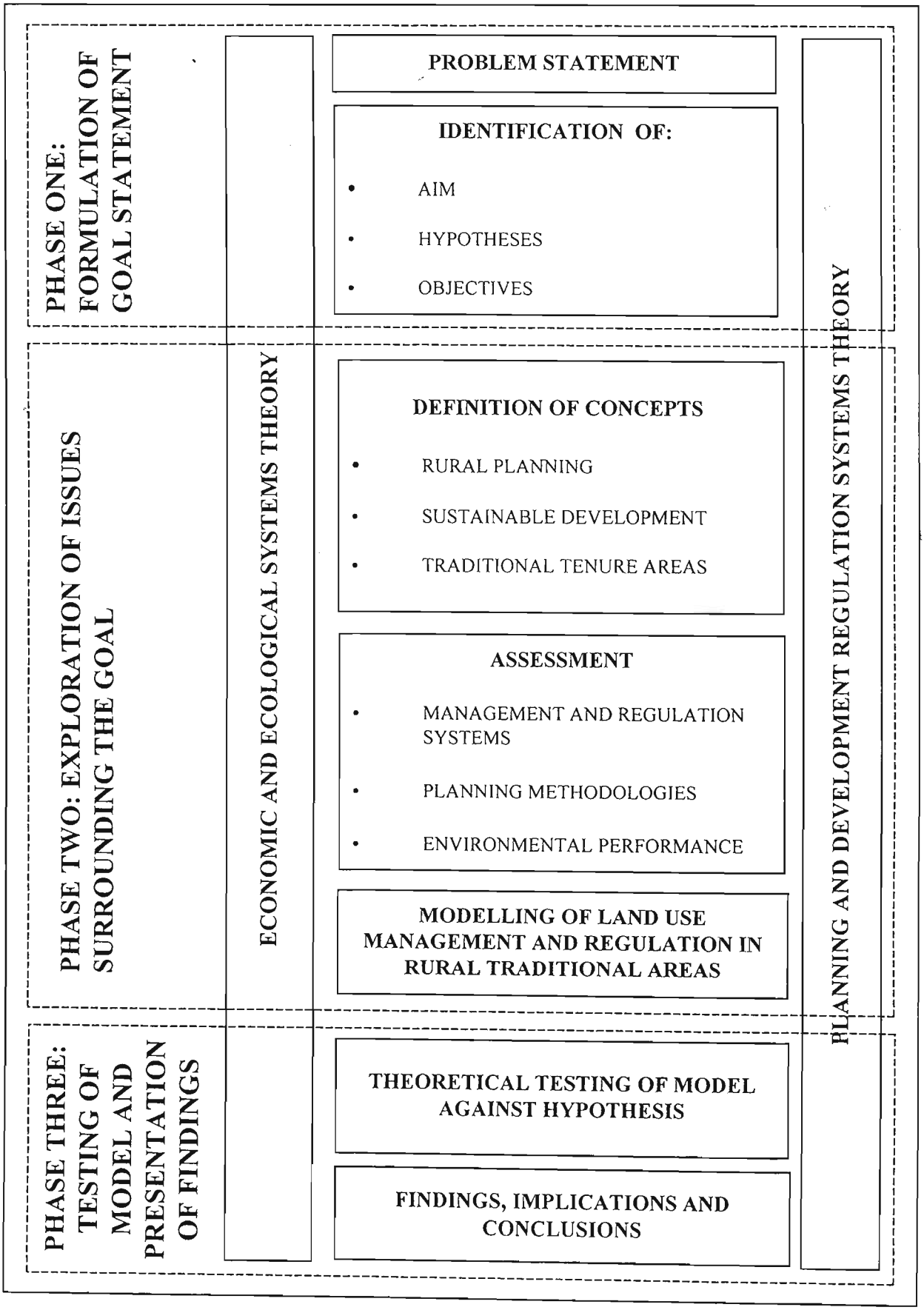


Figure 2.1: Representation of Study Approach

3. RURAL PLANNING AND DEVELOPMENT

3.1 Origins and Foci of Rural Studies

Early land use research within the rural environment has been fragmentary. This is possibly due to the fact that there has been no agreement on the quantitative identification of what is meant by *rural* (Goodall 1987). The study of the rural milieu has been undertaken from a variety of disciplines and perspectives, including sociology, economics, anthropology and geography. A geographical focus may be divided into the human and the physical aspects, while human geography has been sub-divided to include settlement geography within the rural and urban contexts (Van der Merwe 1983).

The study of rural settlement and land use has been directed at the attainment of a variety of specific goals including: location studies dating from early theorists (von Thunen 1826, as cited in Chisholm 1968); the planning rural settlements; and the study of land use patterns and related issues in both developed and developing countries. Early works within the United Kingdom raised issues central to the problem of economics and land use, which addressed mostly issues of location, and concerns relating to the competition between alternative land users and uses for particular sites. Emphasis was placed on achieving two objectives, that of urban containment and countryside protection, including the protection and management of the rural landscape (Chisholm 1968). Early research in South Africa (Hugo 1943; Van Zyl 1966; Tait 1969; Van der Merwe 1969) addressed issues of location, density and the patterns and hierarchy of rural settlement, while later works examined aspects such as the disparity of service provision, the migration of rural populations and issues relating to rural development and land reform (Buthelezi Commission 1982).

The typological approach to the differentiation of rural from urban communities or land use which gave rise to the term rural-urban continuum, identified a dichotomy which has been a pillar of development thinking in the past. Even so, uncertainty has surrounded the definition of this continuum and the result is a continuum within the urban category, not between the rural and the urban categories (Koppel 1991 in Ginsburg, Koppel & McGee 1991). Since the early 1980s, worldwide research has concentrated on issues of population density and particular configurations of material culture, and on the more stereotyped differences between the two extremes of the rural-urban continuum. Attention has generally failed to focus on the middle ground. Koppel (1991) states that in both Africa and Asia, *rural* has been conceived as peasant agriculture unconnected to markets, media or to the urban masses, while *urban* has been conceived as everything else.

The paucity of pre-1980s literature on the rural planning in South African as compared with that from other developing countries suggests that changing land use patterns and social conditions in the rural-urban interface, or peri-urban areas, were more readily recognised in other African and in certain Asian countries. Models of European and North American land use and development experiences, with their neatly defined zones of mixed, conventional rural and urban land use, continued to dominate the rural-urban debate until the 1980s, when it became evident that the land use patterns and the resultant

rural milieu differed from these conventional concepts (Van der Merwe 1983). Apart from the earlier betterment planning initiatives (Yawitch 1988), it was during the late 1970s and 1980s that the attention of researchers and rural planners was attracted to the socio-economic status of the inhabitants and the physical state of the resources within the relatively isolated traditional land tenure areas within KwaZulu-Natal (Crush 1992; Mather 1992). Even so, despite some notable research by geographers (Rogerson & Letsalo 1981; Christopher 1984; Crush 1985; Letsoalo 1987; Mabin 1987; Weiner 1988; Drummond 1990) the contribution to the agrarian debate and the question of rural transformation has been relatively small. This inhibition, until relatively recently, of South African research in the field of rural and agricultural geography, has been acknowledged (Mather 1992). This has been ascribed in part to the general absence of an innovative tradition of rural and agricultural geography within North America and the United Kingdom, both of which have exerted considerable early influence in the urban counter-part of South African geography.

Many planners and geographers have regarded rural planning as merely a sub-set of urban planning (Houston 1990). While the urban and rural planning forms share a common ancestry, it is suggested that rural planning draws more strongly on the natural sciences and on fields of study such as; ecology, land and resource economics, resource management and agriculture related fields, as well as from the different streams of geography. The many dimensions of rural planning include, environmental, social, economic, infrastructure and land use aspects, which although similar to their urban equivalents, differ fundamentally in their focus due to the different nature of the urban and rural land use systems (Houston 1990). The shift in the emphasis of rural studies within South Africa has included a shift from planning for orderly development in the rural areas to the planning for rural upliftment. This trend is highlighted in an early definition which introduced the concept of sustainability, by describing rural development as the process of generally improving the standards of people living in rural areas, and of empowering the rural poor in particular, so that they might improve their standards of living to the point where it becomes self-sustaining (Bryant & White 1984). This reference to self-sustaining rural living constitutes one of the earliest instances where sustainability and rural development have been linked.
The focus on rural planning in South Africa continued to sharpen, and the KwaZulu-Province's Physical Planning Directorate prepared the first draft guidelines for the control of development within non-metropolitan and rural areas (Natal Provincial Administration 1989). One of the earlier rural development policy statements was prepared in 1991 (Independent Development Trust 1991), followed by the draft Rural Development Working Paper prepared by the Physical Planning Directorate's Policy Division in 1992 (Natal Provincial Administration 1992a). A number of interpretations have followed (Metroplan 1994).

Finally, a definitive policy statement is awaiting adoption by Provincial Cabinet (Rural Consultative Forum 1998). This draft KwaZulu-Natal Rural Policy reflects the formal vision of the KwaZulu-Natal government for rural development (Vaughan & McIntosh 1998). However, notwithstanding the substantive planning initiatives undertaken throughout the province at the regional, sub-regional and local levels (Department of Environment Affairs and Tourism 1996; KwaZulu-Natal Development Planning

Committee 1996; KwaZulu-Natal Government 1996; KwaZulu-Natal Government1997; Regional Consultative Forum on Rural Development 1997; Government Gazette 1997a; Government Gazette 1997b; Town and Regional Planning Commission 1998;), this provincial policy fails to provide clarity regarding a definition of the various systems and patterns of rural land use and development. It is submitted that this situation is hampering attempts to effectively manage rural land use within the sustainable bounds of it's resources.

3.2 Perspectives on Rural Land Use Systems

A landmark Asian conference in September 1988, entitled *The Extended Metropolis in Asia* was directed to consider the existence and evolution of settlement systems within Asia that differed markedly from those previously described (East-West Centre Environment and Policy Institute (EWCEAPI) 1988 cited in Ginsburg, Koppel & McGee 1991). Further research of these phenomena resulted in a challenge to previous interpretations. The conventional view held that there was a clear distinction between rural and urban areas and that urban systems will continue to develop and expand, to create conventional cities of immense size (Ginsburg, Koppel & McGee 1991). This conventional view was deemed to be inadequate in three respects, namely:

- it is too narrow in it's view that the widely accepted spatial separation of rural and urban activities will persist as urbanization continues;
- it is inadequate in it's assumption that the urbanization transition will be inevitable because of the operation of *agglomeration economies* and comparative advantage, which are said to facilitate the concentration of the population in linked urban places; and
- the patterns do not fit the Western paradigm of the urban transition, which draws it's rationale from the historical experience of urbanisation as it has occurred in Western Europe and North America (Ginsburg, Koppel & McGee 1991).

The Ginsburg-McGee approach towards the interpretation of this new paradigm included the following:

- a heightened sensitivity to the historical elements of the urban and agrarian transition in the specific countries,
- an appreciation of the ecological, demographic, and economic foundations of the urban and agrarian transition,
- an investigation of the institutional components, particularly the role of the State, in the development process,
- a careful evaluation of the transactional components within given countries, including transport, commodity, and population flows, and
- a broad understanding of the structural shifts in the labour force reflecting economic change (Ginsburg, Koppel & McGee 1991).

This new approach challenges the view that there was a clear distinction between rural and urban areas and that urban systems will continue to develop and expand, to create conventional cities of immense size (Doxiades 1968; Kitching 1982; Ginsburg, Koppel

& McGee 1991). This approach is not particularly concerned with the contrasts between the rural and urban space-economies, and focusses rather on the processes and interactions within this rural-urban space-economy and their influence on particular economic activities within the regions, sub-regions or areas. McGee's (1991) findings are presented in a model of a hypothetical Asian country with five broad classes of the spatial economy ranging from *major city*; through to a peri-urban area; to an area referred to as *desakota;* and including a densely populated rural area; and a sparsely populated rural area. *Desakota* is derived from a Bahasa Indonesia word *desa*, for village and kota meaning town or city. The term *desakotasi* includes *si* which means a process, thereby attempting to coin a word that denotes the phenomenon of a zone of intensive interaction within the hinterland of larger cities but outside of the immediate peri-urban area (Ginsburg, Koppel & McGee 1991).

Recent research concerning the regulation of informal sector land use within Swaziland (Field 1998) identified a similar range of land use zones, albeit on a smaller scale. It is suggested that a system exhibiting similar spatial characteristics to those of the latter three zones, is evident within certain of the areas under traditional land tenure (Ginsburg, Koppel & McGee 1991; Metroplan 1997). It follows that while the whole of these Traditional land tenure areas may demand some attention in terms of land use management, initial attention should be focused on the densely populated areas, and those areas which are also subject to intensive use. The KwaZulu-Natal areas traditional land tenure are similar to the Asian *desakota* zones in terms of their mix of commercial and industrial related activities, community and social services, ecotourism, residential and intensive and extensive agricultural land uses and related activities (Metroplan 1997). It is further instructive to note that recent research in Swaziland has recognised the inadequacies of traditional zoning controls to regulate land use within the rural-urban continuum, and instead sought to apply regulations according to each particular locality's physical, social and economic characteristics (Field 1998). These findings appear to support, at least in part, the probable existence of the new paradigm as identified by Ginsburg, Koppel & McGee (1991) within the KwaZulu-Natal traditional land tenure areas. Certainly, based on observation alone, the intensity and range of land use patterns within these areas do not fit neatly into the western paradigm of rural-urban transition. Notwithstanding, the considerable impact of this high intensity and diverse range land uses on the biophysical environment is obvious, which if unchecked, is likely to impact negatively on the social and economic environments.

3.3 Design of Rural Land Use Management and Regulation Systems

International acceptance of the importance of a sustainable approach to rural land use and development is well documented (Munro & Holgate 1991). Moreover, the importance of adopting such an approach in the context of rural areas has been recognised by multi-national agencies such as the OECD, as illustrated by a statement of the Chairman of the High-Level meeting entitled *Better Policies for Rural Development* as follows:

> "The main goal for rural areas is to achieve sustainable rural development that can adapt to ongoing economic, environmental and social change" (OECD 1996, p. 30).

This implies that it is necessary to identify the particular rural locality's economic, environmental and social characteristics, and to devise a means of measuring and evaluating change, so that rural development policies, strategies and programmes may be informed accordingly. In seeking a yardstick against which to measure change, it appears that an important difference between urban and rural land use systems lies in the relative importance of ecologically sustainable development to each of these systems. The urban land use system appears less dependant on the maintenance of the ecological integrity of the natural environment, since the urban system consists of a largely modified natural environment, supported by manufactured and installed infrastructure, managed by institutions which provide services such as water, sewerage, stormwater drainage, and transport according to predetermined procedures and standards. This situation lessens the inhabitants dependance on ecological sustainability, although broader environmental responses and influences relating to the atmosphere and issues such as atmospheric and noise pollution may assume larger significance. The sustainability of the urban land use system is therefore more dependent on economic circumstance for its continued social welfare, and shaped by land value within urban areas based on factors such as: location of resources and facilities, accessibility, competition between alternative users and uses for particular locations, and on the distribution, storage, supply and consumption of resources and services, and the existence and use of installed infrastructure.

On the other hand, a rural land use system which includes the practice of primary activities, and related secondary and tertiary activities, and where the inhabitants of necessity depend on the natural environment as the primary resource is more dependant on the sustainable use of these resources. It follows that the state of the natural environment, including the landscape, can play a significant role in influencing the economic and social well-being of rural inhabitants. For example, the ability of the rural environment to continue to provide primary and supplementary resources required for the continued welfare of the rural inhabitants. Any change in the availability of these resources will impact on their economic and social well-being. It follows that the design of rural and urban land use management and regulation systems should take account of these different characteristics.

3.4 Summary

Rural research within South Africa and more particularly KwaZulu-Natal has been historically inhibited. The past decade has seen this research move towards the interpretation of a new paradigm. This new approach is less concerned with the contrasts between the rural and urban space-economies, and focusses rather on the processes and interactions within this rural-urban space-economy and their influence on particular economic activities within the regions, sub-regions or areas. These findings have emphasized the need to identify and evaluate the characteristics within the various rural zones (Ginsburg, Koppel & McGee 1991). The inadequacies of traditional zoning regulations and controls to regulate land use within the rural-urban continuum has been recognised since rural and urban land use systems exhibit fundamentally different characteristics (Field 1998). Therefore, to be successful, the management and regulation of the rural land use system will need to identify and specifically address the different characteristics of the space-economy within the rural areas relative to its goal.

4. SUSTAINABLE DEVELOPMENT

4.1 Introduction

Sustainable development has become the most familiar concept and objective to be based upon the sustainability principle, even so:

> "What sustainable development means remains elusive, however" (Lele 1991; Worster 1993 cited in Turner II 1997, p.133).

It is often used to describe an intended approach to development which takes account of, and obviates undesirable impact on the social, economic and ecological environment (Walmsley & Pretorius 1996). The interpretation of sustainable development is fundamental to the design and development of a rural land use management and regulation system, in view of the fact that ecologically sustainable development is the principal goal. While the concept is widely used, it is seldom defined, only rarely placed in context and therefore seldom understood. A large number of researchers have entered into the sustainability debate, contesting a wide range of opposing argument, mostly surrounding the concept of global environmental change. Where some contest the validity of the evidence of global change (Balling 1992; Lindzen 1994), others content that continuing human impact threatens the bio-geophysical foundation of life (Daily & Ehrlich 1992; Meadows, Meadows & Randers 1992; UNPF 1993). There are even those who contend that the great progress and force of technological change actually increases nature's bounty or substitutes for it (Simon 1990; Ausbel 1991). While others still, question the priority of global change interests relative to the needs and concerns of the poverty-stricken in the developing countries (Agarwal & Narain 1991; Ngobese & Cock 1995; Sachs 1993). Sustainability remains a relatively recent concept yet sustainable development encompasses so wide a field that it is beyond the scope of this study to deal comprehensively with the subject. Rather, this section intends only to address those broader issues and principles which may influence an understanding, in the context within which the concept is applied in this study.

4.2 Emergence of the Concept

During the 1960's, a number of publications aroused global public awareness about chemical pollution of the environment (Carson 1962; Boulding 1966; Mishan 1967, 1977). In the late 1960's and early 1970's, ecological and other environmental sciences entered the main stream as important considerations in studies relating to land planning and development, and planning began to lose interest in settlement patterns, building patterns and grand regional development strategies and to turn its attention towards environmental issues.

Ian McHarg rates as one of the most prominent of the early ecological planners, while Rachael Carson, Paul Ehrlich, Barry Commoner and Garrett Hardin, Max Nicholson, Raymand Dasmann, Jean Dorst and Nicholas Polunin have all risen to prominence in this regard. McHarg (1969) developed the first examples of what is now known as environmental impact assessment, and devised an early set of indicators of environmental

intolerance relating to the consequences of certain development activities and practices. The work entitled *Limits of Growth* (Meadows et al. 1972), excited controversy due largely to the fact that it's assumptions and results were widely misunderstood and misinterpreted. This work was later revised (Meadows, Meadows & Randers 1992) giving more emphasis to the importance of sustainable development and predicting the advent of a third revolution, namely the sustainbility revolution. These earlier works paved the way for the United Nation's environmental conference in Stockholm in 1972. The Objective of this conference was to develop mechanisms by which global environmental problems and solutions could be discussed by nations. The Stockholm meeting led to the formulation of many international programmes and initiatives aimed at addressing global environmental problems.The growing body of evidence resulted in a general acceptance of what has been referred to as the *Ehrlich state* (*refer to Glossary)* (Ehrlich, Ehrlich & Holdren 1977). It was this demonstration of the importance of this now obvious link between the disciplines of ecology and economics that resulted in the emergence of what are referred to as ecological economists, and heightened the debate surrounding the economic versus the ecological viewpoints. Early economic viewpoints were centred on the *Hicksian concept** of income (Hicks 1946). The ecological stance drew attention to this view, and that consumption is ultimately based on the exploitation of non-renewable natural resources, and that the continued consumption of non-renewable natural capital, which was unsustainable in the long term (Diesendorf & Hamilton 1997). Standard economic thinking on sustainability is said to be based on the *Hartwick model**, which leads economists to seek the maximum constant rate of per capita consumption that can be maintained indefinitely (Common 1995).

A resurgence of interest in sustainable development during the 1980's resulted in the preparation of the Brundtland Commission's report (World Commission on Environment and Development 1987), which examined the concept of sustainability. This report formulated an approach and guided efforts towards resolving the problems of global consumption, through a global strategy for sustainable living. In 1991, the IUCN, UNEP and WWF published the a global strategy for sustainable living, entitled *Caring for the Earth* (Munro & Holgate 1991). These sustainablity initiatives formed the basis of the 1992 United Nations Conference on Environmental and Development in Rio de Janerio (UNCED 1993) known as the *Earth Summit*, which prompted a re-examination of popular economic thinking. The conference was attended by 178 national delegations and resulted in the adoption of several non-binding and two conventions which have assumed considerable relevance in the debate surrounding sustainable development, namely:

- The Rio Declaration, presented at the United Nations Conference on Environment and Development (UNCED), and comprising twenty seven statements of principle on global sustainable development. Many community based and some government organizations have expressed dissatisfaction with this convention on both environmental and social equity grounds (UNCED 1993);
- Agenda 21, which called for the creation of a commission on Sustainable Development as the major high level institution to follow-up and ensure implementation of these programmes;
- The framework Convention on Climate Change; and
- The Convention on Biological Diversity. The objective of this convention is the

conservation of biological diversity (abbreviated to biodiversity), the sustainable use of it's components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

This growing body of evidence increased awareness of the importance of sustainable development and sustainability has been adopted as the guiding principle for a global society entering the new millennium, superseding almost all others within the environment and development communities (Turner II 1997).

4.3 Towards a Definition of the Concept

In 1993 there were more than sixty definitions of sustainable development (Kozlowski & Hill 1993), and the concept has received widespread attention from a broad range of perspectives. These works have essentially presented the concept as an integration of both ecological and economic sustainability within the framework of sustainable development, while the World Conservation Union has introduced the aspect of carrying capacity in their succinct definition of sustainable living as:

> " ...the quality of human life while living within the carrying capacity of supporting ecosystems" (IUCN, UNEP and WWF 1991, p. 10).

The widely accepted concept of sustainable development is that it encompasses three key elements - the economic, social and environmental. (Munasinghe 1993). The economic approach to sustainability is based on the Hicks-Lindahl concept of the maximum flow of income that can be generated while at least maintaining the stock of assets or capital which yield these benefits. The social concept of sustainability is people-orientated, and seeks to maintain the integrity of social and cultural systems, including the reduction of destructive conflicts (Munasinghe & McNeely 1994 in Hanna & Munasinghe 1995a). Equity is an important part of this approach. The environmental view of sustainable development focuses on the stability of biological and physical systems. The emphasis is on preserving the resilience and dynamic ability of such systems to adapt to change, rather than conservation of some ideal static state. In this regard, natural resource degradation, pollution, and loss of biodiversity all contribute to the reduction of a systems resilience. Reconciling these various concepts and implementing them as a means to achieve sustainable development is a formidable task, since all three elements of sustainable development must be given balanced consideration (Hanna & Munasinghe 1995a). Fowke & Prasad (1996) state that the notion of sustainable development requires the adoption of a holistic view of the interdependent relationship between human society and the natural environment, and that an understanding of the concept requires a knowledge of and understanding of the links between the impact of human activities (particularly economic activities) on the functioning of physical and social environments, and visa versa.

At the core of the sustainable concept lie a number of fundamental and interconnected guiding principles which were formulated and introduced during the *Earth Summit* initiative (UNCED 1993). The major principles included:

- Inter-generational and intra-generational equity: involves accepting that current generation should not leave a degraded environment for the next generation, and recognition that equity within the present generation is a legitimate and necessary goal;
- Integration of economy and environment: acknowledges the linkages between the health of both the economy and the natural environment;
- Dealing cautiously with risk, uncertainty and irreversibility: adoption of the precautionary principle and an anticipatory approach to potential development;
- Conservation of Biological diversity: maintaining the variety of life forms and ecological integrity; and
- Recognition of the global dimension: accepting that the impacts of national, State and local policies and activities are not spatially or temporally confined.

However, these principles have excited considerable debate surrounding their validity, definition and practical implementation. The two principal approaches to the concept of sustainability remain that of ecologists and that of economists. The ecologists, human ecologists and environmentalists approach the concept from a set of principles and goals that are concerned with promoting equity within and between the generations of humans, and some proponents regard economic well-being as an important element of this approach. While economists view sustainability as the maintenance of consumption at some constant level in perpetuity. Some economists take the view that if this can be achieved then the environment will also be capable of being sustained. Economic development, too, is open to interpretation which can have a bearing on understanding what constitutes economic sustainability. Here a broad view of economic development may be taken, which is not necessarily the same as that of economic growth. An ecological economist has defined the difference between economic growth and development as follows:

> " ...to grow means to increase in size through the addition of material through assimilation or accretion. To develop means to expand or realize the potentialities, to bring gradually to a fuller or better state. In short, growth is a quantitative increase in physical scale, while development is qualitative improvement or unfolding of potentiality. An economy can grow without developing, or develop without growing, or both, or neither" (Daly 1976, cited in Diesendorf & Hamilton 1997 p. 84).

Clearly, there are many differing interpretations of the various terms and a host of principles which are open to debate, and which together may qualify the nature and intentions surrounding the concept of sustainability. For example, critique of the commonly held World Commission on Environment and Development definition:

> "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs" (Yeld 1997, p.12)

expresses the view that this statement does not define the terms *development* or *needs*, and that the context suggests that it is confusing *needs* for ecological sustainability with *wants* (Diesendorf & Hamilton 1997) . The relationship between economic and

ecological sustainability provides further insight into the broader meaning of the term, as shown in Figures 4.1 a, b and c. In Figure 4.1a, areas 1, 2, 3 and 4 illustrate four logically possible cases within this domain.

Case 1: If consumption is based on a finite supply of non-renewable resources, or if consumption of renewable resources, such as forests or soils, occurs at a rate exceeding their natural rates of replenishment, and if there are no substitutes, then both economic and ecological sustainability are impossible. This state is represented by the area numbered 1, outside of the domain of the two intersecting ellipses.

Case 2: If there are human-made substitutes(in economic terms) for the natural resources, then economic sustainability may be possible while ecological sustainability fails. For example, all the indigenous forests may be consumed and the profits are invested in afforestation of non- indigenous plantations. Then provided that consumers accept these plantations as substitutes, then economic sustainability may be achieved, i.e. the state represented by area 2 in the figure below. However, if a species is extinguished which turns out to be critical for the long term maintenance of the economy, then the economic sustainability would fail, i.e. state 1. Therefore, this case exhibits a degree of uncertainty, and the cautionary principle may be invoked.

Case 3: In some scenarios, ecological sustainability could be achieved at the cost of economic sustainability, such as if ecological constraints caused an economic decline, represented in the figure below by the state 3. An example of such a case may be the introduction of legislation which required certain processes to meet standards which, in the absence of a substitute or of remedial technology, rendered the process, activity or industry uneconomic, and therefore resulted in it's termination.

Case 4: In a case where the principal goal of ecological economics is met, i.e. where both ecological and economic sustainability are achieved, then this is represented by state 4.

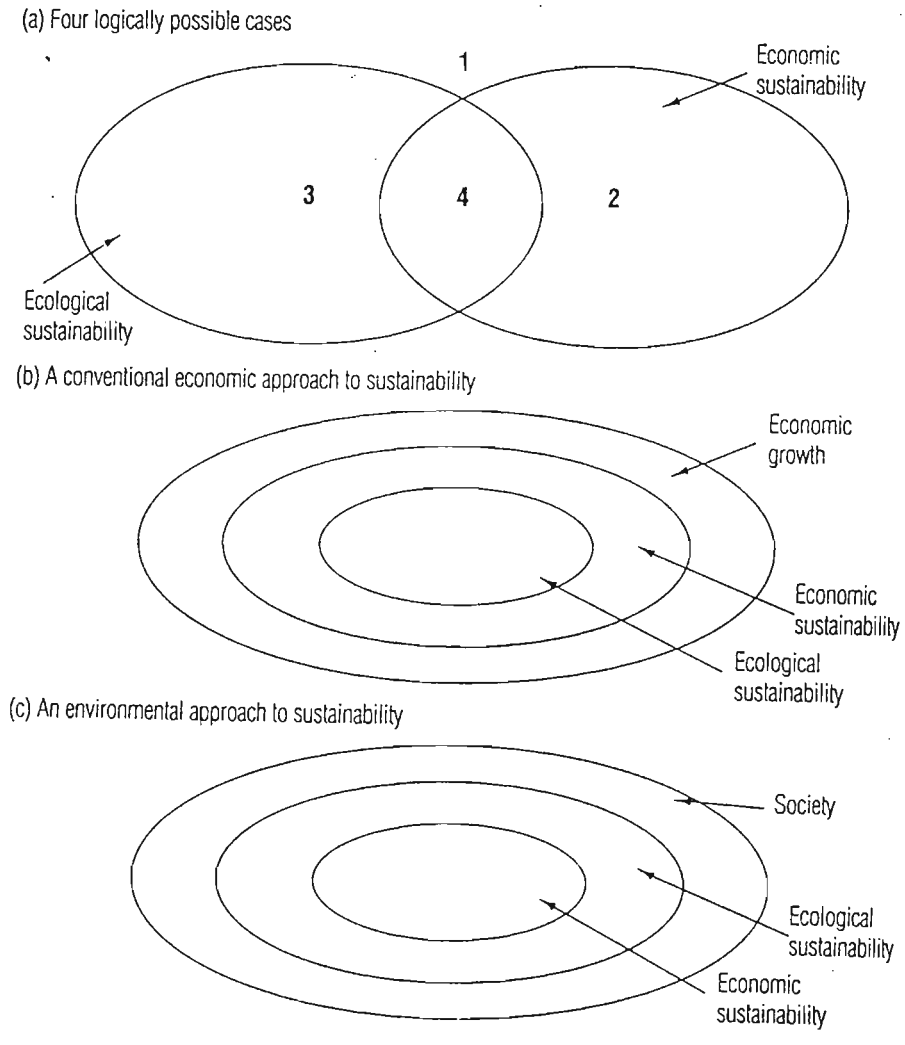


Figure 4.1: The Relationship Between Ecological And Economic Sustainability (Diesendorf & Hamilton 1997).

A comparison between the adoption of either an economic or ecological emphasis is further illustrated in Figure 4.1, where in (b) sustainability is interpreted with an economic priority and in (c) the emphasis is on an ecological priority. In each case, the prioritization of the one discipline may result in a situation where the discipline surrounding the other state is never achieved. For example, in the conventional economic approach to sustainability, society first strives to generate economic growth, then strives to achieve economic sustainability, and only once the first two states are achieved, would the emphasis shift to the inner ellipse, that of the secondary goal of ecological sustainability. Diesendorf & Hamilton (1997) state that many environmentalists would see this economic emphasis as unacceptable. That to achieve ecological and economic sustainability, socially equitable society would argue that the first priority should be an

acceptable form of society. Then that society would determine the options for an ecologically sustainable society, and only then, would it be appropriate to choose the options for economic sustainability (the inner ellipse), within the constraints of the first two stages shown in Figure 4.1 (c). The debate further differentiates between the nature of the exploitable capital which would be conserved and passed on to future generations. Natural capital is defined as the stock of all natural assets such as soils, minerals, air, water, fauna and flora that are exploitable commercially, and human-made capital is defined as the assets produced by human economic activities such as transport systems, buildings, manufacturing plants, educational institutions, literature, etc. For example, certain flora and traces of elements such as iron or aluminium are required for life, but occur in vast quantities and concentrations which offer opportunity for commercial exploitation. This concept is different from that of ecological integrity or biodiversity in that capital is seen as a set of living and inanimate objects that are not considered essential to maintain ecological integrity (Diesendorf & Hamilton (1997). Figure 4.2 illustrates that the conservation of natural capital, is not the same as the conservation of biodiversity and ecosystem integrity. The area contained in the left-hand ellipse represents natural capital, while the area contained in the right-hand ellipse represents biodiversity and ecosystems. Area 1 is that part of biodiversity and ecosystems which is currently not exploitable in economic terms. Area 2 is that part of natural capital which is not essential to maintain biodiversity and ecosystem integrity, e.g. most iron or most aluminium (only traces of each are needed for life). But exploitation of natural capital in area 2 can still damage biota and ecosystems in area 1 through pollution and habitat destruction. The area of overlap, area 3, contains, in addition to biota, most phosphorus, which is essential to life in quite large quantities, but is also subject to considerable commercial exploitation.

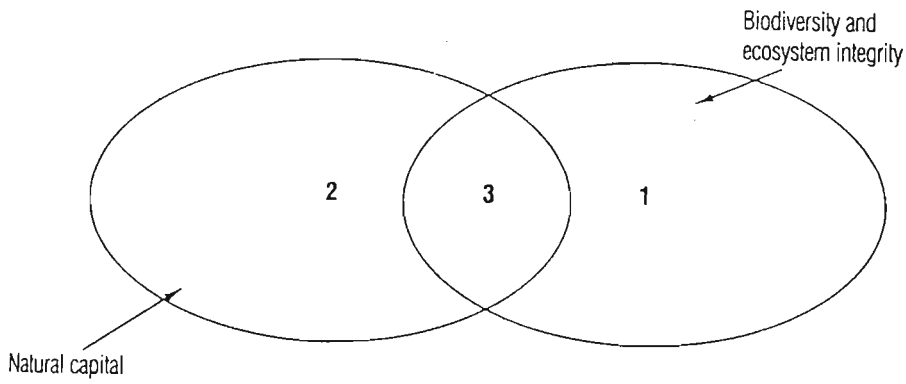


Figure 4.2: The Relationship between Natural Capital and Biodiversity/Ecosystem Integrity (Diesendorf & Hamilton 1997).

Sustainable development has been described from a variety of perspectives (WCED 1987; ICUN 1991, LGMB 1995, cited in Walmsley & Pretorius 1996). In broad ecological terms, sustainable development means the type of economic and social development which sustains the natural environment and promotes social equity, thus, development. Therefore, ecologically sustainable development is the pathway to an ecologically sustainable and socially equitable society. Ecological sustainability is viewed in the context of the following guiding principles:

- Inter-generational and intra-generational equity (including the precautionary principle.);
- Conservation of biodiversity and ecological integrity;
- Conservation of cultural diversity;
- Economic sustainability;
- Conservation of other critical capital;
- Enhancement of well-being.

In their search for a minimum set of sustainability principles, Diesendorf & Hamilton (1997) propose that inter-generational and intra-generational equity, together with the precautionary principle, be seen as the unifying principles, since if equity is maintained or enhanced then conservation of biodiversity, ecological integrity and cultural diversity, the enhancement of well-being, economic sustainability (at a level of consumption which can not be predetermined), and the conservation of any other critical capital. This study adopts the following centrist succinct definition of ecologically sustainable development (ESD) as presented by Diesendorf & Hamilton (1997). Ecologically sustainable development is interpreted as the creation of an ecologically and economically sustainable, socially equitable society . This concept describes an ideal state or condition for which societies and governments should strive.

4.4 Summary

The emergence of the concept of sustainable development is discussed and criticisms of the commonly held WCED definition are outlined. The difficulties arising from attempts to reconcile the debate between the economic and ecological sustainability schools of thought is illustrated in Table 4. The global strategy and international cooperative programmes which has been developed to implement the concept of sustainable development is detailed and Agenda 21, a non-binding international agreement that provides a framework for implementation by all nations and communities is explained. The concept of sustainability represents an integrated approach to the management of human communities and activities and this work has adopted a centrist definition of sustainable development as meaning the type of economic and social development which sustains the natural environment and promotes social equity, and thus development. The lack of clarity surrounding the concept demonstrates a clear need to provide clear examples at a local level in South Africa of what sustainable development entails, how it can be measured and how progress towards it's achievement may be monitored (Walmsley & Pretorius 1996).

5. TRADITIONAL LAND TENURE SYSTEMS AND SHARED RESOURCES IN RURAL AREAS

5.1 Rationale

In proposing the development of a management and regulation system for rural land use and development within areas under traditional land tenure this study is required to understand and take account of the nature of this form of tenure. In investigating this form of tenure, the first issue to be addressed is its definition. The second issue is the perception of a link between common ownership and environmental degradation, and the third and final issue is whether this form of tenure will influence the design and successful implementation of the proposed management and regulation system.

5.2 Traditional Land Tenure in KwaZulu-Natal

The usual idea of tribal tenure seems to be a picture of a traditional chief, sometimes seen as despotic and corrupt, sometimes as benevolent and wise, ruling directly over a vast number of tribal subjects who do exactly as he tells them, but sometimes grumble behind his back Under this arrangement, people are supposed to hold their land in common, to bring all their land needs to the Chief, and, depending on the Chief's degree of corrupt cynicism, to risk being arbitrarily deprived of their land whenever their backs are turned (Cross 1988). In point of fact this understanding could hardly be further from the truth.

A land tenure system may be defined as the system whereby persons gain certain rights to land. These rights may encompass outright or freehold ownership, tenancy usufruct or some other interest recognised and protected by law. The traditional land tenure system such as is found in the separately designated tribal authority areas of KwaZulu-Natal, is one where ownership is vested in the community, and usufructory rights are vested in families. These usufructory rights are protected by tribal law (Van der Wall 1988). The basic land right in the classical sense, is inalienable tenure to every family, which confers both the right to live in the community and the right of access to the resources which the family needs to live. The right to belong in a community is conditional on the community's approval of the transfer of residential land, which in turn may depend on upright moral behaviour. Once allocated, land is normally held in perpetuity, and residents consider the allotment to be their property. It is this individualisation of land rights that Cohen (1980 quoted in Cross 1988) suggests was misunderstood by early researchers, who did not equate this as a form akin with the Western notion of freehold ownership. Traditional land tenure is a mix, where, in some areas it is much closer to individual tenure than was first supposed, and that only certain areas and resources are shared. In KwaZulu-Natal, the communal or shared aspect of tenure refers mainly to certain classes of environmental resources - the most important being pasture grass and water, although many other resources such as fish, wild game species, building materials, clay, reeds, etc., depending on the circumstances, may also constitute shared resources. These resources are not found on every small allotment, although they are needed by all rural families (Cross & Haines 1988).

There is a parallel between this form of ownership and that of ownership of a block of

shares in a property through a shareblock company, which confers exclusive use rights to a dwelling and/or an associated portion of land, and common and equal ownership of the remainder of the unallocated resources owned by that company. Similarly, in the case sectional title ownership, the structure is owned by freehold while the balance of the company's land is again held in common ownership.

Cross (1988, p.17) explains the way in which the traditional land tenure community's political process is defined by land rights:

> "The size of the area allocated may depend on a variety of factors, including the demonstration of need, and persons with unused portions of land may be asked to assist others in need. However, no one expects to share another's land unless specific permission is given or obtained, and the community does not interfere in transfers to legitimate heirs, usually made during the lifetime of the land-holder. However, persons from outside the community require the approval of the whole community including the heirs, since the admission of new members constitutes a factor which will affect future land adjustments. The classical tribal tenure system generally allows for freedom to arrange deals, particularly arable land. However, transactions concerning residential land are subject to a slower and more inclusive process. This act of giving land and associated rights is a moral transaction, and any interference in this process disturbs the community's capacity to organise itself. This moral transaction builds permanent bonds, an institutional interlocking of ties between the members of the community. The classical organisation within such clusters of settlements is the election of a senior representative as head of the settlement, who usually represents the cluster as a tribal councillor. The local level of organization cooperatively defends its interests. If necessary, it opposes arbitrary action on the part of the higher authority - *Izinduna* or the chief or *Inkosi*, as the tribal head is known. The authority of tribal councillors is more tightly land-based than that of the *Inkosi* or the *Izinduna*, since it is derived from the senior land claim of the family which first established the settlement cluster. The *Izinduna* are either appointed by the *Inkosi* or nominated by the community within the district, comprising a number of settlement clusters, and is usually chosen from the descendants of the original head of the district. Similarly, the *Inkosi* is supposed to be a descendent of the head of the original nuclear settlement."

Even so, Cross (1988) reports that in keeping with experience in other African countries, indigenous tenure in KwaZulu-Natal has been subject to economic modernization. The sale and rental of land have emerged, especially in the peri-urban Traditional land tenure areas, and letting and subletting to tenants appears to be the commonest tenure arrangement. While the community's prior approval in respect of the admittance of outsiders has lapsed in some areas, a system of informal freehold ownership of the residential and certain arable allotments has been retained, while the balance of the areas resources are shared as before. However, influences associated with this economic modernization, changing political climates and other forms of interference have contributed to the weakening of the traditional organizational structures, (Cross & Haines 1988) and to a concern for the concomitant weakening of the community's ability to monitor and regulate natural resource utilization.

5.3 Communal Ownership and Environmental Degradation

The early work by Hardin (1968) led some to erroneously draw a parallel between Hardin's *commons,* and land in so-called 'common' ownership known as tribal areas, and to deduce that such 'common' ownership was synonymous with a degraded environment (Vink 1988). The wide response to this parable showed the widely differing notions of commons, and that the parameters and assumptions put forward by Hardin make this parable unsolvable (Stillman 1983). Certainly, the claim that common ownership is synonymous with environmental degradation has been shown to be false, since this view neglects the many wider issues (O'Riordan & Turner 1983).

The economic, and social dynamics within a traditional land tenure and shared or communal land tenure systems introduce a range of issues which affect the question of sustainability. Hanna & Munasinghe (1995a) point to a expanding body of scientific evidence that contradicts the general view that communally owned property is the culprit of environmental degradation and that private property is necessary to sustain environmental resources. The view is expressed that a well-specified property rights regime and a congruency of that regime with its ecological and social context offers the same opportunity. It has been argued that most environmental problems can be seen as problems of incomplete, inconsistent, or unenforced property rights, and without a solution to the property rights problem, the environmental problem will remain (Hanna & Munasinghe 1995b). It follows that a more equitable distribution of resources and assets is a significant step towards poverty reduction and social sustainability, and therefore towards environmental sustainability. Clearly, property rights regimes that specify access to the natural resource base and rights of use have a crucial role to play in this context (Dasgupta 1995).

5.4 Implications for Rural Land Use Management and Regulation

The ability of the rural traditional land tenure areas to sustain a viable land based agrarian economy (Wilson 1971; Cross & Haines 1988) and whether or not urbanization should be encouraged as the most viable long term option for many of the inhabitants of the rural Traditional land tenure areas (Buthelezi Commission 1982; Cross & Haines 1988) is not the issue here. Rather, the core issue is how might the rural land use and development within these areas, characterised by overcrowding, environmental degradation, and traditional land tenure, be effectively managed and regulated towards the development of a sustainable society.

Meadows, Meadows & Randers (1992) have drawn attention to the universal commitment to growth as opposed to appropriate sustainable development. Moreover, the South African governments desire to alleviate poverty, and unemployment has been identified in Section 1.2 as being responsible in large measure for the commitment to growth (Mbeki 1997; Jordan 1997a , 1997b). The dilemma appears to be in risking the prospect of short-term employment and the prospect of a measure of prosperity by declining those opportunities where some uncertainty as to their threat to economic, social and ecological sustainability. While a sustainable approach to qualitative rather than quantitative development is deemed more appropriate for the development of a

stable rural land economy there is clearly a need for more diligent, thorough assessment of the possible longer-term impacts of development proposals. Certainly, the introduction of land use management and regulation system which incorporates the early transparent evaluation of the impact of certain practices, approaches, policies, plans and projects will enhance the ability to identify those areas where sustainability is threatened.

Nonetheless, the introduction of such a land use management and regulation system is likely to be seen as a possible threat to the principle of social and economic equity and the rural land economy. The extent to which a stable and economically viable rural land use economy capable of providing equity and social justice acceptable to the people, is achievable within South Africa, is linked to the question of land ownership and rights (Cross & Haines 1988). The current system is undoubtedly a legacy of the historical events and policies and any proposal to manage or regulate land use, especially within these tribal areas is likely to be viewed with considerable suspicion. account should be taken of the important role played by land rights, since there is agreement that the rural community is structured through and by land rights (Cross & Haines 1988; Hanna & Munasinghe 1995a). Therefore, any changes to the land rights system may threaten a change in the community. Notwithstanding ownership, the extent to which the environmental resource users' are empowered both to benefit directly from and to regulate their use of these resources, and other factors such as the term of their occupancy, can give rise to different objectives for the use of these resources. These arrangements can give rise to different expectations as to what is to be sustained, and who is to have claims on environmental resources, which in turn may influence the regulation and management of their use and therefore ultimately influence the sustainability of certain resources (Hanna & Munasinghe 1995a). Therefore a prerequisite for the promotion of stewardship of environmental resources, is the creation of an incentive structure which must include the possession of both the knowledge, rights and the capacity to set the sustainability objectives and to give effect to their achievement. Therefore, it is important that the underlying purpose, implementation procedure and rationale of such a management and regulation system is transparently obvious, i.e. that it seeks to create ecologically and economically sustainable, socially equitable society through the management and regulation of sustainable land use and development.

5.5 Summary

The traditional land tenure system provides a measure of social security for the tribal inhabitants, and any threat to the system constitutes a threat to the community and to the individual. Therefore, it would be wise to heed the lesson from the previous government's *betterment planning* initiative, which had a disastrous impact on local community organization and social survival networks at ground level. Any proposals involving the monitoring, management and regulation of land use and development, within the areas under traditional land tenure, will be required to be soundly based, to be clearly in the community's own interest, and for this fact to be transparently evident. Moreover, the ultimate decision on what to do and how to do it will require the prior knowledge, support and full participation of the traditional tribal structures.

6. MANAGEMENT AND REGULATION OF RURAL LAND USE IN TRADITIONAL LAND TENURE AREAS

6.1 Context

In the context of this thesis, development regulation may be broadly defined as the process by which planning authorities exercise their statutory duty to control or regulate all development in accordance with the provisions of their development plans (or local plans, district plans or structure plans as the case maybe). This control is possible by virtue of the obligation upon all developers to seek planning permission for new development (Goodall 1987). This process regulates land use, activities and development in the broadest sense, through a process of evaluation and review according to provisions in the form of policies, plans, regulations and standards. The two principal variables within this process are the intent and content of the provisions and the knowledge and capability of the regulating agent or administrating authority.

The unsustainable land use and development within the traditional areas and the need for a rural land use management and regulation system within traditional land tenure areas has been addressed in chapter 1. This chapter describes the present system and proposes to demonstrate that, while a suitable framework to institute such a system is in place, no effective and efficient system of sustainable land use and development regulation employing performance evaluation is either operative or anticipated within the province.

6.2 Land Use in Rural Traditional Land Tenure Areas

Rural areas, particularly those under traditional land tenure, contain a wide variety of land uses including agriculture, ranging from subsistence to various forms of commercial agriculture (Metroplan 1997). While the land is theoretically owned by the designated Tribal Authority, the structures may be individually owned. These uses include the following:

- Rural residential. The primary use is residential in both the more formal sense, where lots are clustered together in small lots (individually less than 4,000 square metres) comprised of unregistered clusters of settlements, and in the less formal sense where unregistered lots, larger than 4,000 square metres but generally smaller than 10,000 square metres, often referred to as rural residential lots. The larger residential lots may include a small cultivated area and/or an enclosure for livestock. These areas are generally subject to an understanding that the family to whom this area has been allocated has the exclusive use of this area.

- Agricultural - small holdings and arable. These cultivated areas are often associated with the residential areas and may comprise a cluster of one or many allotments. These areas may include residences as in small holdings or be separate from but adjoining a rural residential area or be positioned in clusters and located in close proximity to the rural residential areas. The primary use of these areas is either market gardening or is used on a subsistence agricultural basis or a combination of these two uses. The size of these areas varies considerably, depending on the

fertility, availability or suitability of the soil and may be between 4000 square metres and a number of hectares,. These areas are generally subject to an understanding that the family, to whom an area has been allocated, has exclusive use of each sub-lot. Although, there may be some flexibility in the boundaries and use of these sub-lots over time.

- Agricultural - pastoral. These are generally comprised of grasslands and are used for the grazing of livestock. These areas are seldom delimited for individual use and are generally subject to arrangements permitting the shared use of these resources. The trees, plants, water courses, springs, and other resources located within these areas are similarly subject to such shared use.

- Agricultural-agroforestry. The timber milling companies have promoted small timber growers for some years . These allottments are of various sizes, ranging from approximately 2 hectares to 100 hectares, and are comprised mainly of *Saligna* species.

- Industrial and commercial uses. These include uses that would be classified as service, light industrial and even small scale general industrial, as well as uses that would be classified as commercial, including a wide range of different size or scale of enterprises, from a formal branch of a chain store, to less formal small produce stalls and trading areas. These uses are generally located on access roads, either within or in close proximity to clusters of residential and/or community or utility related uses. While the structure and business is often owned by local members of the Tribal Authority, in the case where ownership is in outside hands, then these uses are generally subject to approval by the authorities. Termed a *permission to occupy*, these approval documents represent a statutory authority issued by the tribal council and subject to prior ratification by the Department of Traditional Affairs and the Environment.

- Social services and community uses. These uses include health, educational, institutional and recreational related, as well as services infrastructure and utility uses. The institutional uses may include those related to health, education and Tribal Authority and government, in which case they may be owned by the institution concerned and the land may be formally subdivided and registered in the Provincial Deeds Office. Other structures are generally built on the basis of permissions to occupy or similar such unregistered authorizations by a Tribal Authority.

- Tourism uses. Tourism and more specifically, ecotourism related uses, may be linked to structures or simply to an area or resource, and authority to occupy and/or use these resources for tourism purposes may either be formally recognised by the Department of Traditional and Environment Affairs, or be less formally approved by a Tribal Authority, depending on both the type, scale and the ownership of the enterprise.

These areas support a range of activities and are subject to a wide range of uses from exclusive to shared or communal use. These areas provide essential food, materials for

fuel, building and utility purposes, medicinal resources, agricultural resources, and the like, which provides employment, supplements incomes, and food supplies and generally contributes to the welfare of the inhabitants in general, and more specifically, for the benefit of the members of the relevant Tribal community. In this way, land use within the traditional land tenure areas bear some similarity to the settlement transition areas in Asia described by Ginsburg, Koppel and McGee (1991). However, the increases in population and the commensurate increase in demand may ultimately encourage the over exploitation of these rural natural resources. While the strength of the Tribal Authority may be a factor influencing the capacity to manage these resources, the unsustainable use of many of these resources is now acknowledged Walmsley & Pretorius 1996). Clearly there is a need to research a more effective means of managing the increased extent and scale of over utilization and pressure on these resources.

What is proposed is not the imposition of a scientist-led land use regulation system similar to that which currently regulates urban land use. Rather, it is a system based on the following:

- stakeholder decision-making,
- informed by transparent indicators of the condition or state of the economic, social and biophysical environment, of the nature and extent of the pressures exerted on these environments, and of the response of these environments to the various policies, plans, programmes and projects which have been designed and introduced to improve social and economic well-being and to protect the biophysical environment.

6.3 Sustainable Land Use and Development in Rural Traditional Land Tenure Areas

KwaZulu-Natal is the most populous province in South Africa, with estimates ranging from a little less than 8 million (Central Statistical Services 1997) to almost 10 million (Wilkens & Hofmeyer 1994, cited in Hindson & McCarthy 1994). Determining the split between urban and rural dwellers requires a cautious approach, since it depends on the definition of urban and rural. The Central Statistical Services (1997) estimate for the non-urban population is 56%. This figure has been subdivided further by area into commercial farming districts (7% of the total population) and rural districts (49% of the total population). The Economic and Development Strategy for KwaZulu-Natal classifies these rural districts as those areas under the jurisdiction of the traditional authorities, i.e. traditional land tenure areas (KwaZulu-Natal Development Planning Committee 1996). Wilkens & Hofmeyer (1994 cited in Hindson & McCarthy 1994) provide an further split within the rural district total, between rural dense i.e. informal rural settlements (8% of the rural population) and rural dispersed (91% of the rural population). Todes (1994 cited in KwaZulu-Natal Development Planning Committee 1996) has shown that, whereas the populations within traditional land tenure areas experienced a decline immediately after 1985, as people migrated to the urban areas, population numbers have since grown in traditional land tenure areas and in some cases growth rates have exceeded natural increase. For example, research (Seneque, Smit & Maughan-Brown 1995 cited in Metroplan 1997) determined the population growth rate for the Maputaland subregion to be 1.94% per annum, which was marginally higher than the provincial average. This

same research has predicted an increase in this rate to 2.5% by 2005. The population growth rate for the KwaJobe traditional authority area was estimated to be 2.3% in 1989 and the population is expected to double within 30 years (Vanderverre *et al.* 1989). Consequently, population densities within traditional land tenure areas vary between traditional authorities. 73 people per km^2 has been recorded within the KwaJobe traditional area (Lewis 1997) of Maputaland, while the average for 10 tribal authority areas within Maputaland, one of which is KwaJobe, was found to be approximately 50 persons per km^2 (Seneque, Smit & Maughan-Brown 1995 cited in Metroplan 1997).

The incidence of poverty within KwaZulu-Natal is high, with 74 % of all rural dwelling individuals receiving an income below the hypothetical poverty line (KwaZulu-Natal Development Planning Committee 1996). Factors contributing to this situation within the traditional land tenure areas of Maputaland in 1990 were found to include: a youthful population (62% of the population were younger than 20 years) and consequently a low economically active population (57%); a high dependency ratio (5:1, although KwaJobe's ratio is 8:1): high unemployment (15.7%); low levels of education (56.7% had no formal education); low average annual per capita income (R693 while KwaJobe's annual per capita income was less than R300) (Development Bank of Southern Africa 1991 cited in Metroplan 1997).

There is agreement that the natural environment within traditional land tenure areas is degraded (Vanderverre *et al.* 1989; KwaZulu-Natal Provincial Administration 1992; Ngobese & Cock 1995; Walmsley & Pretorius 1996). The question which gives rise to some debate is the cause of this degradation. Vanderverre *et al.* (1989) have linked increasing population pressure directly with environmental degradation and cite research within traditional land tenure areas on the Pongola Floodplain. The unsustainable use of certain of these areas for cropping activities and their subsequent environmental degradation has been ascribed to poverty and increasing population pressure. Similarly, Ogg (1995) found that the livestock carrying capacity of land within traditional tenure areas in Maputaland, as established by the Department of Agriculture , were exceeded by in excess of 100 % and that this overstocking was directly responsible for extensive environmental degradation.

Notwithstanding the evidence of individual studies, the complex links between poverty, population and the environment require cautious interpretation and the link between poverty and resource use behaviour based on desperation requires further research and clarification. Jodha (1995 cited in Hanna & Munasinghe 1995c) examined a complex unsustainable pattern of resource use and while the results are inconclusive, the root cause of this behaviour has been attributed to the replacement of traditional conservation-orientated resource management systems with more extractive systems brought about through changes in the structure of governance, interwoven with values of equity and stewardship, traditional knowledge, and conditions of poverty. In addition, Quinlan & McCarthy (1994) have challenged the notion that a rural community, however traumatised or displaced, would have an anti-conservation ideology. Although the links between poverty, population and the environment are far from clear, the view has been expressed that democratic participation in sustainable resource use, is required in order to stimulate awareness of environmental degradation, then it is contended, solutions will

be forthcoming (Quinlan & McCarthy 1994).

A study of the population distribution, tenure and land use within north eastern Zululand indicates a strong relationship between the density of rural populations and the extent and degree of land cover conversion. Areas of indigenous vegetation are increasingly being converted to agricultural activities and related settlement, and conflict between different types and intensities of land use is increasingly evident (Metroplan 1997). Housing, commercial and manufacturing enterprises, agricultural land, coastal forest, protected natural environment areas and services infrastructure are juxtaposed. Competition for space in some areas and confusion over the location of boundaries and extents of areas designated by the tribal authorities in the allocation of *use-rights* and *permissions-to-occupy* are becoming commonplace (Metroplan 1997). The role of traditional land tenure in influencing the type and intensity of land use, and impacts on natural resources within these areas, has been the subject of some debate (A'Bear, Louw & Mnçwango 1996; Metroplan 1997). It has been established that natural resources, such as certain plants and trees which were once plentiful within Maputaland have become scarce resources within these areas due to an increased demand and consumption outstripping the supply (Cunningham 1985). Many of these impacts are the result of unsustainable land use practices, and should this trend continue, then the large-scale destruction of the environment, and the reduction of the inhabitants to extreme levels of poverty has been predicted (Brown & Wolf 1985).

Many differing approaches to the reduction of poverty have been proposed by development funding agencies and followed by governments of developing countries, and while these strategies have not always included a concern for sustainable use of the environments resources, most have included some form of rural land reform and rural development (Hayami, Quiumbing & Adriano 1990; The Council of Agriculture 1991a, 1991b; The World Bank 1994a, 1994b). Similar options have been explored in the context of South Africa's search for solutions to this multi-faceted problem (Schrire 1992). The World Bank (1994a) has identified the restructuring of the agricultural industry, rural development and substantial increases in smallholder agricultural activity as a key strategy towards the successful reduction of poverty in South Africa's post-Apartheid era.

Few of these researchers have explicitly included any definition of rural or rural development, nor has sustainable resource utilization been explicitly addressed within poverty reducing strategies. Perhaps this later omission is due to a presumption that the alleviation of poverty will necessarily reduce the pressure to use the environments resources in an unsustainable way. Even so, the inadequacy of the present measures to effectively regulate sustainable resource use and development within rural areas has been recognised. There has been a call for new methodological tools to be devised and used to ensure sustainable development in the South African context and to seek an appropriate balance between social equity and economic growth (Ngobese & Cock 1995).

Town planning and agricultural legislation has underscored the classification of land situated outside of urban areas as being both traditionally and statutorily treated as agricultural land. Consequently, agricultural use predominates within rural areas.

Agriculture is an industry that provides a valuable contribution to the economic and social development of the provincial, regional and local communities. As in the case of other industries, agriculture requires secure access to specific resources and conditions if it is to operate efficiently, compete effectively in the market place, and meet the broader environmental objectives. Land is the main resource requirement of agriculture and hence land use planning has a vital role to play in ensuring that agriculture has access to those resources and to ensure that conditions are conducive for sustainable agricultural practice. However, Houston (1990) points to a general misconception that agricultural land is considered a temporary use for the land, and as a consequence allows rural and agricultural land to be gradually fragmented and lost from production due to its conversion for other uses. The economic consequences of allowing such a view to proliferate include low rates of agricultural business investment, unsustainable land practices and increased pressure for subdivision as an economic saviour and a means of achieving environmental repair.

6.4 Planning and Development Provisions for Sustainable Land Use and Development in KwaZulu-Natal

The initiation by provincial and the new regional government, of several major development planning initiatives in KwaZulu-Natal promises far-reaching changes to the previous planning and development legislation (Greig 1998). The provincial Town Planning Ordinance, No. 27 of 1949 as amended (Lex Patria 1998) was one of the first to be reviewed. In 1995, the Department of Local Government and Housing (DLG&H) initiated the preparation of new planning and development legislation for KwaZulu-Natal. The intention is to establish one piece of planning legislation which would be applicable throughout the province and to dovetail the implementation of the proposed provincial Act with the implementation of the Development Facilitation Act, No. 67 of 1995. The KwaZulu-Natal Planning and Development Act was released in 1998 (Department of Local Government and Housing 1998) and consequently the Development and Planning Commission is now responsible for the overall facilitation and co-ordination of planning and development throughout the province (Brauteseth 1998).

Importantly, this Act has extended the obligation of developers to seek the Commission's prior authority for all development, including the need for Integrated Environmental Management (IEM). However, while this Act regulates land use and development within urban areas via a statutory Town Planning Scheme, land use and development within rural areas is to be regulated via a hierarchy of development plans, prepared at varying scales, for example: special area, local area, region or provincial development plan, depending on the need and capabilities concerned (Maree 1998). The Development Facilitation Act sets out general principles for land development which the provinces legislation is required to include. These principles aim to promote *inter alia* sustainable land development practices, and are to be realised via the formulation of Land Development Objectives (LDO) at the level of the local development plan (Maree 1998). The State and provincial governments' desire and intention to promote sustainable development is clear. However, apart from vague references there is no specific definition of sustainable development in the legislation, and consequently no means of establishing whether and to what extent these LDOs are achieved.

6.5 Towards Statutory Land Use Management and Regulation of Rural Traditional Land Tenure Areas

6.5.1 Land use regulation in urban areas

An understanding of the mechanism employed in urban statutory land use regulation provides a useful background to the search for a rural equivalent. The general purpose of development plans, which includes a town planning scheme, is the coordinated, harmonious and sustainable development of the area to which it realities, in such a way as will most effectively tend to promote health, safety, order, amenity, convenience and general welfare, as well as efficiency, economy and participation in the planning and development process (Lex Patria 1998). Although none of these terms are defined.

The urban scheme is largely based on determined aims, goals and objectives which are expressed through a set of provisions and conditions that regulate land use accordingly. Central to the scheme is the spatial delimitation of land use areas or zones, and the regulation of land use within these zones is undertaken using a set of conditions which are generally described in the text and displayed in a series of tables which cover the following:

- definitions and descriptions of the types of buildings and land uses;
- reservations of land for specific purposes;
- a list of the land use zones and descriptions of the purposes for which land may be used, conditionally used, and uses that are prohibited within these zones; and
- specifications of the maximum permitted development density or intensity for each of the individual land use zones, together with additional regulations where necessary.

The urban Scheme places only a light emphasis on the sustainable use of resources. Rather the Scheme emphasises the zoning and reservation of land and the regulation of land use. The spatial configuration and relationship between land use zones is determined by their capability in terms of the scheme's general purpose, and the aspects of health, safety and amenity are of paramount importance (Lex Patria 1995).

6.5.2 Existing regulation of rural land use

Prior to the implementation of the new environmental (Act 73 of 1989 as amended) and planning legislation (Department of Local Government and Housing 1998), all land outside urban areas was classified as agricultural land, and all agricultural related uses were freely permitted. There are now an increasing number of exceptions to this original position, as the conservation of various resources, including soil, water, and various environment related statutes, policies and regulations have been introduced in an attempt to conserve

and promote the sustainable use of these scarce resources. These include legislation designed to regulate the subdivision and use of agricultural land, regional and subregional development plans (Metroplan 1995, 1996), integrated catchment management frameworks (Howard 1998), special case area plans (Alletson 1998) where specifically identified environmental sensitive areas are subject to land use regulation, and coastal zone management plans (McKenzie 1998) which incorporate a range of provisions, including guiding the management and regulation of zones, and land use classifications within rural areas. Nonetheless, these plans lack provisions with the capacity to measure the effectiveness of their policies and regulatory provisions relative to the achievement of their aims, and the effectiveness of the implementation of their policies, i.e. an indication of their performance. Review of these development plans is conducted through an assessment process that includes the post implementation selection of what are determined to constitute appropriate quantitative and qualitative indicators of the plans past performance and the nature of the present state or condition of the system and environment. This process, while diligently executed, both lacks the systematic and strategic strengths and lacks a process to permit sensitive, continuous review and gathering of knowledge to permit the calibration of the set policies and regulatory provisions during the lifespan of the plan. To achieve this end, a system would require the following inherent capacity:

- the pre-implementation identification, measurement and verification of the state of the planning variables;
- the determination and setting of limits of acceptable change, or thresholds, for these states or conditions; and
- the existence of a measurement regime designed to measure the impact of the various land uses, policies and regulatory provisions over time.

However, KwaZulu-Natal planner's attempts to develop and introduce some form of specific land use regulation within rural areas are few. Most attempts represent an extension of the same urban-style rationale. For example, a system of rural land use zoning or classification proposed (Metroplan 1997) for the Southern Maputaland Biosphere Reserve, which includes substantial areas of land under traditional land tenure (An extract of this proposal is contained in Appendix A). In essence, the aim of the proposed land use zoning was as follows: to guide decision-making to both minimize land use conflicts regarding potential nature conservation and development programmes within the study area; and to facilitate rapid decision making in respect of development applications. The study area covered 5,000 square kilometres and has a resident population of in excess of 120,000 people. An urban-style approach to land use zoning was adopted. The zones were broadly described in terms of the desired type and intensity of land use utilizing the Man and the Biosphere (Walker & Steffen 1999) principle of buffering sensitive areas from intrusive land uses, to protect their integrity. The Metroplan (1997) proposal was derived from an extensive process of community participation through workshops in the

Traditional land tenure areas, however, lack of implementation funding resulted in it's abandonment prior to implementation.

A subsequent land use zoning policy was developed by consultants (Nicholson Consulting Services 1997) under contract to the KwaZulu-Natal Town and Regional Planning Commission for the greater Northern Zululand area. The structure of this policy followed the more traditional course of urban regulation systems, with arbitrarily set use and activity thresholds. The purpose of this policy is to guide Town and Regional Planning Commission decision-making on development applications on privately owned land outside of the Traditional land tenure areas.

A search for examples from abroad reveals that the Australia has a similar system although in some respects has developed beyond the South African position. Like South Africa, the Australian town and regional planning system has the same early British origins by virtue of it's colonial past and the employment of British-trained planners. In South Africa, development within rural areas is guided and regulated by a mix of statutory and non-statutory policy, objectives and regulatory provisions contained within regional, district or local area structure plans and certain specific environmental and planning based legislation as described above. There are no rural planning schemes in the traditional sense of the word. Consequently, the term *planning scheme* in South Africa is usually preceded by the word *town*, since these schemes are restricted to urban and semi-urban areas. Whereas within the six States of Australia and in New Zealand, most rural areas are subject to both statutory structure plans at the regional, district and local levels which set policy, goals and objectives, and statutory regional and district planning schemes which regulate land use. Within the rural areas. These Schemes contain a wide range of rural zones and include strict regulatory conditions. The following is an example of titles for zones that have been introduced: Rural, Rural Landscape, Rural Conservation, Rural Extraction, Special Rural, Rural Residential, Rural Town site, Intensive Farming, Small Holdings, Rural Tourism, Landscape Protection, Broadacre Rural, Rural Living and Rural Multiple Occupancy (Western Australian Planning Commission 1996; 1997b). These regulatory instruments resemble urban town planning schemes and employ a similar rationale. However, the delimitation and configuration of the rural planning zones within Australian is to a large extent based on the outcomes of land capability and land suitability assessments. Land capability is defined as the ability of land to sustain a specified land use without resulting in significant on-site or off-site degradation or damage to the land resources (Wells & King 1989; Van Gool & Moore 1989). In the latter case, the suitability of land to sustain a specified land useis assessed after considering a range of factors which may include factors such as: land capability and the impact on adjacent land uses and/or on sensitive environments, landscapes, heritage or amenity values. However, Western Australian examples which have used land capability to guide zone determination and delimitation has tended to place considerable emphasis on protecting suitable agricultural land from urban uses and from rural residential

applications where agriculture is a secondary consideration (King & Wells 1989; Wells 1989; Campbell & Moore 1991; Department of Conservation and Land Management 1997). These rural planning Schemes are developed through an extensive public participation process. An example of provisions from a statutory rural management plan is shown in Table 6.1. While Figure 6.1 and Table 6.2 shows an example of a conceptual statutory rural planning scheme using the urban-style rationale as applied within Western Australian and which parallels the urban-style schemes in South Africa. Figure 6.1 illustrates a conceptual example of an extract from a rural planning scheme map and Table 6.2 is a conceptual example of the type of table which commonly appears within planning scheme clauses, and which is read and interpreted in conjunction with the scheme map to guide and regulate land use and development within the various zones.

A similar rationale was proposed for the Southern Maputaland Biosphere Reserve (Metroplan 1997), located within north eastern Zululand (an example is shown in Appendix A), although this example incorporated refinements based on UNESCO's Man-and-the-biosphere concept (UNESCO 1987). Figure 6.1 and Table 6.2 show that the Western Australian rural planning Scheme does not generally differentiate between environmental features within the agricultural landscape. Although certain lakes, wetland areas and environmentally sensitive areas subject to special protection which is indicated by means of symbols on the Scheme map and reference notes in the Scheme text. Nevertheless, all applications for development within the Western Australian rural areas are meticulously assessed in light of both the provisions of the district planning Scheme and the policies contained within the various planning strategies and structure plans.

The Southern Maputaland Planning Scheme was contained in the proposed subregional development plan, which aimed to guide decision-making on land use and development (Metroplan 1997). These land use regulation systems rely on the delimitation of broad land use zones using an urban-style rationale combined with a wide range of policy provisions aims to guide land use and development. However, this approach lacks a systematic means of establishing the following:

- the current condition or state of the economic, social and biophysical environment;
- the nature and extent of the pressures exerted on these environments; and
- the response of these environments to the various policies, plans, programmes and projects which have been designed and introduced to improve social and economic well-being and to protect the biophysical environment.

Table 6.1: Examples of Agriculture, Rural Residential and Conservation Zones for a Statutory Rural Management Plan (Modified after Western Australian Planning Commission 1997c) *Categories, objectives and land use considerations are subject to land suitability assessment and extensive public participation.

ZONE	LOT SIZES	OBJECTIVE	PREFERRED USES	MANAGEMENT CONSIDERATIONS
Agriculture	• Variable lot sizes to meet local circumstances, farm adjustment and boundary rationalization, agriculture and economic considerations.	To maintain agricultural uses and repair land while providing for diversification of economic opportunities and the community's land use needs.	– Broadacre rural and diversified rural uses e.g. stable. – Recreation and tourism requiring or enhanced by rural setting. – Uses associated with urban/town growth, including: cemeteries; refuse and waste water disposal works.	• Rural/intensive rural land use and management. • Land use conflict • Housing density and need for dwellings • Provisioned services and infrastructure • Environmental and resource protection and management • Long-term sustainability
Rural: Residential	• 2.0ha or larger • May be reduced if incorporating rural cluster concept • Maximum and average lot sizes may be imposed in zones or precincts.	To provide for planned and managed residential and small scale agriculture or other small scale farm land uses and amenities	– Predominantly rural land use and management on a small scale which will not conflict with residential uses. – Uses which would be considered include: Small scale Intensive Agriculture including: livestock production; Horticulture including: fruit and nut orchards; Home Office/Occupation; Kennels, Stables, etc.	• Rural land use and management. • Landscape protection • Environmental protection • Impact on surrounding land uses • Residential amenity • Fire management • Land uses linked to performance standards
Conservation	• Variable lot sizes to conserve and maintain biodiversity and landscape qualities.	To conserve and repair environmental values.	- Predominantly conservation. - Management of indigenous biodiversity. - Minimise or exclude land clearing and access.	• Environmental protection • Landscape protection • Impact on surrounding and adjoining uses • Fire management • Develop performance standards

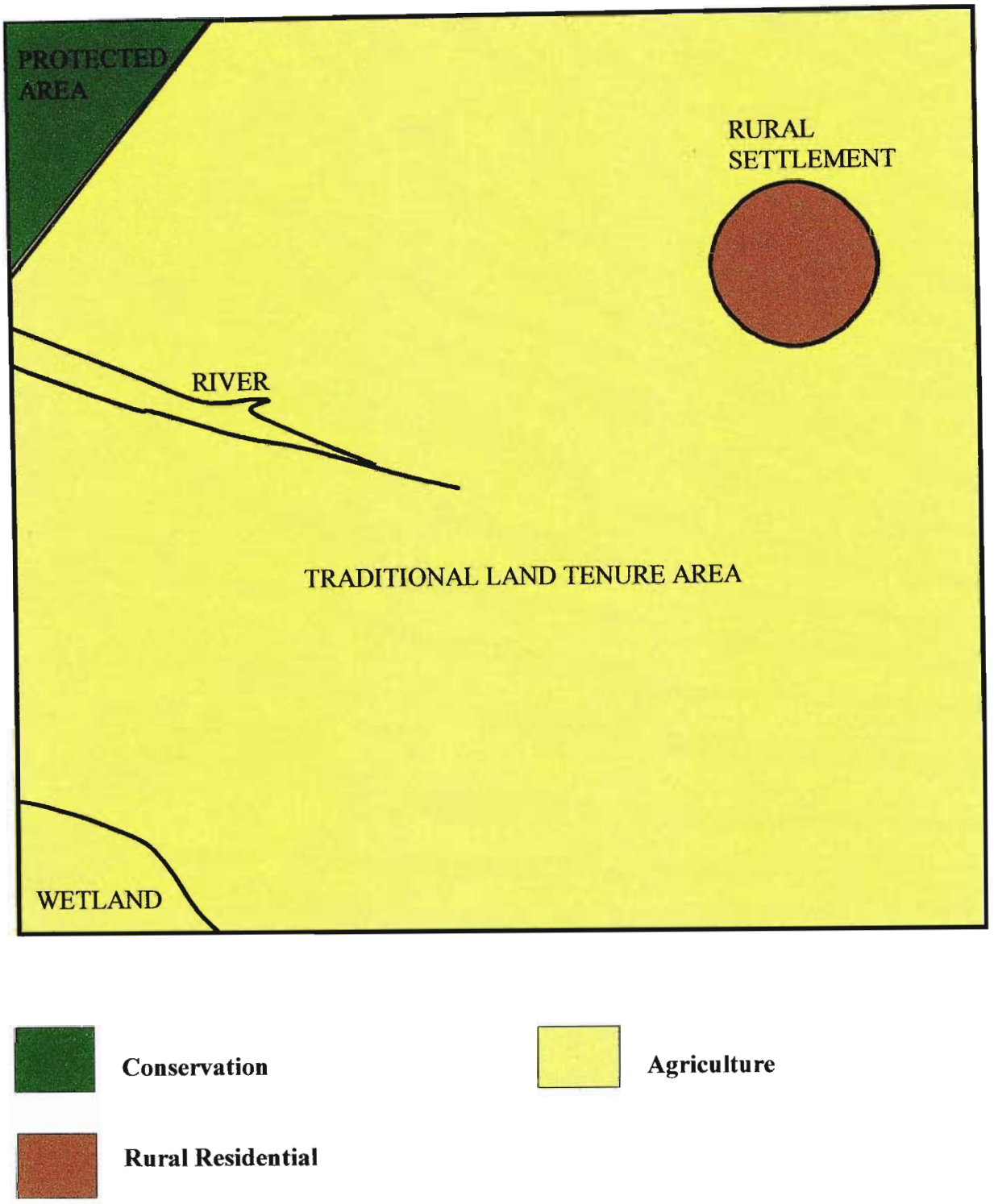


Figure 6.1: **Example of an Extract from a Conceptual Urban-style Rural Planning Scheme Map*** (adapted after Metroplan 1997; Western Australian Planning Commission 1997c) * **Refer to Tables 6.1 and 6.2.**

Table 6.2: Examples of Agriculture, Rural Residential and Conservation Zones for a Statutory Rural Planning Scheme (Modified after Farrier 1993) *Location and configuration of zones is subject to land suitability assessment and extensive public participation.

Column I	Column II	Column III	Column IV	Column V
Zone and colour of indication on map.	**Purposes for which development may be carried out *without* development permission (Each purpose is rigorously defined in the Scheme text).**	**Purposes for which development may be carried out *subject to such conditions as may be imposed pursuant (the relevant clauses of the Act).***	**Purposes for which development may be carried out only with development consent.**	**Purposes for which development is prohibited.**
Agriculture (General farming) Light Yellow-Green.	Agriculture (except Feedlots; Piggeries; Poultry Farming and any other intensive keeping of animals) and Dwelling House (permitted in terms of Clause xyz i)*	Home Industries; Open Space; Roads; and Rural Industry.	Any purpose other than those included in Column II, III or V.	Industries (other than Extractive Industries); Housing Industries; Rural Industries or Offensive or Hazardous Industries; Residential Buildings; Roadside Stalls on Main or Arterial Roads; Shops (other than General Stores).
Rural: Residential Burnt Sienna.	Dwelling House.	Drainage; Open Space; Roads.	Any purpose other than those included in Column II, III or V.	Bulk Stores; Caravan Parks; Car Repair Stations; Commercial Premises; Petrol Filling Stations; Hotels; Industries (other than Home Industries); Institutions; Motor (including any form of Scrapyard); Mines; Extractive Industry; Motor Showrooms; Professional Offices; Residential Buildings; Shops; stock and Sale-yards; Transport Terminals; Warehouses.
Conservation Olive Green	Conservation Activities.	Drainage; Roads; Dwelling House (restricted in terms of Clause xyz ii)*	Ecotourism Development.	Any purpose other than those included in Column II, III or IV.

*Clauses xyz i & ii limits the number and density of dwelling Houses in terms of certain criteria.

Research into these Australian examples of rural planning Schemes has shown that, while performance standards have been developed and applied (Western Australian Planning Commission 1997c), performance measurement has not been incorporated into these statutory instruments. Early criticism of these schemes labelled them as simply an extension of the approach developed for and used in urban areas, which at best have comparatively little to say about the distinction between rural and urban areas, and at worst regard rural land as deferred urban areas (Houston 1990). A recent substantive review of rural planning schemes in Western Australia in the context of agricultural development (Western Australian Planning Commission 1997c) has confirmed this earlier criticism and identified the following shortcomings:

- a failure to recognise the essential differences between rural and urban areas;
- the need for a more integrated approach be adopted;.
- an absence of a clear expression of the rationale, intent and the context of the regulations;
- are burdened by long unwieldy land use schedules that require to be amended whenever a change to the zones and/or their conditions are proposed;
- contain complex and often confusing definitions and special conditions that are difficult to justify and to implement effectively; and
- administration of these district schemes requires a high level of expertise.

The identified need for a more integrated approach relates to the inclusion within the Scheme of policies, management programs and regulations from other State departments, agencies and institutions, as key components of strategies incorporated into such Regional and District Schemes. A similar need was identified through the community participation process within Southern Maputaland (Metroplan 1996), where the compartmentalized nature of the various government departments, development and service agencies and the resultant lack of both communication and a shared service and development vision was identified as a major constraint to planning and development progress towards poverty alleviation within the region.

6.6 Summary

While the strength of the Tribal Authority may be a factor influencing the capacity to manage these resources, the unsustainable use of many of these resources is now acknowledged (Walmsley & Pretorius 1996). The need to research a more effective means of managing the increased extent and scale of natural resource utilization and the nature of the pressures on these resources is examined. Although the links between poverty, population and the environment are far from clear, the view has been expressed by Quinlan & McCarthy (1994) that democratic participation in sustainable resource use is required in order to stimulate awareness of environmental degradation, then it is contended, solutions will be forthcoming. The sensitivity of the rural political and local

economy precludes the imposition of a scientist-led land use regulation system. What is proposed is a system based on extensive stakeholder participation and decision-making, guided by transparent indicators of the condition or state of the economic, social and biophysical environment, of the nature and extent of the pressures exerted on these environments, and of the response of these environments to the various policies, plans, programmes and projects which have been designed and introduced to improve social and economic well-being and to protect the biophysical environment.

To date, South African town and regional planning legislation contains no mechanism designed specifically to monitor, measure or evaluate the system's performance against the post-implementation achievement of policies, programs and regulatory provisions. A dual system of land use regulation exists within KwaZulu-Natal. Rural land use outside of traditional land tenure areas is subject to a low level of statutory regulation via general legislation, while more specific and detailed regulation is applied within areas of limited spatial extent that have special needs in this regard. Land use in rural traditional land tenure areas remains complex and notwithstanding the existence of various legislation, these areas remain largely unregulated from a land use perspective and unsustainable resource utilization prevails. This current land use management and regulation system is neither systematic nor strategic in it's approach and is deemed to lack both a process that permits the sensitive, continuous review of the process and a process that permits the gathering and accumulation of consequential knowledge to permit the calibration of the set policies and regulatory provisions. Rural land use regulation in KwaZulu-Natal has been compared with an example from Western Australia. The Australian example uses substantially the same rationale as that employed in South African urban areas. Moreover, this system does not employ systematic performance measurement, although unlike South Africa, almost all of the rural area is subject to the provisions of statutory Schemes which strictly regulate land use in terms of forward-looking statutory structure plans. Extensive Australian research into these rural Scheme provisions has revealed substantive criticism of the current rationale. This criticism points to the fact that these rural Schemes merely extend and employ urban-style Scheme rationale, which it is argued does not adequately address the specific needs of rural areas. The identified need for an integrated approach to planning and development underscores the importance for this aspect to be incorporated within land use management and regulation systems.

7. EVALUATION OF PLANNING METHODOLOGY

This chapter explores planning methodologies with the view to clarifying the role of evaluation and its role in informing the review of the planning process. These findings will be used to guide the exploration and development of the proposed model for the management and regulation of rural land use.

7.1 Exploration of Planning Approaches

The difficulty associated with describing planning theory includes the fact that many of the fundamental questions concerning planning belong to a much broader inquiry concerning the role of the State in social and spatial transformation, and the fact that planning, as a discipline, borrows diverse methodologies from many different fields, which means that it's theoretical base cannot easily be classified in terms of it's tools of analysis. However, there is general agreement that planning is intervention with an intention to alter the existing course of events (Campbell & Fainstein 1996).

These interventions have led planners to adopt various approaches over time. Recent investigations of these approaches by Campbell & Fainstein (1996) and Faludi & Altes (1997) are instructive in distinguishing between them. Campbell & Fainstein's (1996) classification of these approaches has established a typology derived from the empirical association between these various planning approaches and political theory. This rationale defines four planning approaches which are described as follows:

- Traditional approach. The objective of the early traditional planners was the orderly development of the environment. This was a comprehensive approach characterised by a reliance on large information gathering exercises and complex analyses aimed at serving the public interest. In this traditional approach the planner prescribed both the goals of the plan and the means of attaining them. The objective of the traditional exercise was the production of a plan as the product, and focussed attention on its attainment.

- Democratic approach. During the 1960s, critics accused planners of imposing their will, values, standards and norms on society, and called for a more democratic, participatory approach. The democratic approach relied on the public as the ultimate authority in the formulation of plans, and accordingly took the popular view which differentiated between the special interests and the public interest. The planning process became as important as the product or plan.

- Incremental Approach. Incrementalism was applied during the 1970s and 1980s, it entails a more modest approach via a succession of advances utilising a limited number of alternatives. This approach uses a calculated and rational compromise in the course of decision making and as opposed to the equity planners more expansive approach to redressing what are seen as inequalities and disparities, the incrementalist sees an ultimate harmony, and sets out towards it's incremental attainment.

- Equity planning. The equity approach emerged during the late 1980s, and the overarching goal is to increase equality. The emphasis shifts from the participatory process in the previous democratic approach, to the substance or social content of the planning programmes. The identity of who determines the means and the ends of the plan depends on the situation. Herein lies the fundamental difference between equity planning and the traditional approach, since in the former, particular planning specifics need not be justified as being in the public's interest, and equity planning can be unashameably partisan. In addition, equity planners enlist the participation of either the public or a client group in determining goals and explicitly accept planning as a political rather than a strictly scientific discipline. Consequently, the terms equity and advocacy planning are now used almost interchangeably.

Alternately, Faludi & Altes (1997) have developed a typology based on eight characteristics, and identified the technocratic and sociocratic approaches as illustrated in Table 7.1.

Table 7.1 : The Technocratic and Sociocratic Planning Approaches (Source: Faludi & Altes 1997).

CHARACTERISTICS	TECHNOCRATIC APPROACH	SOCIOCRATIC APPROACH
Planning Subject	Monolithic	Coalition
Role of Experts	Linchpin	One out of many
Centralization of Decisions	Great	Small
Plan as a Product	Blueprint	Indicative
Measure of Effectiveness	Conformance	Performance
Scope	Comprehensive	Selective
Notion of Rationality	Absolute	Contextual
Planning Process	Linear	Cyclical

Essentially, technocratic planning assumes a strong role for authorities in safeguarding the public's interest. Planners assume the role of experts and have considerable authority. The plan is the central focus of attention and those who implement it exercise no discretion. This approach is plan-led and the content of the plan is absolute. On the other hand, sociocratic planning pays attention to the views of others. The authorities are not the only ones called upon to act in the public's interest, and are not above the other paticipants. The plan's content is not absolute, and is concerned with general lines of development, leaving room for negotiation and reformulation.

Comparison of these two typologies indicates that the characteristics of Faludi & Altes's (1997) technocratic approach are similar to those attributed by Campbell & Fainstein's (1996) traditional approach. Similarly, the sociocratic approach (Faludi & Altes 1997),

exhibits similar characteristics to that of a combination of democratic and equity approaches (Campbell & Fainstein 1996). The current planning and development approach within KwaZulu-Natal strives for both transparency and the widest possible representation of the public's views. Moreover, input into the planning process embraces diverse issues including: social justice and environmental concerns. In this regard, current circumstances are similar to the equity planning and the sociocratic approaches. It is suggested that the current KwaZulu-Natal planning process exhibits the following characteristics:

(i) an increasing emphasis on striving towards the achievement of sustainable development (although this term not defined);
(ii) an increasingly wide range of disciplines are represented on the core planning team;
(iii) increasing participation by a wide range of government and non-government agencies; and
(iv) addresses a widening range of social, economic and ecological issues.

It is submitted that, compared with previous approaches, there has been a significant shift in the process to a widely representative and integrated planning approach. In as much as these characteristics have not been previously as dominant, then perhaps this constitutes an important shift to what may be termed an integrated approach.

7.2 Exploration of Planning Methodology

Notwithstanding the apparent shift in the planning approach, a comparison of the methodologies employed between the current and the past approaches (Catanese & Steiss 1968; Metroplan 1997; Western Australian Planning Commission 1996; 1997a; 1997b; 1998, 1999a, 1999b) in Table 7.2 suggests that the methodology has remained substantially the same, and encompasses essentially four phases, namely:

Phase I: System description and problem or issue definition;
Phase II: Solution generation and analysis;
Phase III: Evaluation and choice of alternatives; and
Phase IV: Implementation, monitoring and review.

The variations between the various steps within each of these phases are slight, resulting from variations in terminology and small shifts in emphasis.

Table 7.2: Comparison Between the Current and Past Planning Methodologies

PHASE	STEP	CURRENT (1990s) PLANNING METHODOLOGY (Metroplan 1997; Western Australian Planning Commission 1996;1997a; 1997b; 1998, 1999a, 1999b).	STEP	PAST (1960s) PLANNING METHODOLOGY (Catanese & Steiss 1968).
I: SYSTEM DESCRIPTION AND PROBLEM OR ISSUE DEFINITION	i	Identification of problems, issues, needs, opportunities and assumptions	i	Definition and clarification of current and future problems and their inter-relationships
	ii	Preliminary setting of goals and objectives	ii	Prediction of future conditions arising from identifiable problems
II: SOLUTION GENERATION AND ANALYSIS	iii	Collection, analysis and synthesis of data .	iii	Research, data collection and identification of parameters, boundary conditions or constraints
	iv	Forecasting	iv	Prediction of future conditions arising from identifiable problems
	v	Revision of goals and the determination of objectives	v	Determination of the range of possible solutions to the totality of problems
			vi	Formulation of goals and objectives at varying levels
III: EVALUATION AND CHOICE OF ALTERNATIVES	vi	Formulation of alternative plans	vii	Formulation of alternatives
	vii	Evaluation of alternatives	viii	Evaluation of alternatives
	viii	Selection of preferred alternative	ix	Selection of preferred alternative
IV: IMPLEMENTA-TION, MONITORING AND REVIEW	ix	Implementation	x	Implementation
	x	Monitoring and evaluation	xi	Monitoring and evaluation
	xi	Review	xii	Review

Although these two approaches do not specifically include reference to stakeholder participation, this aspect of the process has been implicit. Certainly, all practitioners during the 1970's, 1980's and early 1990's were well aware of the need to consult with the stakeholder representatives. This requirement has broadened markedly with the change of government in South Africa. Since the early 1990's, stakeholder mistrust of representatives made it a necessary requirement of the planning process to involve wide sectors of the stakeholders directly, and to seek their input and support during all phases of the process (A'Bear, Louw & Mncwango 1996).

7.3 Planning Context of Evaluation, Assessment, Monitoring and Review

Policy, plan and programme evaluation is an important element of the process. Not withstanding it's extensive use, some confusion surrounds the precise meaning of the term *evaluation* and related concepts which are often used interchangeably (Minnery et al. 1993). The meaning of related terms such as: *assessment*, *monitoring*, and *review* as compared with that of *evaluation*, is highlighted as follows:

- *Assessment*: the act of judging (or guessing) the probable outcomes of alternative potential future courses of action and weighing these outcomes against identified objectives;

- *Monitoring*: the investigation of outputs and impacts of existing and past actions;

- *Review*: the investigation of the environment within which policy is being put into effect, normally with a view to modifying the policy so it will better fit evolving environmental conditions; and

- *Evaluation*: the investigation of the outputs and impacts of existing and past actions (monitoring) plus judgement of the congruence of these outputs and impacts with objectives.

Minnery et al. (1993) lists two main reasons for the increased importance of evaluation within the planning process as follows:

- Increased pressures on public sector finances has led to greater demands for all public sector funds to be used efficiently, and effective evaluation is a vital element towards achieving greater efficiency; and

- The need for efficiency highlights the need for an effective means of ascertaining the degree to which the planning objectives are being met, or the extent to which the performance is improving, thereby providing essential feedback for the continued management of the planning process.

O'Faircheallaigh (1990 cited in Minnery et al. 1993) identifies four distinct processes which are involved in the process of evaluation, namely: (i) Identification of goals which are assumed to have motivated the formation of policies and the construction of programmes; (ii) Observation of effects emanating from a policy or programme; (iii) A judgement as to whether and to what extent, the observed effects represent progress towards specified goals; and (iv) Offering of an explanation as to why goals were or were not achieved. Minnery et al. (1993) support O'Faircheallaigh's (1990) view that the benefits of such an evaluation process lie in assisting decision-makers to undertake the following sequence of tasks:

(i) Assess the continued relevance and priority of the policy, programme or plan;
(ii) Determine congruence between performance and objectives;
(iii) Examine alternative ways of achieving the objectives;

(iv) Identify successes that can be built upon;
(v) Identify secondary benefits and unintended adverse consequences;
(vi) Assist in the redesign and/or amendment of the policy, programme or plan, as per the feedback and findings of the evaluation process; and
(vii) Assist in the allocation or reallocation of resources between programmes and between existing and new programmes

Notwithstanding the use of the term evaluation in Phase IV, step x and xi in Table 7.2, evidence or rather the lack of it, suggests that planners have found it easier to conduct the evaluation of alternatives embodied in Phase III, step vii (Booth & Jaffe 1987 cited in Minnery et al. 1993; Metroplan 1996). Certainly, in the past, less attention was paid to evaluating the performance of planning policies during or subsequent to their implementation (Masser 1983; Metroplan 1996). This omission has been ascribed to inadequacies relating to the capability to measure this performance (Walmsley & Pretorius 1996). While this has been a significant shortcoming of previous planning approaches, the recent advances in environmental performance indicator research (OECD 1994; 1996; 1997a; 1997b) offer an opportunity to successfully address this issue.

7.4 Summary

A review of the evolution of the planning process suggests that the current approach represents an integrated planning approach which strives towards the achievement of sustainable development. A review of planning methodology indicates that the basic appearance of the methodological process has remained substantially the same since the 1960's. Stakeholder participation has been implicit within this process. The change in approach appears to have been more in the realm of implementation, with a shift from stakeholder consultation through representatives towards the direct involvement of the stakeholders themselves in the planning and decision-making process. In addition, these methodologies have both included monitoring the implementation of plans, with the view to informing stakeholders of the performance of the respective policies, plans and programmes. These efforts have hitherto been hampered by the difficulties surrounding evaluation and measurement of this performance. The recent advance in environmental performance indicator research offer an opportunity to successfully address this issue.

8. ASSESSING THE PERFORMANCE OF THE SOCIAL, ECONOMIC AND BIOPHYSICAL ENVIRONMENT

This chapter examines the origins of environmental performance evaluation and highlights the role of various research agencies and governments in this regard, discusses the methodology and rationale of performance measures, examines an approach that has gained wide acceptance amongst leading researchers in the field, and discusses the adaptation and use of this approach for the regulation of rural land use.

8.1 Origins of Environmental Performance Evaluation

Attempts at the statistical measurement of abstract concepts such as *quality of life* and *social well-being* have their origins in the United States in 1929 (Report to the President's Research Committee on Social Trends 1933, cited in Western Australian Planning Commission 1999a). Further research during the 1960s by the National Commission in Technology Automation and Economic Progress (NCTAEP) set out to identify a set of economic indicators, while the National Aeronautics and Space Administration (NASA) researched the social implications of the space programme (Bauer 1966, cited in Western Australian Planning Commission 1999a). While in 1969, the U.S. government Department of Health, Education and Welfare (Health, Education and Welfare 1969, cited in Western Australian Planning Commission 1999a) developed and applied a set of social indicators. There is evidence of a shift in the approach of central governments in Europe and North America during in the early 1970s, as they sought to determine and measure the outcome of their policies in terms of improvements to the over-all well-being of the residents of neighbourhoods, cities and regions, rather than just in terms of economic activity and efficiency (Knox 1975). Smith (1973a, 1973b) was among the first to recognise that social indicators could assist in the establishment of a regular and detailed policy-related system of measurement. While Culyer, Lavers & Williams (1972) noted the need for a whole range of components of well-being. Knox (1975) proposed a government system whereby individual indicators such as standards of housing; health, education; and the state of the environment, could inform and guide policy formulation and implementation.

During the early 1980s, research investigating ways of slowing, halting and ultimately reversing Africa's economic, social and environmental decline identified the need for national assessments and long-term projections of environmental, resource, demographic, and economic trends, including the measurement of indicators such as: topsoil losses, the deteriorating state of grasslands, loss of forest cover, changes in hydrological cycles, and the measurement of economic trends within rural communities (Brown & Wolf 1985). This research proposed that agencies such as the United Nations and The World Bank should assist with and guide the determination of these environmental indicators for the purpose defining the thrust and scale of a successful reversal strategy (Brown & Wolf 1985).

Finally, the 1992 Earth Summit (UNCED 1993) initiated the global drive towards sustainable development and prompted the search for a model which would span all aspects of urban and rural development and evaluate environmental performance using

key *state of the environment* indicators. This search for a viable means of measuring environmental performance involved numerous international researchers and agencies, including the 'Organisation for Economic Co-operation and Development (OECD), individual OECD member countries such as Australia, and the United Nations Commission for Sustainable Development (CSD).

8.1.1 Role of the OECD

The Organisation for Economic Co-operation and Development (OECD) was formed in 1961, from the Organization for European Economic Cooperation(OEEC). The OECD comprises 29 member countries and seeks to promote policies designed to achieve the highest sustainable economic growth and employment and rising standard of living, of the population, and to ensure economic growth and external and internal stability, to reduce obstacles to trade in goods and services, to liberalise movements of capital, and to contribute to the economic development of all the worlds' countries. In this way, the OECD has kept the state of the environment of member countries under review for the past twenty years. The wide range of domestic and international commitments to policy and the implementation of programmes designed to give effect to these policies, raised the important question of how best to measure the actual fulfilment of these commitments (OECD 1994). Therefore, the OECD researchers set out to develop a pragmatic approach involving the use of environmental indicators to measure performance.

8.1.2 Australian research on environmental performance evaluation

As a member of the OECD, Australia has been at the forefront of environmental performance indicator research for many years in both regional, national and global forums (OECD 1997c). The Australian National Strategy for Ecologically Sustainable Development (Council of Australian Governments 1992) set out to assist Australia meet it's international obligations, including those under the United Nation's Agenda 21 and under the OECDs member country environmental reviews. The maintenance of ecosystem function is viewed as central to environmental integrity in Australia, and Federal Department of the Environment commissioned studies which researched, identified and recommended a range of indicators that, properly monitored, would help track the condition of Australia's environment in general and individual ecosystems in particular, and evaluate the effects of the processes and the human activities that affect it. Investigation of the rationale and results of this considerable body of Australian research offers an early opportunity to ascertain the feasibility of adapting and extending this approach to model the management and regulation of rural land use and development.

8.1.3 UN Commission on Sustainable Development: South Africa's role

Although South Africa did not participate officially at the United Nations Conference on Environment and Development (UNCED), also referred to as the

Earth Summit, in Rio de Janeiro in 1992, the government submitted a country report entitled: 'Building the foundation for sustainable development in South Africa', which highlighted the poor state of the environment. South Africa participated for the first time in the meetings of the Commission for Sustainable Development (CSD) at it's third session in April 1995 (Department of Environmental Affairs and Tourism 1996). In 1996, South Africa participated in an international initiative coordinated by the United Nation's Commission on Sustainable Development (UN CSD). A national Subcommittee on Sustainable Development of the national Committee for Environmental Co-ordination was established in 1996. This Subcommittee acts as the national co-ordinating body through the National Department of Environmental Affairs and Tourism and serves as the national focal point for international communication in this regard. South Africa participated officially in the UN CSD meeting held in Glencove, United States of America, in February 1996, which aimed at identifying possible global indicators of sustainable development The programme's structure and testing process was further developed at a follow-up meeting in Ghent, Belgium, in November 1996.

The South African Government has ratified two International Conventions/Agreements since UNCED. They are the Basel Convention (ratified in May 1994) and the Convention on Biological Diversity (ratified in September 1995). The Convention on Desertification was signed by the South African Government in January 1995, and is expected to be ratified in the near future, and the Framework Convention on Climate Change and the World Heritage Convention are awaiting ratification. Although various Agenda 21 related activities were launched in South Africa, in the years immediately after the Earth Summit, these activities remained largely unco-ordinated due to the absence of a comprehensive national strategy to address implementation (Department of Environmental Affairs and Tourism 1996). Consequently, the national Subcommittee on Sustainable Development was established to address this need for co-ordination. This Subcommittee is widely representative of South Africa's government, non-government agencies, institutions and interest groups to ensure an integrated approach, and is currently involved in the testing and selection of South African CSD indicators of sustainable development (Walmsley & Pretorius 1996). A list of these indicators is provided in Appendix B.

8.2 Methodology of Environmental Performance Evaluation

Some researchers have drawn a distinction between the term environmental indicator and sustainability indicator. The Local Government Management Board (1995 cited in Walmsley & Pretorious 1996) states that sustainability indicators need to take account of economic factors, quality of life and future welfare aspects, as well as environmental quality, whilst environmental indicators deal more specifically with natural environmental issues and the influence of humans. This study takes a broader view and uses the term environmental performance in the wider context of an integrated social, economic and biophysical environment. Therefore, in this study, the environmental performance indicators aim to measure the performance of the social, economic and

biophysical environments relative to their respective sustainability objectives.

8.2.1 Evolution and use of models in planning

Issues such as a country's growth and development have long occupied the minds of economists, social scientists and planners, as governments endeavoured to formulate economic and social policy aimed at guiding development, stimulating growth and alleviating poverty within their countries (Lee 1973). Models have played a prominent role in this research, as multi-disciplinary teams of scientists grappled with complex socio-economic issues. The purpose of modelling the planning system has been described as creating a conceptual system independent of, but corresponding to the real world system, seeking to understand the phenomena of change, then to anticipate them, and finally to evaluate them (Chadwick 1966). Originating in the Netherlands in 1936, advances in model building are evident during and subsequent to World War II by many developed countries, particularly in Europe and the United States of America. Developing countries', notably India, concern with long term economic planning resulted in the first socio-economic models for the analysis of development problems. These consisted mainly of growth models. As evidence accumulated that acute poverty was not alleviated by the application of macro policy measures, planners turned to modelling as they sought measures to increase aggregate income growth within their economies. During the 1970s and 1980s, the development of ecology as a separate discipline, including specialisations such as ecological economists, has placed increasing emphasis on the need to ensure and maintain social justice and environmental sustainability within planning. Consequently, the methods and processes used in the evaluation of the status of planning areas, and of the effectiveness of planning policies and goals, came under increasing scrutiny (Borri, Khakee & Lacirignola 1997). The number of models addressing the inter-relationship between economic and ecological systems increased progressively. These include: the materials balance; input-output; regional environmental equality (O'Riordan & Turner 1983); steady-state model as proposed by Daly (1977 cited in O'Riordan & Turner 1983); and state of the environment models (Steyaert 1993).

The emergence of environmental concerns as the focus of attention has included research programmes for global change, such as the International Geosphere-Biosphere Programme (ICSU 1996). The need for an environmental policy decision process based on scientifically valid assessments of critical environmental issues, further encouraged the use of models to describe and understand the interactive physical, chemical and biological processes. By the mid-1980s, research strategies were developed to provide the scientific foundation to address these challenging issues. The Earth System Sciences Committee (ESSC 1986) developed a conceptual model of the earth system process operating on time scales of decades to centuries and proposed *the integrated model of the entire Earth System* (Steyaert 1993), and the Organisation of Economic Co-operation and Development (OECD) developed the Pressure-State-Response model as a representation of the cause and effect

relationship within the earth's system (OECD 1994).

8.2.2 State of the environment modelling

While early modelling approaches described in Chapter 4 converged in their interpretations from an economic perspective, the later *state of the environment* modelling initiatives adopted a multi-disciplinary and integrated approach, which has emphasised sustainable systems. Moreover, the advent of the geographic information system (GIS) has enhanced the scientists ability to understand and describe the earth's complex, interactive physical, chemical and biological processes which comprise the earth's environmental system. These environmental processes are typically three dimensional, time dependent, and complex. Such complexity can include nonlinear behaviour, stochastic components, and feedback-loops over multiple time and space scales. This complexity is illustrated by an example of a conceptual model of the earth's systems process, shown in Figure 8.1. However, while there may be significant qualitative understanding of these processes, the quantitative understanding remains limited. This has been due to fact that the ability to express the physical process as a set of detailed mathematical equations either do not yet exist, or the equations are considered to be too complex to solve without simplifications (Steyaert 1993). Fortunately, GIS applications have evolved significantly since early 1980s, and now span a wide range of tools, from simple inventory and management to sophisticated modelling of spatial data. It is this capability which has especially advanced the researchers capability to address and to model the cause and effect relationships within the complex environmental system.

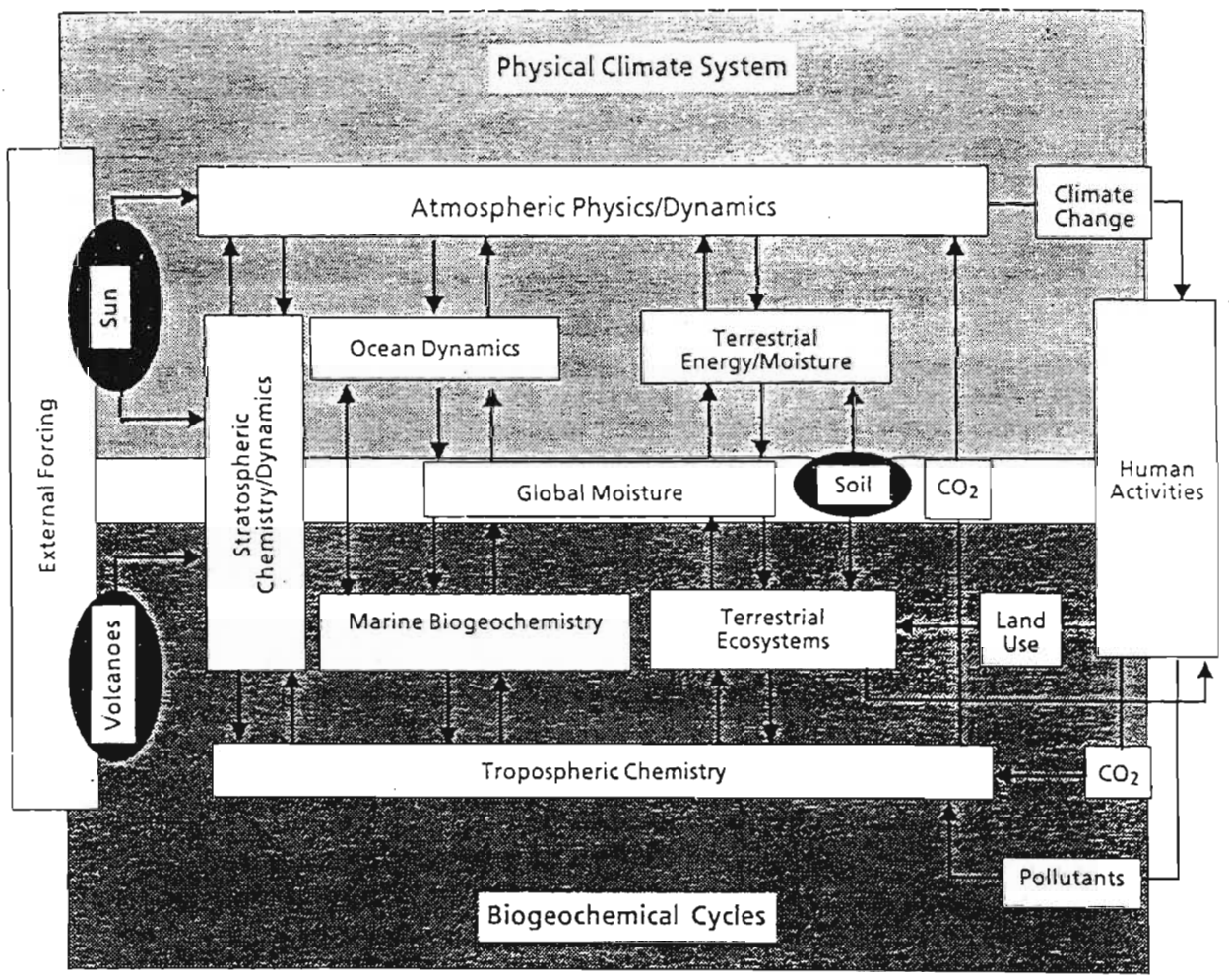


Figure 8.1: A Conceptual Model of the Earth Systems Process Operating on Time-scales of Decades to Centuries (Source: ESSC 1986, cited in Steyaert 1993).

The state of the environmental simulation modelling programme preceded the Earth Summit (Wynberg 1992). Indeed, the Organisation for Economic Co-operation and Development (OECD 1994) originally developed a framework based on the concept of causality, to organize the OECD's Environment Directorate research on environmental indicators (OECD Council Agreements:

Ministerial level meetings, and communiques by Heads of State, Paris and London G-7 & Economic Summits in 1989, 1990 and 1991).

Research surrounding the concept of environmental performance evolved the use of environmental indicators using the pressure-state-response (P-S-R) model. This framework is now widely used internationally, due to the concept being policy relevant, linking the environment with economic activities and agents, as well as being readable and robust. Whether policy objectives and commitments are in fact being met is the essence of appraising environmental performance (OECD 1994). The P-S-R model is illustrated in Figure 8.2, and the conceptual framework is outlined as follows:

- Indicators of environmental pressures which describe pressures from human activities exerted on the environment, including on natural resources.
- Indicators of environmental conditions which relate to the quality of the environment and the quality and quantity of natural resources. As such, they reflect the ultimate objective of environmental policies. Indicators of environmental conditions are designed to give an overview of the situation (the state) of the environment and it's development over time.
- Indicators of societal responses which show the extent to which society is responding to environmental changes and concerns. They refer to individual and collective actions: i) to mitigate, adapt to, or prevent human-induced negative impacts on the environmental, ii) to halt or reverse environmental damage already inflicted, and iii) to preserve and conserve nature and natural resources (OECD 1997a).

During the late 1980s, research staff, of the then Natal Parks Board (now the KwaZulu-Natal Conservation Service), applied an approach similar to that of the state-of-the-environment assessments, within the Board's protected areas. This process used pre-determined environmental indicators to establish the limits of acceptable change in field studies, and so evaluate the impact of management policies and techniques on indigenous habitats (Goodman 1998 pers. comm. 28 July). Such indicator studies proved useful in identifying and focussing attention on the pressures within a system and thereby facilitating the determination of appropriate responses. These early environmental indicator studies are characterised by a listing of diagnostic variables, which are used in comparative assessments of the state of the environment of the subject area. A major shortcoming of such studies was the absence of an over-arching model of the linkages that interconnect the key indicators (DEST 1996).

In seeking to ascertain the state of the various national social, economic and biophysical environments, OECD research has sought to understand the cause and effect relationship during the implementation of policy objectives, and to determine whether, and to what extent, an objective may have been achieved. This process is directed by addressing the following issues:

- the current condition or state of the phenomena, resource or circumstance which is the subject of the policy objective. For example, the condition of

groundwater may relate to the quality or the quantity of this resource, and depending on the focus, this knowledge would direct the enquiry to identify a measure of this condition. Hence, a measure of water quality or quantity would represent the indicator of the condition or the state of the resource.

- the nature and extent of the pressures that may contribute to the current condition or state. For example, the consumption or the contamination of groundwater is an indicator of the pressure on the resource.
- the durability of the policy objective over time or the progress towards the attainment of the objective, provides information on the success of the policy implementation initiative, i.e. is an indicator of the level of the response to a programmed intervention.

Thus, the OECD, in collaboration with international researchers, developed a pressure-state-response (P-S-R) framework (OECD, 1994) to differentiate between indicators which respectively relate to human pressures on the environment, actual states of the environment, and the responses which may be undertaken to alleviate the environmental damage. This model has been found to be particularly useful in focussing attention on responses to environmental problems, a previously neglected area in indicator studies. The P-S-R framework or model, is also referred to as the Condition-Pressure-Response (C-P-R) or the Condition-Stress-Response (C-S-R) models.

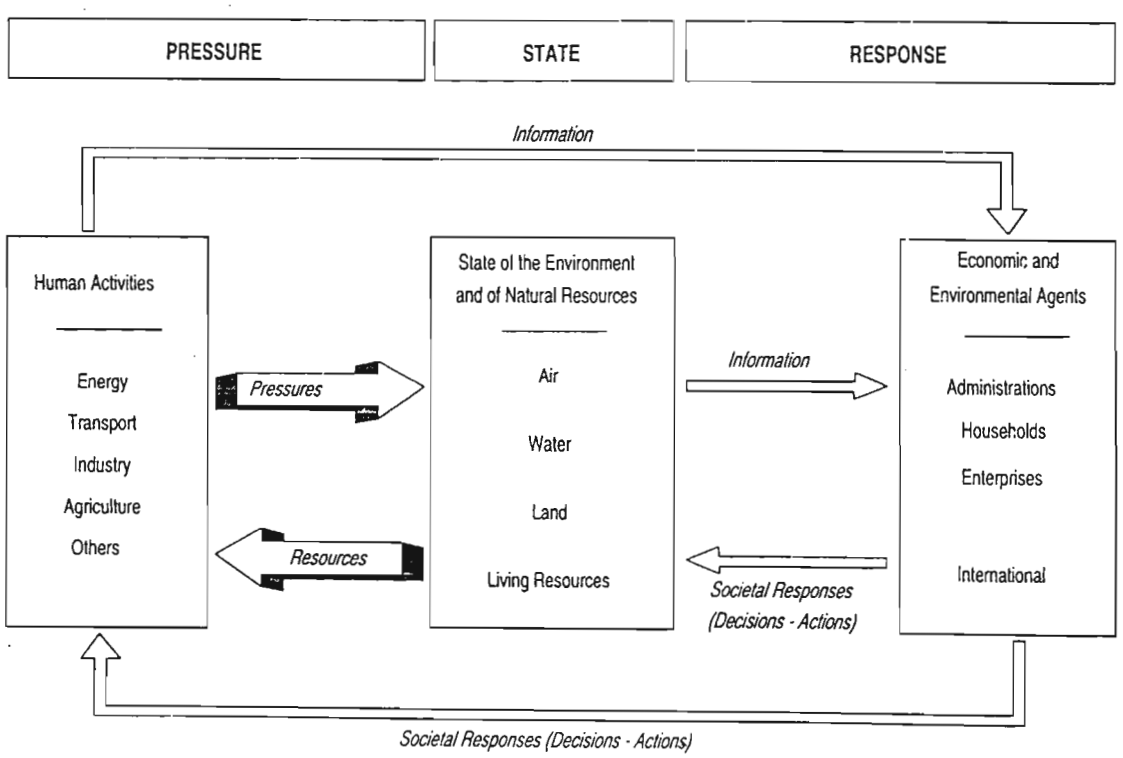


Figure 8.2: The Pressure-State-Response Model (Source: OECD 1994).

Recent Australian state of the environment research has modified this original model to address the aspect of environmental performance and reporting across all scales, i.e. at sectoral, national, international and global levels, and this version is illustrated in Figure 8.3.

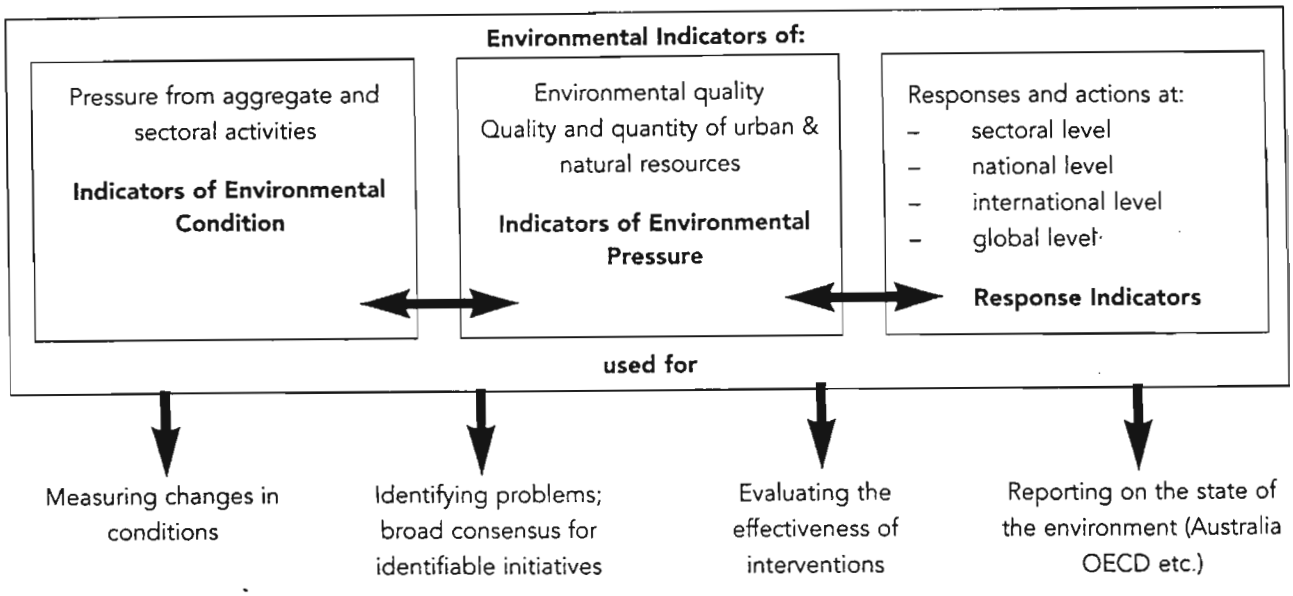


Figure 8.3: The Pressure-State-Response Model used in Australian Environmental Reporting (Source: Newton et al. 1998, adapted from OECD 1994).

Earlier approaches tended to focus on only the natural environment. It has now been recognised that in addition to the terrestrial, atmospheric, freshwater and marine environments, the performance evaluation system should extend to the urban environment. This includes aspects such as pollution, conservation, natural resources management and socio-economic aspects within the context of the natural and build environment (Newton et al. 1998). It has been proposed that the Department of Environmental Affairs and Tourism led state of the environment reporting initiative should take responsibility for monitoring and reporting on the wider condition of the South African environment (Walmsley & Pretorius 1996). In the interim, the earlier efforts of various OECD countries, have development a knowledge of the respective condition of their environments, to stage where it is possible to advance and set limits or thresholds of the various desired states or conditions within these various environments. Figure 8.4 shows how the measurement of these conditions may be plotted over time to illustrate relative trends.

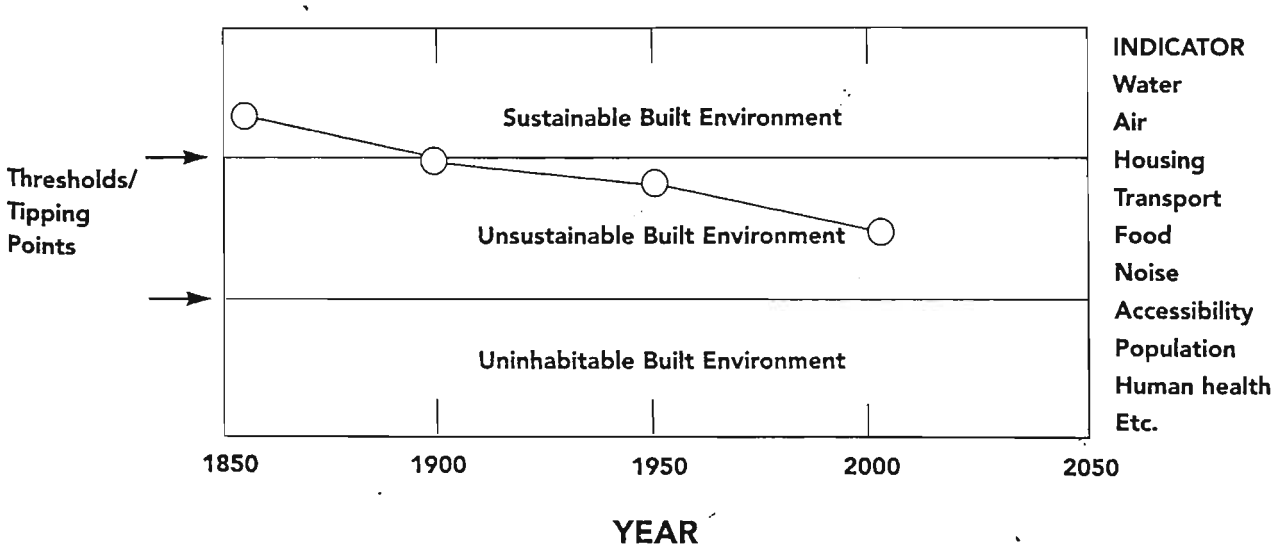


Figure 8.4: **Significance of Thresholds in Mapping Sustainability Trajectories** (Source: Newton et al. 1998).

It follows that the integrated application and tracking of selected indicators of the state of social, economic and biophysical environment may permit the evaluation and classification of the environment within the rural areas, as a basis for the development and implementation of regional, district or local land use and development plans. A similar technique was developed to assess and classify a number of visual and cultural landscapes within the natural and built environments (McCloskey 1979; Craik & Fiemer 1979;). The success of this approach led researchers to apply this technique with the view to protecting existing scenic landscapes valued as tourist attractions in areas adjoining a national park. This example required the classification and definition of various classes of rural landscape according to criteria relating to the nature, extent and perceived value of the subject landscape (Department of Conservation and Land Management 1997). The approach involved extensive research into the nature and extent of the landscapes and negative impacts through wide and inclusive stakeholder participation which resulted in the classification and mapping of the landscapes. The result informed the preparation of statutory policies and strategies which guide decision making during the evaluation of rural development applications. This focussed approach to policy formulation represents an advance on the a more generally formulated policies designed to protect rural amenity and contained within planning initiatives such as the *Drakensberg Special Case Area Plan, (Alletson 1998)*. However, the former approach relies largely on subjective assessment and no systematic, structured method for the later evaluation of the effectiveness of these strategies, to enable their effective review, has been included within this statutory system. Until such a system is developed and introduced, the evaluation and review of policies, plans and programmes will continue to rely on generalised rather than conclusive findings. This example

illustrates the need for a mechanism capable of delivering more precise information on the effect of the implementation of policies, plans and programmes on land use and/or the development that it aims to manage. The pressure-state-response model is specifically designed to address this cause and effect relationship. It submitted that the extension of this rationale to encompass a classification system, which includes broader indicators of sustainability, would greatly enhance the evaluation and revision of policies and strategies with a much wider application. The spatial representation and overlay of these data using GIS technologies may then be used to guide decision making towards the management of socially, economically and ecologically sustainable land use and development. Such a system is likely to provide a sound basis for decision-making in respect of the cause and effect of previously formulated policies and their process of implementation.

8.2.3 Addressing the Limitations

While the P-S-R model has been found to be a useful framework for application to any environmental indicators set which focusses on human causes and responses, the model has some acknowledged shortcomings. Hamblin (1998) has identified the following shortcomings:

(i) The implied cycle of cause and effect is simplistic; in particular the model only deals with human responses and not ecological (non-human) ones therefore feedback from other parts of the physical environment to the phenomena under question is not usually part of the model;
(ii) The distinctions between pressures are not always clear-cut, because the focus of the viewer may change depending on the underlying objective, so that an indicator which is a pressure in one perspective may be a state in another and a response in a third;
(iii) The model lacks the inter-generational dynamics inherent in sustainability approaches to future paths of development; and
(iv) There is a tension in applying this model to human settlements, since human activities are generally considered to be pressures.

Notwithstanding these shortcomings, the strengths are considered to out weigh the disbenefits, and while continuing to search for ways to overcome these limitations, the state-of-the-environment researchers (DEST 1996; Hamblin 1998; ANZECC 1996; Ward, Butler & Hill 1998; Fairweather & Napier 1998; Sanders, Margules & Hill 1998; Manton & Jasper 1998; Newton et al.1998; Pearson et al. 1998; Alexandra, Higgins & White 1998) have adopted P-S-R as the guiding framework. Consequently, the South African government initiative is following the same course (Walmsley & Pretorius 1996), and this model is increasingly used in global environmental research.

Initial attempts to apply this model to human settlement presented some difficulties, particularly since the human element is central to the increasing impact on the resources, and the state of these resources may in turn influence the state of the social and economic environment. Subsequent research (Newton et al. 1998) developed further elements into the P-S-R model to address these processes

via a range of input-output models. Examples of these models are illustrated in Figures 8.5, 8.6 and 8.7, being the extended metabolism model for the domains of waste, water and environmental health, respectively. These models aim to clarify the application of the P-S-R in respect to human settlements. The biosphere has been classified into domains, such as: biodiversity; or the atmosphere or the land or ground and surface water. Each of these areas have been studied to facilitate the recognition of processes operating across all domains and at all levels, which exert pressures on social, economic and biophysical environments in late 20th century society. This approach has permitted micro or local processes and even macro or exogenous pressures, that exert pressure far beyond the boundaries of a region, country or continent to be modelled, e.g. economic dependency, technological changes to energy processing or communication.

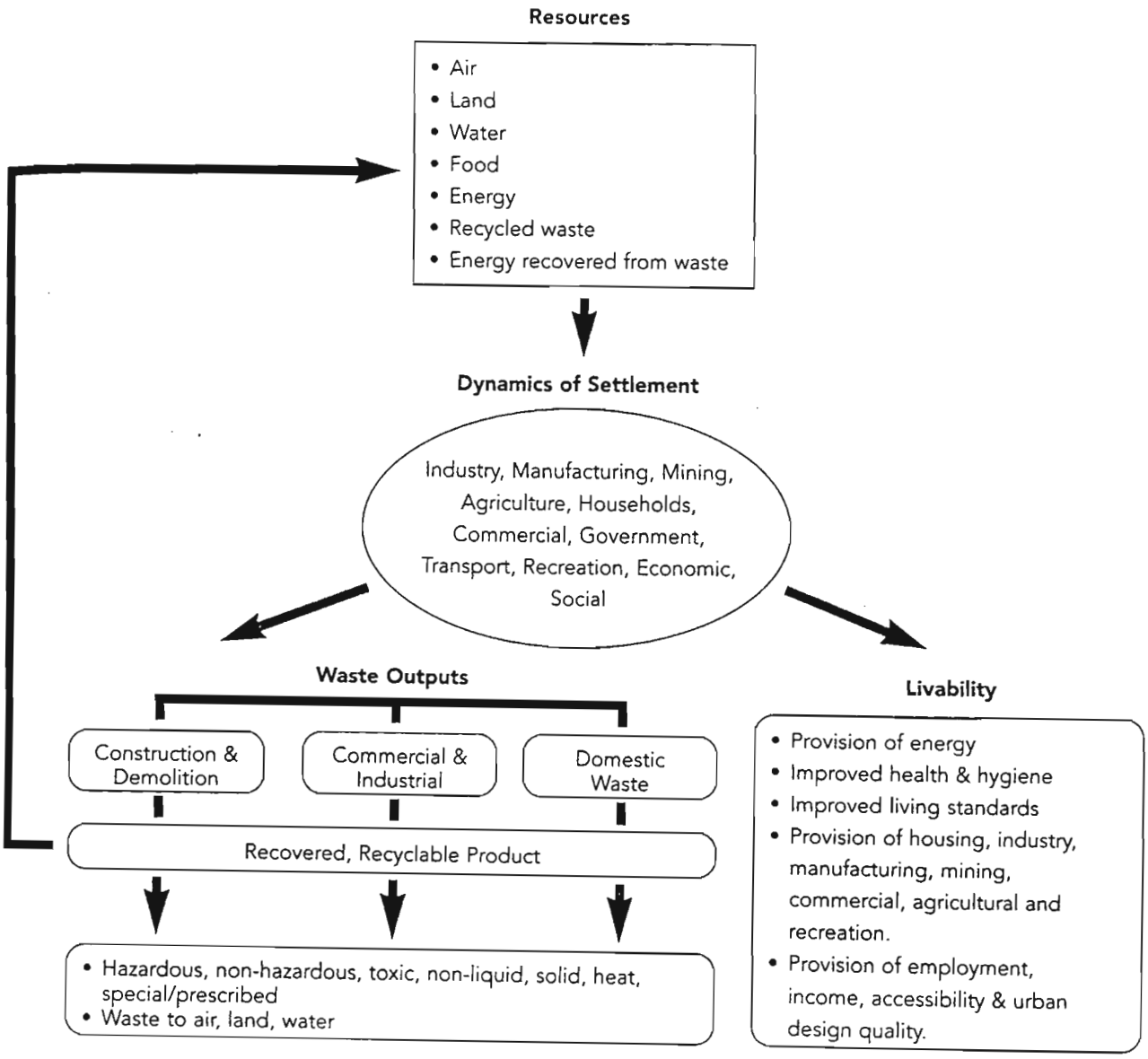


Figure 8.5: Extended Metabolism Model for the Domain of Waste (Source: Newton et al. 1998).

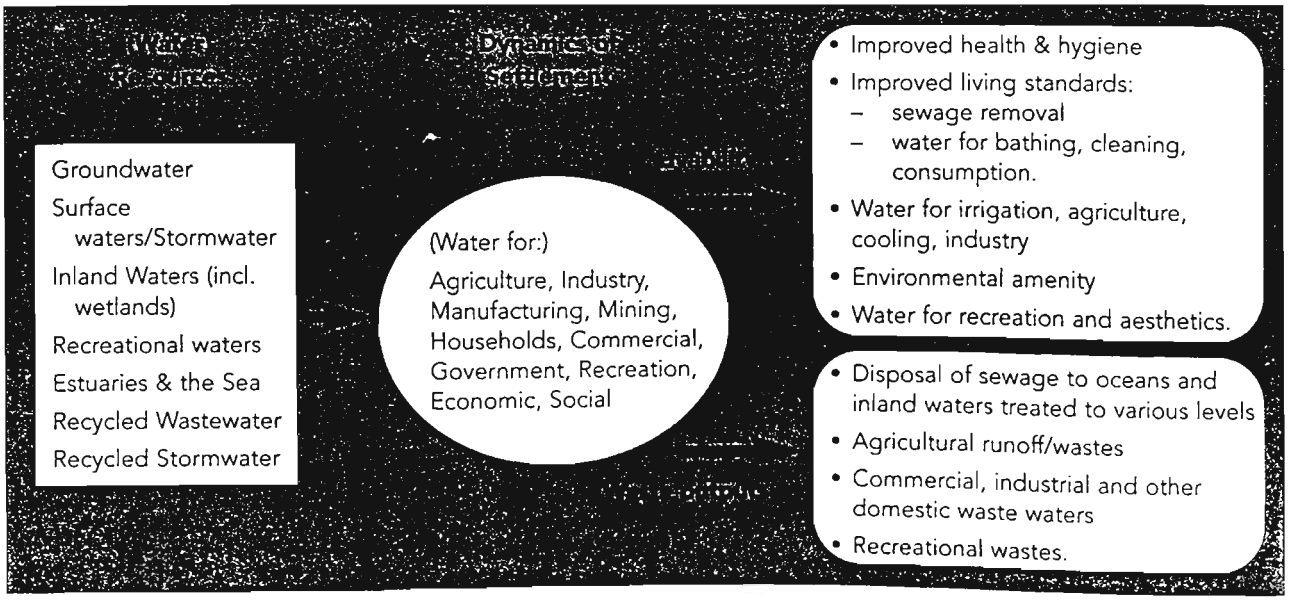


Figure 8.6: **Extended Metabolism Model for the Domain of Water** (Source: Newton et al. 1998).

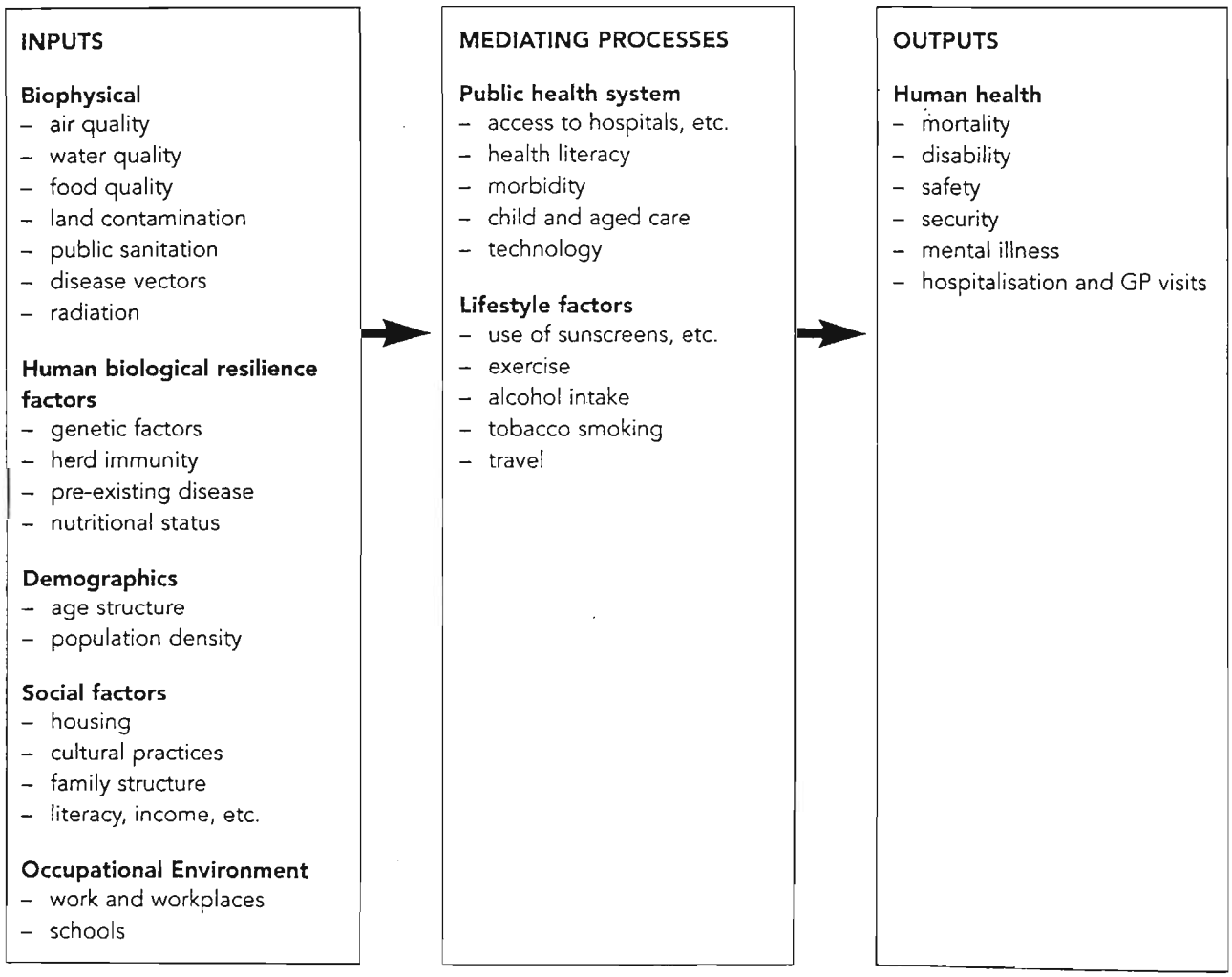
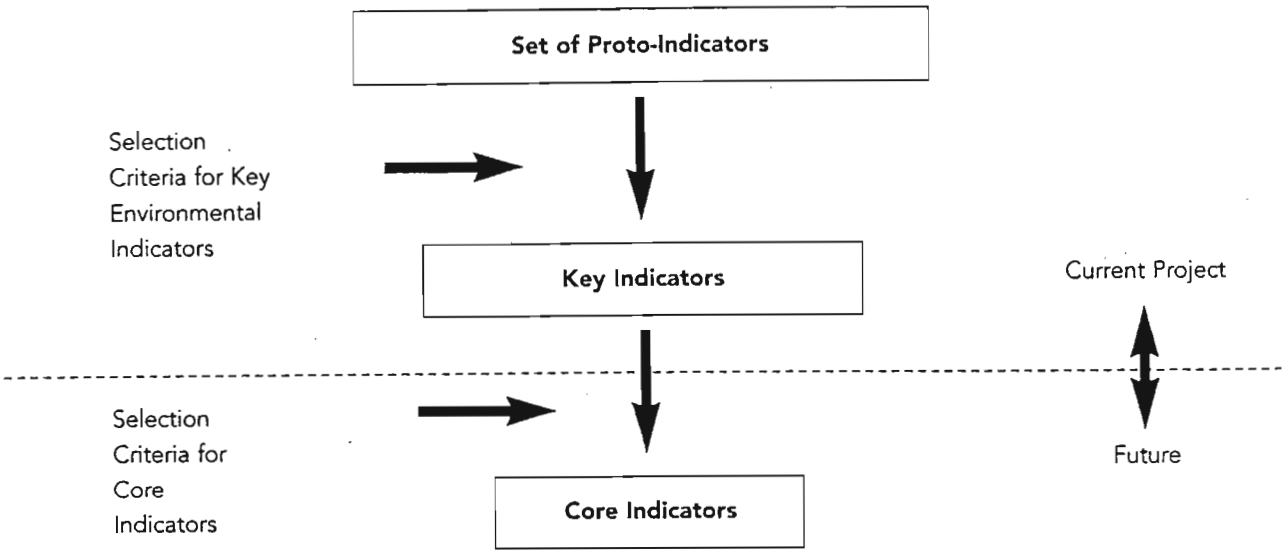


Figure 8.7: **Extended Metabolism Model for the Domain of Environmental Health** (Source: Newton et al. 1998).

8.2.4 Environmental performance indicator selection methodology

Researchers involved in the Australian State of the Environment initiative have collaborated with other OECD and United Nations researchers to develop a methodology for identifying, selecting and applying performance indicators (ANZECC 1996; DEST 1996; Walmsley & Pretorius 1996; Hamblin 1998; Ward, Butler & Hill 1998; Fairweather & Napier 1998; Sanders, Margules & Hill 1998; Manton & Jasper 1998; Newton et al.1998; Pearson et al. 1998; Alexandra, Higgins & White 1998). A prerequisite for this stage is a participative process involving representatives of all stakeholders and permitting consultation between these representatives and their members during the course of the process. A similar process is currently being undertaken as part of the South African initiative and which is currently being undertaken by the national Subcommittee on Sustainable Development as described in Subsection 8.1.3. The various stages of the an indicator selection process is shown in Figure 8.8. It is proposed that the same rationale be adapted and used in the selection of thresholds, and indicators at the regional and local levels at which a land use management and regulation system is to function.



Proto-indicators are a collection of indicators derived from a comprehensive search of extant indicators studies undertaken in Australia and overseas.

Key environmental indicators are the minimum set of indicators which, when properly monitored, will provide rigorous data describing the major trends and impacts on the Australian environment.

Core environmental indicators are those that are useful for identifying environmental trends at all spatial scales, thus requiring a consistent reporting basis across jurisdictions.

Figure 8.8: Process for Developing Environmental Indicators of Human Settlements (Source: Newton et al. 1998).

This methodology involves the collection, testing and selection of a wide range of potential indicators from many sources. The initial or *proto-indicators* are tested individually and ranked in terms of their performance against various criteria. Examples of these criteria categories are shown in Table 8.1.

Table 8.1: Example of Criteria used in Indicator Selection (Modified after Newton et al 1998).

- IMPORTANT: e.g.
  - reflect a fundamental or high valued aspect of the environment
  - be either national in scope or application to regional environmental issues of national significance.
  - Where possible and appropriate, facilitate community involvement.
- FEASIBLE: e.g.
  - be monitored regularly with relative ease.
  - be cost-effective.
  - contribute to the fulfilment of reporting obligations.
- CREDIBLE: e.g.
  - be capable of being monitored to provide statistically verifiable and reproducible data that show trends over time and, preferably, apply to a broad range of environmental regions.
  - be scientifically credible
  - where possible and appropriate, use existing commercial and managerial indicators.
- REPRESENTATIVE OF THE PUBLIC'S (COMMUNITY) VIEWS: e.g.
  - prepared through a process characterised by substantial public or community participation
  - supported by a wide and representative section of the public or community
- UNDERSTANDABLE: e.g.
  - be easy to understand.
  - have relevance to policy and management needs.
- USEFUL: e.g.
  - serve as a robust indicator of environmental change.
  - provide an early warning of potential problems
  - contribute to monitoring of progress towards implementing commitments in nationally significant environmental policies.

The *key indicators* are selected from those proto-indicators which perform best, and which are considered to be the minimum set of indicators which, when properly monitored, will provide rigorous data, describing the major trends and impacts on the environment. A set of *core environmental indicators* are selected from the key indicator categories is being those which are considered useful for identifying environmental trends at all spatial scales, and which can be used in a programme of consistent measurement and reporting across jurisdictions. An example of these categories is shown in Appendix C. Each indicator has a nominated unit of measurement considered most appropriate to its representation. These may include:

- intensity indicators e.g. number, volume, mass, etc.
- exceedances such as those related to some threshold or standard
- extremes e.g. percentiles, etc.
- normalised indicators e.g. per capita; per m^2; km/hectare, etc.

The levels measured using these indicators are compared against predetermined standards or thresholds of sustainability. Environmental thresholds represent the point or level at which a particular pressure is of sufficient intensity or impact to begin to produce a change in the state of a particular system, which if maintained, would threaten the sustainability of the system (Newton et al. 1998). An example of pressure-state-response indicators is shown in Appendix D.

8.2.5 The South African state of the environment reporting initiative

The purpose of the national state of the environment reporting initiative is to provide South Africa's stakeholders with the highest quality information available on the state of the environment and how it is proposed to be managed. The initiative has the following objectives:

- to provide scientific information on the status and trends in the condition of the South African environment, and comment on the implications thereof.
- describe the impact of the state of the environment on human living conditions, the pressures that effect the environment and the human activities causing these pressures, and in so doing provide a link with policy issues.
- assist in responding to the international reporting obligations.
- create awareness of environmental issues facing the country, and promote understanding of the major environmental challenges.
- identify gaps of knowledge and data, so that funding for research may be focussed on the identified priorities (Walmsley & Pretorius 1996).

The information obtained via this process is to be provided to the Subcommittee for Sustainable Development referred to in Subsection 8.1.3 so that the following aims may be addressed:

- the preparation of CSD annual reports, including the undertaking of the Sustainability Indicators Testing Programme;
- to provide information regarding South Africa's position in respect of the Convention to Combat Desertification;
- to provide information regarding South Africa's obligations in respect of Local Agenda 21 issues and State of the Environment Reporting.

The testing of indicators for sustainable development is a process which runs parallel with South Africa's State of the Environment Reporting (SOER) programme, as it is expected that the information arising from the indicator programme will be incorporated in the SOER programme (Walmsley & Pretorius 1996). The United Nations Commission for Sustainable Development (UN CSD) aims to develop a tool to measure progress towards sustainable development, for use by all countries, based on each countries national priorities, by the year 2000. Therefore, the UN CSD indicator testing programme has a broader focus, namely:

- development of a comprehensive communication strategy with regard to indicators for sustainable development and the testing process;
- hosting of sectoral workshops to discuss in more detail the proposed indicators and methodology sheets;
- publication of data sets collected during the first year of testing; and
- development of a sustainable development home page on the Internet where results of testing will be reflected (Walmsley & Pretorius 1996).

The South African initiative aims to participate in the international initiative with the view to developing a national, viable and flexible system for monitoring progress on sustainable development, and which can guide national strategies, policies and actions in this regard. The UN CSD has forwarded a preliminary list of 134 potential indicators to the Subcommittee for selection and testing, and the South African Subcommittee, has, through it's various workgroups, selected a subset of 48 of these indicators, and are currently engaged in their assessment and evaluation. The subset of these indicators is listed in Appendix B (Department of Environmental Affairs and Tourism 1997). The focus of the Department of Environmental Affairs and Tourism is on a national initiative to develop a national set of environmental indicators.

The approach proposed in this study is the proposed adaptation and extension of the state of the environment programme to form a system which initially guides land use management practices and ultimately regulates land use across all levels of government and includes extensive stakeholders participation in the process. It is proposed that this system should function both institutionally and spatially. Institutionally by integrating the involvement of the provincial, the regional and the local government departments and agencies, including all stakeholders, and spatially by guiding and regulating land use management practice and administration towards sustainability.

8.2.6 Indicator selection refinement through adaptive management

Research into the successful selection and use of performance indicators recommends the following of a strategic planning approach within the context of the adaptive management cycle. The cornerstone of the adaptive management cycle is the recognition that people do not possess either full control over or a complete understanding of their environment. Therefore, this strategy involves the undertaking of a regular revision of a plan, programme or management system so as to take account of unanticipated changes in outlook or condition over time (Alexander, Higgins & White 1998). The adaptive management framework incorporates analytical tools together with a monitoring programme during the implementation phase, which allows for on-going refinement of regional, district or area policies/strategies/actions, and is likely to promote a disciplined approach. This approach is particularly well suited to the specific and trackable nature of the proposed deterministic planning process and is shown in Figure 8.9.
The following steps form the adaptive management cycle:

i) the cycle begins by setting objectives and identifying issues.
ii) setting of targets that must be achieved in order to address the issues and meet the objectives.
iii) attempting to attain the targets.
iv) monitoring and evaluation of both the results and the process.
v) feedback takes place throughout the process and assists in it's evaluation.
iv) review of the process, including the review of the targets and the issues and objectives in the longer term.

In order to ensure transparency, the adaptive management cycle should include the participation and involvement of all stakeholders. This process would enable the lead agencies responsible for directing the data gathering process, and the transformation of this data into useful information, to ensure that the decision-making process is capable of taking full account of information arising from all stages within the cycle. For example, to ensure that:

- the system is functioning as planned;
- the system is monitoring the things that it set out to monitor;
- the results of the evaluation process are communicated to the decision-makers in a timely manner; and
- the stakeholders remain fully informed throughout the process.

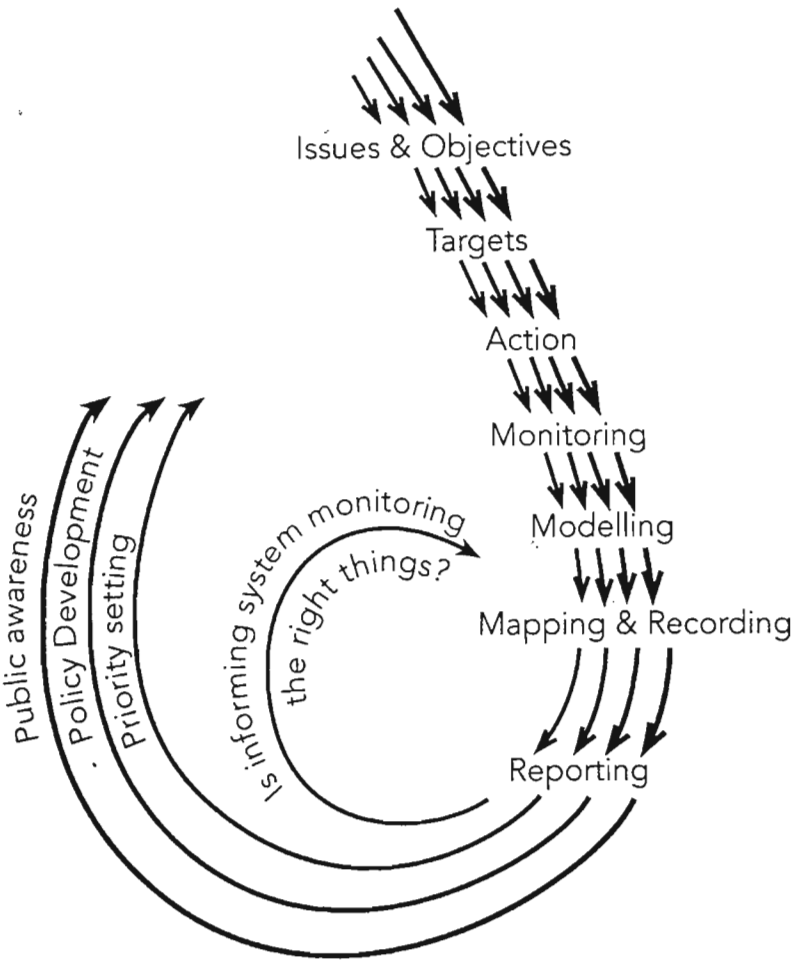


Figure 8.9: **The Adaptive Management Cycle** (adapted from Thomas and Heath, 1997, cited in Alexandra, Higgins & White1996).

8.3 Summary

The drive towards sustainable development has prompted the search for a model which had wide international acceptance. The important role of models in land use planning and development research is discussed. While these models originally addressed the inter-relationship between economic and ecological systems, increasing attention has been focussed on environmental problem-solving, modelling issues such as global change (ICSU 1996), the biosphere (Steyaert 1993) and environmental performance (OECD 1994). The *state of the environment* reporting programme initiated by the Organisation for Economic Co-operation and Development (OECD) has laid the foundation in the search for a viable means of measuring environmental performance by individual OECD member countries. The OECD-developed *pressure-state-response* model with its capability of being policy relevant, of addressing the cause and effect relationship between the implementation of policies, plans and programmes and the result of this implementation process, of linking the environment with social and economic activities and agents, and of being both readable and robust, is now widely used internationally to

guide the process of performance evaluation. Recent research surrounding the Australian state of the environment reporting initiative has refined the application of the pressure-state-response model and developed various techniques relating to it's calibration. This study has identified these techniques as being suitable for adaption and use in the development of a South African management and regulation system for sustainable rural land use (Newton et al. 1998). South African state of the environment reporting forms part of a UN CSD-led global initiative to develop national sets of environmental indicators. The South African government has recognised the value of this state of the environment initiative and has appointed the national environmental agency to coordinate the country's participation in the UN CSD-led testing of national environmental indicators.

This study proposes the expansion of the South African initiative of selecting national indicators to develop a regulation system for sustainable rural land use for application on provincial, regional and local scale within the framework of the pressure-state-response model. In addition, this study proposes the use of the adaptive management cycle, which allows strategic interventions within the context of the pressure-state-response model. The result is to be a blended model which draws on the work of Canton and Molye (1997, cited in Alexandra, Higgins & White1996) that is applicable within a regional context and is capable of being implemented at a district and even at a local community level. This system proposes:

- an integrated planning process involving the coordinated identification of multi-disciplinary issues
- the preparation and implementation policies, plans and programmes aimed at addressing these issues
- the identification of pressure-state-response mechanisms within the context of the identified models using performance indicators
- the monitoring of the condition of the economic, social and biophysical environment, of the nature and extent of the pressures exerted on these environments, and of the response of these environments, to the implementation of the various policies, plans and programmes
- the monitoring of these pressures, states and responses through an iterative process of transparent research, identification, testing and selection of suitable indicators of performance
- the results are to be evaluated
- the findings are to inform decision-making regarding the review of the policy, plans and programmes
- the entire process is to include the participation of all the stakeholders

It is proposed that the environmental performance measurement should be integrated both institutionally and spatially i.e. institutionally, through the integrated involvement of the provincial, the regional and the local government departments, multi-disciplinary institutions and agencies and the full participation of the host communities, i.e. including all stakeholders; and spatially, by guiding decision-making concerning the regulation of land use and the design and implementation of land use management practices, and including regional, district and local rural planning schemes which strive towards the achievement of sustainability.

9. MODELLING LAND USE MANAGEMENT AND REGULATION IN RURAL TRADITIONAL LAND TENURE AREAS

9.1 Towards a Deterministic, Integrated Approach

The need to address national issues relating to the social, economic and biophysical environment via a system of national environmental performance evaluation and produce state of the environment reports as required by multiple stakeholders, has been widely acknowledged (UNCED 1993; OCED 1994, 1996, 1997a, 1997b; DEST 1996, Walmsley & Pretorius 1996). In addition, research (DEST 1996; Walmsley & Pretorius 1996; Hamblin 1998; ANZECC 1996; Ward, Butler & Hill 1998; Fairweather & Napier 1998; Sanders, Margules & Hill 1998; Manton & Jasper 1998; Newton et al.1998; Pearson et al. 1998; Alexandra, Higgins & White 1998) has acknowledged the need to address the identified issues in terms of the respective domain. The required data would be routinely identified and collected at provincial, regional and even local levels and it is proposed to assess and report on the results at these three levels. In addition, the collation, combination and synthesis of the data from these various levels into a national data-set would facilitate the meeting of South Africa's national and international obligations as described in Subsection 8.1.3. The location of the responsibility for this state of the environment reporting programme has been identified in section 8.2.4 as the national or central government in each case (UNCED 1993; OCED 1994, 1996, 1997a, 1997b; DEST 1996, Walmsley & Pretorius 1996), and accordingly this responsibility has been assigned to the State Department of Environmental Affairs and Tourism.

It is submitted in the hypotheses that the rationale underlying this initiative may be adapted and extended to serve a wider application at a provincial, regional and local level. The need to broaden the base of the current four phase planning process has been addressed in Chapter 7. Firstly, it has been proposed that the initial research phase should be broadened to include the identification of the key social, economic and environmental issues that require to be addressed. Secondly, the need to broaden and expand the role of monitoring and review of these policies, plans and programmes during the implementation phase via a continuous process of stakeholder participation and using indicators to inform their decision-making and to evaluate their efficacy in achieving sustainability. In addition, there is a need to strengthen the link between the land use planning and land use management; and to re-establish accountability as a cornerstone of the land use evaluation and management process. Therefore it is proposed to utilise the dynamics within the following two models to accomplish this task, including: the original P-S-R model (Figure 8.2), and the P-S-R environmental reporting model (Figure 8.3). The current planning approach (Table 7.2) has been extended to incorporate the rationale of the extended metabolism domain models (Figures 8.5, 8.6 and 8.7, and the systematic, strategic approach of the adaptive management cycle (Figure 8.9). Finally, the expanded planning approach is linked to the combined rationale and reporting regime of the Pressure-State-Response model through an integrated participation process, comprising all the relevant stakeholders. The proposed model is shown in Figure 8.10. This process is to be implemented, monitored and reviewed through a transparent process that includes the participation of all stakeholders and is consistent with the existing legislation and statutory provisions of all levels of government. Previous attempts to address the need for

an effective land use management and regulation system for rural KwaZulu-Natal have explored an approach similar to that employed within urban areas (Metroplan 1997) and Australian planners have adopted a similar approach (Western Australian Planning Commission 1996; 1997a; 1997b; 1997c; 1998; 1999b). However, past experience (Foyel & Houston 1992; Ginsburg, Koppel & McGee 1991; Farrier 1995) suggest that an urban-style of land use management and regulation is not appropriate in the rural context.

The current approach in addressing the first three phases of the planning process as outlined in Section 7.2 is strategic in nature and capable of delivering a sound result in the form of a policy or plan. However, it is in the final phase of this process, i.e. the implementation and monitoring phase, that difficulties are experienced. These difficulties include the uncertainty surrounding the measurement of the performance of policies and strategies in goal achievement. Although certain characteristics of land use regulation within urban areas has been addressed in Section 6.4.1, Table 9.1 represents a comparison between certain characteristics of this urban approach and that of the proposed deterministic, integrated approach.

9.1.1 Comparison between the urban-style and proposed rural planning scheme

The identification of all the factors that influence the design and selection of a land use management and regulation system is beyond the scope of this study. This is due to the relative nature of the various components and special circumstances that may apply at any one time. It could be said that an effective system is likely to be required to achieve the desired purpose at a reasonable cost within an acceptably short time-frame. Nonetheless, the selection of a methodology or system can be influenced by practical considerations such as cost. For example, the general shortage of funds within all areas of government necessitates the a cost effective approach to planning and development regulation. Data and staffing requirements are two components that can influence these costs. In addition, staffing requirements may vary according to the levels of expertise required and duration of the exercise. Further factors such as the durability of the policy, plans and programmes i.e. their robustness and flexibility to remain relevant under changed circumstances is an important consideration.

Notwithstanding the practical considerations, it is surely important to select a system that performs the required task and delivers the required results at whatever is deemed to be a reasonable cost within a reasonable time-frame. The significant difference between the urban-style scheme and the proposed rural planning system lies in the rationale of the zoning of land for use and development. The former strives for uniformity of the land use function within zones, and strives to minimise conflict or amenity interference both within and between zones. While the latter strives for simultaneous conformity in the characteristics of three regimes, namely, social, economic and the biophysical environment, with the principal aim of striving towards the attainment of sustainable land use and development, of which amenity in only one component. Herein lies the crux of dissimilarity between the two systems. Table 9.1 provides

some indication of this authors perceptions in regard to the various differences between the two systems, although some elaboration may be required. For example, the proposed deterministic, integrated land use management and regulation system would clearly require higher levels of data, staffing and expertise, and take longer to prepare initially than the current urban-style process. This is likely to result from the proposed addition of the components proposed in Chapter 7, i.e. an increased need for initial research in order to identify broader issues in the social, economic and biophysical environments. In addition, the expansion of the monitoring and review process calls for a continuous programme of research, identification, testing, selection and application of indicators The benefits of this expanded emphasis on issue identification and the monitoring and review of policy, plan and programme implementation in accordance with the trends displayed by the selected indicators have been addressed in Chapters 7 and 8. It is submitted that the proposed approach would be balanced and systematic, robust yet flexible, and would provide manifestly more accurate information on the integrated state of study areas social, economic and biophysical sustainability. A further consideration in system selection is the lifespan of the system. The lifespan of the existing planning approach and that of the proposed approach differs markedly. It is submitted that once prepared, an urban-style scheme requires to be reviewed at five-yearly intervals, although this urban-style scheme and the accompanying, forward-looking policy plan (often termed a structure or a development plan) would of necessity be subject to some *ad hoc* monitoring during that time. Once it is deemed necessary to review the policy plan, it becomes necessary to undertaken a study exercise of significant proportions which can cost many hundreds of thousands of rands and take a period of between one to two years to complete (Metroplan 1994, 1995, 1996). While in the case of the proposed system, once prepared, the system would be subject to continuous review of the extent to which the policies, management programs and regulations pertaining to the land use zones, are achieving their desired ends i.e. of the pressures, states and responses. Therefore the effectiveness of the proposed system is likely to exceed that of the urban-style system whose narrower focus is based on a single, infrequent, and large data collection exercise. Further differences are likely to include the use of Geographic Information Systems to assist in the day-today management and interpretation of the vast set of detailed, spatially-linked data for presentation to the stakeholders for decision-making. Moreover, the immediacy and therefore the availability of this information and data base would greatly enhance the it's usefulness and permit the participation and development of further detailed, integrated policies, strategies, and programs by a wide range of government departments and agencies, including: socio-economic aspects, agricultural, health and the environment. The benefits of this integrated approach include the availability of a more accurate and effective information system to the stakeholders. This information is likely to enhance their ability to take informed decisions concerning land use regulation and management. This would include the the integration of the social, economic and environmental aspects of the planning and development of land and services infrastructure and the associated economies gained through these linkages. Consequently, the resultant availability of such a comprehensive and accurate set

of information would enable a higher standard of integrated design, implementation, development, management and appropriate regulation to be undertaken towards the achievement of sustainability.

Table 9.1: Comparison between the Urban-Style and the Proposed Rural Planning System of Land Use and Development Management and Regulation

SYSTEM CHARACTERISTICS	URBAN-STYLE SYSTEM	PROPOSED RURAL PLANNING SYSTEM
Land Use Area or Zone Delimitation Rationale	Uniformity of land use function.	Conformity of social, economic and biophysical characteristics with the objectives of sustainable development.
Aim of Land Use Conditions	Supportive of objectives.	Supportive of objectives.
Evaluation of Performance in terms of set Objectives	Scientific and subjective assessment, based on observable evidence and measurable indicators where these exist. Although the lack of sufficient and rigorous data sets may result in a reliance on past trends and intuitive assessment.	Balanced, scientific, finite measurement using predetermined indicators of the social, economic and ecological environment's health, against preset thresholds and targets.
Nature of Output	Specific where available, alternatively - qualitative, indicative and predictive.	Largely specific, quantitative, qualitative, verifiable and predictive.
Reporting scale or measurement intervals	Randomly determined intervals. Predictive accuracy decreasing with time.	Scientifically determined intervals. Results immediately quantifiable and relevant.
Planning Criteria Selection Process	Strategic.	Strategic.
Indicator Selection Procedure	Strategic and scientific - although scarcity of information often resulted in randomly selected emergent indicators.	Strategic and scientifically selected by predetermined indicators.
Certainty of Response	Uncertain.	Generally reliable
Measurement of Progress over Time.	Interpretive prediction and intuition.	Specifically measurable and trackable.
Time and expertise required to design and develop the Scheme	High level of wide ranging expertise and disciplines, inlc. economic, agricultural, social, environmental and planning fields.	High level of wide ranging expertise and disciplines, including: economic, social, agricultural, environmental and planning fields.
Extent of stakeholder participation	High level	High level
Level of expertise required for administration of the system	Low level of involvement.	High level of expertise required across a wide range of disciplines to co-ordinate and implement the continuous monitoring and administration regime
Volume of Data Requirements	High on the initiation of each plan or planning event	Very High on initiation of the planning process and low levels thereafter.

9.1.2 The expansion of data collection, analysis and evaluation during the planning process

There is wide concern that environmental information management in South Africa is inadequate to meet the requirements and needs of decision-makers and numerous stakeholders (Walmsley & Pretorius 1996). This situation prompted the development of the proposed deterministic, integrated land use management and regulation system. Therefore, it is proposed that the research and data collection phases of the current planning approach, relating to the physical, social and economic characteristics and to land capability, and stakeholder participation as discussed in Section 7.2, be supplemented and expanded through the inclusion of additional phases and elements.

The first is the formal inclusion of an initial phase where stakeholders would focus on the identification of a broad range of issues and initiate broad-based issue identification. The second concerns stakeholders. Since stakeholder participation has been an acknowledged as an being an important element within the planning process for many years, the proposed model continues to include continuous stakeholder participation in the decision-making process, including the direction and review of research methods and results. Although, the importance of stakeholder participation has been elevated through the inclusion of a phase which seeks stakeholder consensus on key issues, objectives, strategies and actions and in the review of management regulations within the planning process. In addition, the process requires a series of iterative steps be followed whereby the findings are continually reviewed for their relevance and assessed for their continued validity for the process. The third addition concerns the expansion of an existing phase, namely: that of implementation and monitoring, by incorporating performance evaluation using *environmental performance indicators*. This includes a process of evaluating the proposed policies, plans and programmes performance, in terms of their stated objectives. These objectives are required to have regard for sustainable land use and development within the context of the social, economic and biophysical environment. Moreover, this process would be conducted at the regional, district and local government levels, although it should remain consistent with national and provincial development policy and programmes.

It is conceded, that when compared with the current approach outlined in Table 7.2, the proposed broader approach is likely to require the collection, analysis and evaluation of increased amounts of data during all phases of the planning process. However, the increased emphasis on issue identification and the monitoring and review of policy, plan and programme implementation in accordance with the objectives through the identification of trends displayed by the selected indicators is significant. This approach is designed to enhance the benefits of this approach substantially. Consequently, it is submitted that the proposed approach is likely to be well balanced and systematic, yet flexible, and should provide manifestly more accurate information on the integrated state of a study areas social, economic and biophysical sustainability. This process has been formulated accordingly and is illustrated in Table 9.2.

Table 9.2: A Proposed Deterministic, Integrated Rural Planning Process

PHASE	STEP	PROPOSED RURAL PLANNING PROCESS
I: INITIAL RESEARCH	1.	Undertake broad-based contextual research including assembly of relevant documents and data pertaining to the study area
II SYSTEM DESCRIPTION AND ISSUE DEFINITION	2	Identify and describe the systems and system processes, including problems, issues, needs, opportunities and assumptions
	3	Classify or group the key issues according to existing or proposed national, provincial, regional of local policy programmes, where these exist.
	4	Convert each of the key issues into preliminary objectives
	5	Establish and define domains, and cross-tabulate the key issues according to the respective objective for each domain
	6	Identify and list *key indicator categories* that are supportive of each domain
	7	Classify, by cross-tabulation, the key indicator categories according to their objectives and their related issues, for each of the Programmes according to each domain
	8	Prepare a first Phase of the Status Report for the Key Issues identified in Step 2, by Programme and by domain (refer to examples in Tables 10.2 and 10.3). These Status Reports are to be prepared in three stages. These stages are described in Steps 8, 9 and 10 respectively. Therefore, for each Programme identified in Step 3, and accordingly for each domain identified in Step 5, undertake the following: – List the preliminary objective as prepared in Step 4; and – identify and list the Key indicator category as identified in Step 6.
	9	On completion of the first Phase of the preliminary Status Report, the second Phase entails the reassessment and review of the preliminary objective to ensure it's continued validity for the process and that it remains in support of the collection, analysis and synthesis of the data for the purposes outlined in Steps 4 to 7 above.

III: SOLUTION GENERATION AND ANALYSIS	10	The third phase of the Status Report entails the iterative participation of the public in the design and implementation of the processes and research required for the selection of indicators as described in Chapter 8. This includes the initial selection and testing of *proto-indicators* and a *proto-target* for each key issue, according to each domain and for each Programme. These proto-indicators should include the three areas namely: a *pressure indicator*; a *state indicator* and a *response indicator* in each case. The following characteristics of each (proto-) indicator should ultimately be recorded (refer to examples in Tables 10.2 and 10.3): – description of indicator; – rationale; – means of analysis and interpretation; – description of the proposed monitoring strategy; – description of the reporting period or scale; – description of the expected content and format of the output or result; – description of the expected or identified data sources; and – identification and description of the links between this and other indicators, in this and other domains .
	11	Identify and allocate responsibilities for the design and implementation of the data collection, analysis and synthesis methodologies.
	12	Design and implement the data collection, analysis and synthesis of the data in terms of the defined methodology, and complete the Pressure-State-Response Matrix shown in Table 10.4, for each issue. This process includes the revision of the objectives, the testing and verification of the proto-indicators and the proto-targets, in terms of, for example the criteria listed in Table 8.1. This approach aims to guide the selection of the *indicators* and a *target* for each key issue, namely: a *pressure indicator*; a *state indicator* and a *response indicator* in each case, and the development of strategies and actions required to meet the set *target* according to each domain and for each Programme.
IV: EVALUATION AND SELECTION OF ALTERNATIVES	13	Collectively evaluate and interpret the results of the exercise which prepared strategies and actions according to the three indicators within EACH Pressure-State-Response Matrix, i.e. by key issue and MAP all the physical features of the relevant areas of application so that the identified strategies and actions may be placed in context according to each domain.
	14	Develop a number of the land use scenarios or alternatives and evaluate the strategies and actions, and test the objectives against each scenario or alternative.

	15	Select the preferred scenario or alternative in each case (following appropriate procedures for stakeholder involvement and participation), and spatially define the various areas or zones within which the land uses that are supportive of the preferred scenario may be undertaken.
	16	Complete a Monitoring and Management Matrix for each key issue, according to the zone and the domain, in each case as shown in Tables 10.5, 10.6 and 10.7 as follows: – formulate the management regulations in support of the objectives, and the target in each case; and – detail and describe the process and directives necessary in terms of the requirements for monitoring, evaluation and review, to support the attainment of each of the objectives and the targets.
V: SEEK STAKEHOLDER CONSENSUS	17	Review and reaffirm key issues, and where necessary amend accordingly
	18	Review and reaffirm objectives, and where necessary amend accordingly
	19	Review and reaffirm the strategies and actions, and where necessary amend accordingly
	20	Review and reaffirm the management regulations, and where necessary amend accordingly
VI: IMPLEMENTATION MONITORING AND REVIEW	21	Implement the plan.
	22	Monitor progress and compare results in accordance with the policies and objectives.
	23	Evaluate the findings and review the management regulations accordingly.
	24	Review the entire process as scheduled (where necessary review the activities in phases II, III, and IV, and proceed with the activities in phases V and VI), and regularly review and amend the plan, including the monitoring and evaluation process, where necessary.

A model of this process is presented in Figure 9.1.

This system proposes the addressing of a wide range of issues through a continuous and iterative process of public participation and research. Clearly, the results of all these activities are unlikely to coincide. In addition, the initial nature and standard of the information and findings is likely to vary considerably. It is submitted that none of these factors need detract from the validity of this process. It is envisaged that implementation will be a gradual process. Once the point

described in Phase II, Step 5 has been reached and domain areas have been selected, then the process of public participation and research is iterative. As data pertaining to the state of the various aspects and environments is obtained and mapped spatially, sustainabilty thresholds set, and the various indicators are selected and implemented, the results will be capable of informing the land use management and regulation system. For example, the application of the first, single publicly supported indicator may be incorporated into the design and implementation of the management and regulation system. As the process of research, public participation, evaluation and review proceeds over time in respect of both this and other potential indicators, further indicators may be added to the land use management and regulation system to the point where a wide range or set of indicators is continuously being applied, evaluated and reviewed. It is proposed that this process would be initiated as a non-statutory process aimed at guiding and educating the public and land use management practitioners. Once the stage is reached where this process has been refined and has achieved wide spread public acceptance, then it would be appropriate to introduce this system in a statutory role.

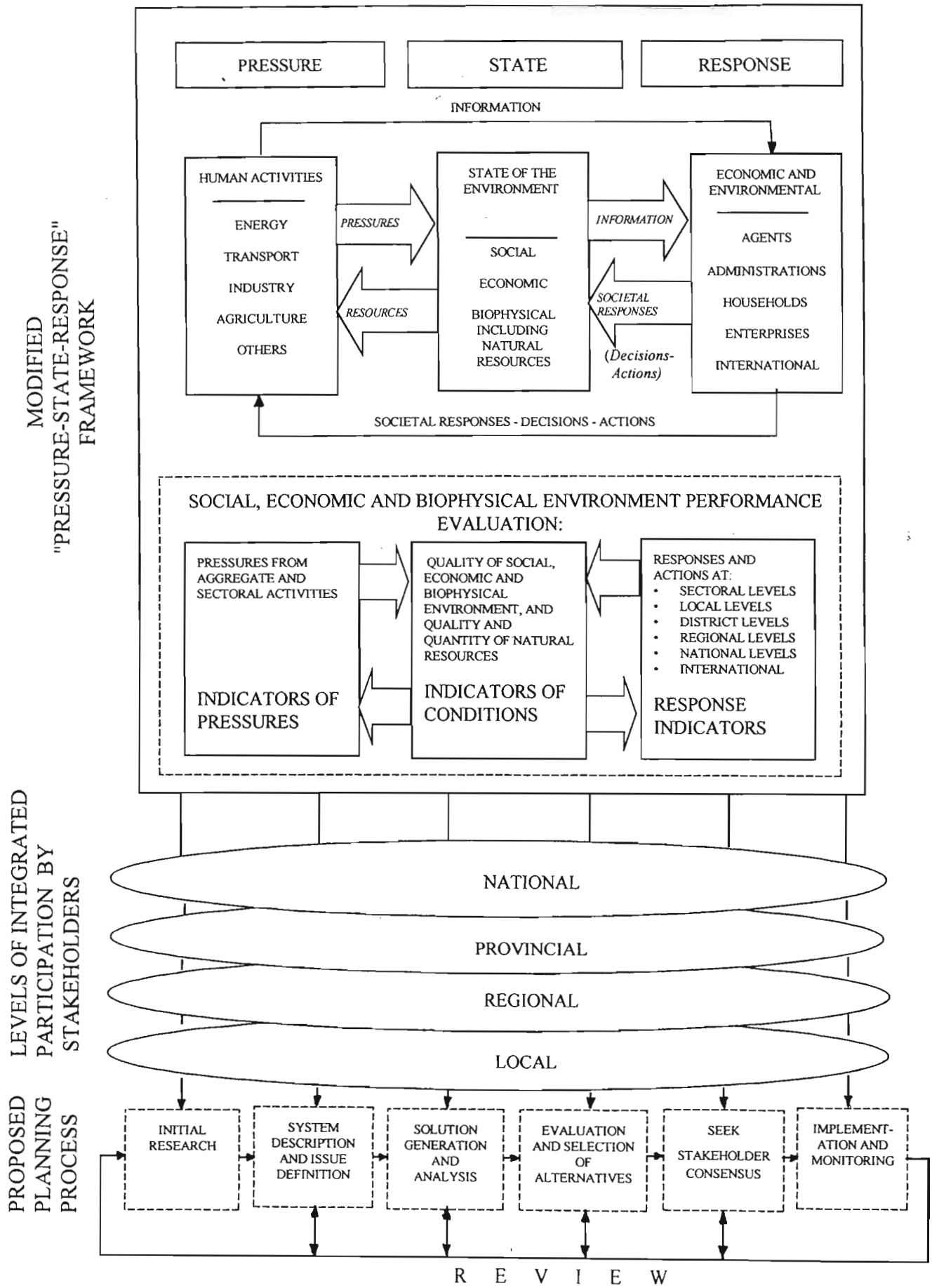


Figure 9.1: A Deterministic Model of the Proposed Integrated Land Use Management and Regulation System for Traditional Land Tenure Areas

9.2 Summary

This method proposes a model founded on the principle of sustainable development, functioning within the context of the original P-S-R model, utilising the state of the environment reporting model, wherein indicators of the performance of the social, economic and biophysical environment are researched and selected using strategic planning and the adaptive management cycle, and requiring the participation and consensus of all stakeholders. The specific advantages of utilising environmental performance indicators are detailed, and a list of policy objectives that may be considered for application within KwaZulu-Natal are developed. The deterministic, integrated approach is compared with the existing approach to urban land use management and regulation. Amendments to the existing planning approach are detailed and a revised deterministic, integrated planning process is proposed initially as a process of guiding and facilitating the public's understanding and acceptance of the process. It is envisaged that this system would play an important role in the statutory management and regulation of land use with traditional land areas.The model proposes a system which aims to:

- encourage the inclusion and integration of the policies and programmes of all public and private agencies;
- strive towards the collective achievement of sustainability as the underlying goal within the planning and plan implementation process;
- develop the capability of measuring the achievement of planning policies, goals and programmes which guide their review and reformulation and thereby strengthens the link between land use planning and land use management; and
- initially guide land use towards sustainability by non-statutory means and later to fulfil a statutory function in this regard.

10. IMPLEMENTATION OF A DETERMINISTIC MODEL FOR INTEGRATED, RURAL LAND USE MANAGEMENT AND REGULATION IN TRADITIONAL LAND TENURE AREAS

10.1 Background to the Theoretical Implementation of the Proposed Model

The proposed methodology has yet to be implemented within South African planning practice. The Southern Maputaland Biosphere Reserve Study (Metroplan 1997) utilised current planning methodology as described and referenced in Table 7.2. The study brief of that initiative specified a reliance on existing research and did not permit the conduct of new research. Instead, that study relied of a significantly expanded community participation element to identify issues and search for planning solutions to the identified problems through local communities. The value of the Southern Maputaland study (Metroplan 1997) to this thesis lies in the findings from community workshops, which identified the perception that certain natural environments had been degraded. In addition, the participants i.e. local inhabitants of the traditional land tenure areas, interpreted this degradation and the shortage of certain widely used natural resources as being the result of unsustainable demand and use. The evidence of poverty, high population densities, socio-economic status and unsustainable resource use within this area has been addressed in Sub-section 6.3. Although it is possible that the combination of these and other factors may play a decisive role in contributing towards the degradation of the environment, the links between poverty, land rights, population density and the unsustainable use of natural resources remain to be fully explored. Even so, the Southern Maputaland study developed a series of planning objectives, strategies and actions which aimed to address these and other concerns, using a process which parallels the current planning approach applied by many planners and researchers in the field of rural planning (Metroplan 1997; Western Australian Planning Commission 1996; 1997a; 1997b; 1998 and 1999).

Concerns with the formulation and presentation of these and many other study objectives and strategies surround issues such as: whether their implementation progress is trackable and the level of achievement is measurable over time; and to what extent these strategies successfully achieve their objectives. Burns expressed this concern in his foreword to the landmark publication: *Evaluation in the Planning Process* (Lichfield, Kettle & Whitbread 1975) by declaring that he had read lists of objectives in plans and planning documents that might just as well never have been written for all the difference they made to the plan. He argued that in many cases the process, technique and measures for the effective evaluation of the performance of these objectives and of the implementation of these plans and their strategies were inadequate. Although the proposed process modelled in this thesis has not yet been practically applied within specific context of land use management and regulation, the merit of this rationale in identifying, testing and applying indicators to measure, monitor and track environmental performance is evidenced in the successful testing and the practical application of this technique within the international field of the state of the environment research (ANZECC 1996; DEST 1996; Walmsley & Pretorius 1996; Department of Environmental Affairs and Tourism 1997; Alexander, Higgins & White 1998; Hamblin 1998; Fairweather & Napier 1998; Manton & Jasper 1998; Newton et al. 1998; Parson et al 1998; Sanders, Margules & Hill 1998; Ward, Butler & Hill 1998). The practical applicability of the findings of this research has been demonstrated by the Organisation for Economic Co-operation and Development (1994; 1997c). In addition, this international research shows that this technique is applicable at all levels,

including: regional, district and local levels, and should therefore be applicable within rural traditional land tenure areas. At a national level, the select set of the national indicators addressed in Sub-section 8.1.3 (the complete set is shown in Appendix B) is currently being tested in the context of the state of the environment programme under the guidance of the National Council of Sustainable Development. The preliminary results of this national state of the environment initiative suggest that the application of social, economic and biophysical indicators is viable at a national level (Walmsley & Pretorius 1996) and examples of four of these indicator reports are presented in Appendix E (Department of Environmental Affairs and Tourism 1997). It is this fact and the demonstrated success at an international level which suggests that this rationale is transferable to the field of planning, for adaptation and use as a key informant of performance, within the proposed integrated land use management and regulation system.

The implementation of the proposed theoretical model has been discussed in terms of a sequential process described in Chapter 9. This process is illustrated using a conceptual example of a traditional land tenure area. While each area may possess certain unique characteristics, it is proposed to select as representative an example as possible. Therefore the following land use and land form characteristics are proposed: certain rural land uses identified in Section 6.2. i.e. Rural - Residential; Agriculture - Small holdings; and Agriculture - Pastoral; together with landforms and terrain that are usually present within such traditional tenure areas such as conservation areas, rivers, wetlands and forest areas. The same conceptual area is shown in Figures 6.1, 10.2 and 10.3 to ensure consistency. In terms of the number and location of traditional authority areas, history has played a role in distributing these areas in a complex interlocking pattern throughout the province (Laband & Thompson 1989) as shown in Appendix F. Therefore while it is not proposed to focus the conceptual example on any one area in particular, it is deemed necessary to note that the social, economic and biophysical attributes of these areas are recognised as being complex and requiring sensitive evaluation and planning (Vanderverre et al. 1989; Metroplan 1994, 1995, 1996; A'Bear, Louw & Mncango 1996; Vaughan & McIntosh 1998). For example the area known as north eastern Zululand and often referred to as Maputaland, which lies at the southern end of the Mozambican coastal plain has spectacular flora and flora, offering a diversity of biota unparalleled elsewhere in South Africa (Bainbridge 1996). The vast tracts of rural land within these traditional land tenure areas has prompted many attempts to promote rural community development through the diversification of agricultural land use and practices (ZAI Inc.1994; Department for Agriculture 1995; Ogg 1995; Metroplan 1997). In addition, these areas are perceived to represent excellent opportunities for investment in ecotourism, as evidenced by the growing investment by the leisure industry within these areas (Metroplan 1997). Many of these initiatives have aimed to create employment and to accelerate development, such as the State's Spatial Development Initiative (SDI) which aims to create development axes through KwaZulu-Natal. The SDI Technical Task Team focussed attention on the creation of an agriculture and tourism led economic development and employment creation within a number of these traditional land tenure areas (Spatial Development Initiatives Technical Task Team 1997). However, the lack of any form of land use management or regulation system within these areas has given rise to concerns regarding the possible negative impact of large scale unregulated land use and development on the social, economic and biophysical environments. The Southern Maputaland SDI traverses some ten traditional land tenure areas where no land use management system exists. This north eastern Zululand area experiences low levels of services and social support infrastructure, while the per capita income

levels of the inhabitants of the Traditional land tenure areas are of the lowest in South Africa (Metroplan 1997; DBSA 1994). Moreover, the area is characterised by a high degree of failure in community development initiatives, and research (Kiss 1990; Wells, Brandon & Hannah 1992; Wells & Brandon 1993; IIED 1994; A'Bear 1996; Metroplan 1996, 1997) suggests that to be successful within a traditional tenure area, a development initiative must address and balance the following challenging interests:

- the complex and often competing interests of the various sectors of the local communities;
- the aspirations of the private, institutional and/or government funders' of the initiative; and
- the need to minimise the environmental impact of the various initiatives within the context of sustainable resource use.

The Southern Maputaland study (Metroplan 1997) employed an equity planning approach within a strategic context. Data was gathered through a rigorous stakeholder participation exercise including more than 50 community meetings involving many hundreds of tribal community members. A list of stakeholders of the conceptual area is shown in Table 10.1.

Table 10.1 : Stakeholders of a Conceptual Traditional Land Tenure Area

- Inhabitants
- Land owners
- Traditional and community Authorities
- Organised agricultural Associations
- Organised Commerce and Industry
- Organised Tourism Associations
- Tourism and Conservation Development Partnerships
- Non-government Organisations, societies, special interest groups, community-based organisations and informal agricultural, commerce and industry and tourism organisations
- Local Transitional Councils
- State, provincial, Regional and Local Government Departments and agencies
- Service Providers (both private, State and Parastatal* agencies)

*Example: KwaZulu-Natal Nature Conservation Service

The area possesses natural resources of inestimable value to tourism in general and in terms of its ecotourism potential in particular, and the unique biogeographic resources of Maputaland represent a national heritage of the greatest conservation and scientific significance (Bainbridge 1996). In contrast, the area possesses relatively low agricultural potential, by virtue of extensive areas having marginal soils and limited water supplies (Metroplan 1997). The fragile economic, social and natural environments which typify rural Maputaland's physical environment makes it particularly sensitive to the threat of overexploitation. The study assembled a formidable data set of the type usually developed during such studies, and developed a comprehensive strategic framework of subregional policy goals, together with supporting objectives and actions, detailing for each action, the initiator and the agency responsible for implementation and financing in each case. In addition, the study described and recommended a specific institutional structure to co-ordinate the plans implementation, and a system of land use zoning, broadly based on the current urban-style regulation system. An extract of this system is shown in Appendix A. A map of the north eastern Zululand (often referred to as Maputaland) area is shown in Figure 10.1.

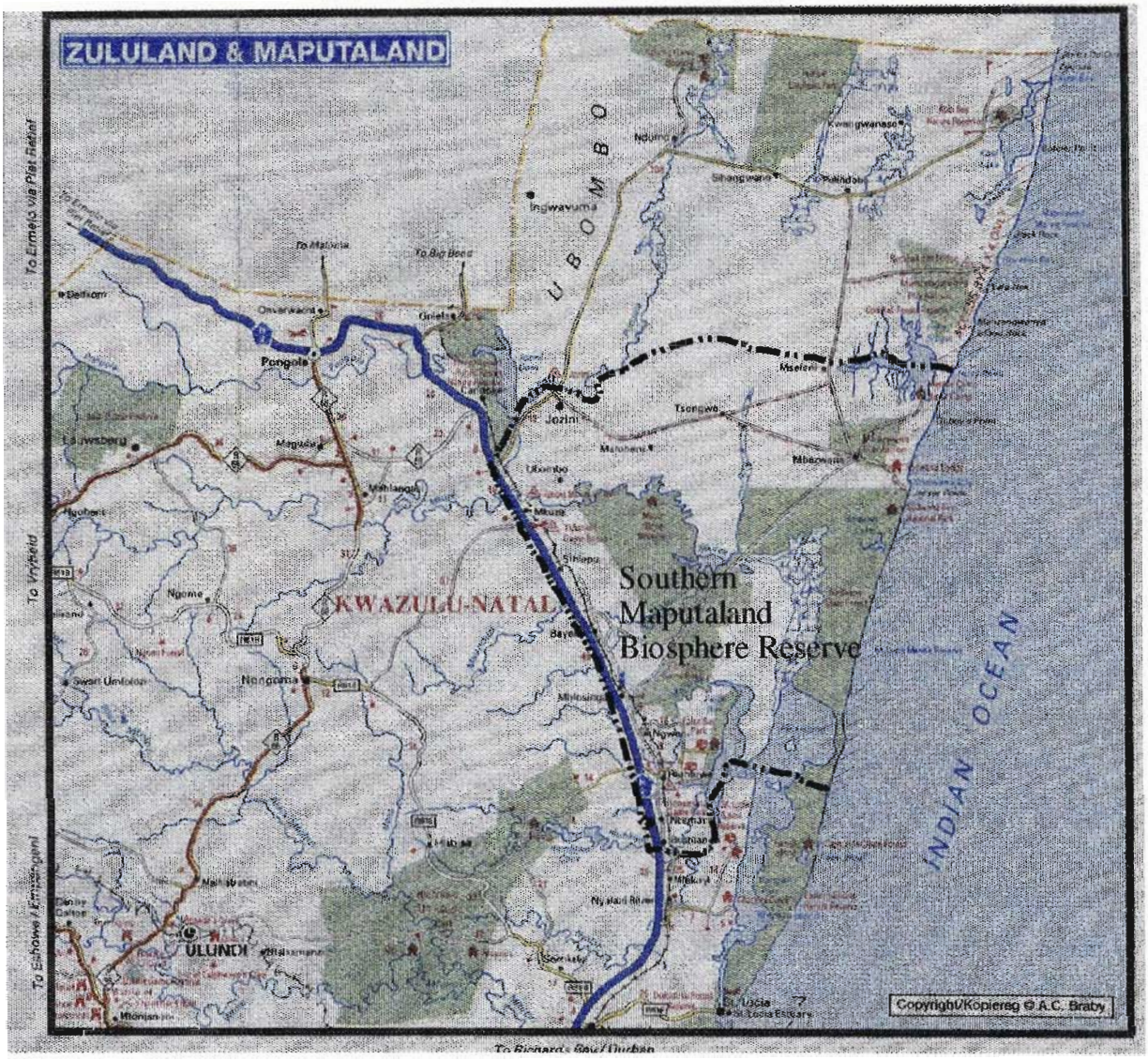


Figure 10.1: North Eastern Zululand, including the Southern Maputaland Biosphere Reserve

In order to demonstrate the sequential integrated, deterministic process as proposed in Chapter 9, the proposed planning process has been applied to a conceptual traditional land tenure area, hereafter referred to as the study area. The step-by-step implementation process is addressed in Section 10.2 below.

10.2 Proposed Methodology

The methodology comprises the six planning phases and twenty four steps as outlined in Section 9.1 and presented in Table 9.2, as follows:

PHASE I: INITIAL RESEARCH

Step 1: *Undertake broad-based research in respect of the study or problem area, including the assembly of relevant documents and data pertaining to the topic and identification of stakeholders.*

PHASE II: SYSTEM DESCRIPTION AND ISSUE DEFINITION

Step 2: *Identify and describe the systems and system processes, including problems, issues, issues, needs, opportunities and assumptions.*

To facilitate the later classification and formulation of the objectives, each issue should succinctly identify a single aspect, rather than a combination of aspects. This entails a strategic approach which requires the identification of the study area's key issues. The first vital step in this process is to embark on an inclusive exercise whereby all stakeholders, and the local community or inhabitants in particular, participate in a comprehensive exercise of identifying and verifying the key issues, i.e. the problems and needs relevant to the study area.

Step 3: *Classify or group the key issues, by cross-tabulation, and list the various key issues into broad programme areas according to the national (or provincial, regional or local) policy programmes in each case.*

In order to illustrate this conceptual example, programme titles have been selected from the wide range of examples developed under the United Nations Conference on Environment and Development (UNCED 1993) Agenda 21 initiative. A selection of these programmes is presented as follows:

AGENDA 21	POLICY PROGRAMME
CHAPTER 3	Eradication of poverty;
6	Protecting and promoting human health;
7	Promoting sustainable human settlement development;
8	Integrating environment and development in decision-making;
10	Integrated approach to the planning and management of land resources;
14	Promoting sustainable agriculture and rural development;
17	Protection of all oceans, seas, coastal areas, and the protection and rational use and development of their living resources; and
21	Environmentally sound management of solid wastes and sewage related issues.

For example: the following conceptual key issues are identified and cross-tabulated under the appropriate Programme, as follows:

PROGRAMME	KEY ISSUE
Eradication of poverty	High levels of unemployment and low levels of income amongst local inhabitants
Protecting and promoting human health	High levels of ground and surface water pollution within the subregion.

Step 4: *Convert each of the key issues into preliminary objectives in support of each Programme.*

For example, the corresponding conceptual key issues listed in Step 3 have been converted into Programme objectives as follows:

(i) To facilitate an appropriate increase in employment and income levels within the subregion.

(ii) To identify and contain contamination of inland waters (both surface and groundwater) by bacterium in the Family *Enterobacteriaceae,* particularly by faecal coliforms (such as *Escherichia coli*) and faecal streptococci (enterococci) such as *Streptococci faecalis*, *S. gallinarium* and *S. avium*, that would impact on humans, at levels below national guidelines or established environmental criteria, by 2002, while preventing the pollution by new sources.

For example:

PROGRAMME	KEY ISSUE	PRELIMINARY PROGRAMME OBJECTIVE
Eradication of poverty	High levels of unemployment and low levels of income amongst inhabitants of the subregion	To facilitate an appropriate increase in employment and income levels within the subregion.
Protecting and promoting human health	High levels of ground and surface water pollution within the subregion.	To identify and contain contamination of inland waters (both surface and goundwater), particularly by faecal coliforms (such as *Escherichia coli*) and faecal streptococci (enterococci), that would impact on humans, at levels below national guidelines or established environmental criteria, by 2002, while preventing the pollution by new sources.

Step 5: *Establish and define the domains for the study area, and cross- tabulate the key issues according to the respective objective for each domain.*

The national Subcommittee on Sustainable Development, has selected a number of issues, under four domains, namely social indicators; economic indicators; institutional indicators; and environmental indicators (Department of Environmental Affairs and Tourism1997). The focus in the initial South African selection is orientated towards the needs of a developing country, while the OECD domains adopted by developed countries such as Australia are understandably orientated and guided by those countries *state of the environment* research. It is proposed to illustrate the selection of Programmes by using a combination of the CSD's South African domains and the domains adopted in the course of OECD research. The following ten domains have been developed with wide international collaboration, and have been applied globally, namely:

- Social aspects;
- Economic aspects;
- Institutional aspects (Department of Environmental Affairs and Tourism 1997);
- the land;
- inland waters;
- estuaries and the sea;
- human settlements;
- natural and cultural heritage;
- biological diversity (biodiversity); and
- the atmosphere (DEST 1996).

Examples of these domains are described as follows:

(i) SOCIAL ASPECTS: The social aspects of a developing country differ significantly from that of a developed country. Therefore, the locally selected aspects which have been selected are derived directly from the Agenda 21, and address developing country aspects such as: combatting poverty; and protecting and promoting human health;

(ii) ECONOMIC ASPECTS: The aspects relating to economics are similarly orientated towards a country with a developing economy, and include: changing consumption patterns; and International co-operation to accelerate sustainable development in countries and related domestic policies;

(iii) INSTITUTIONAL ASPECTS: The institutional aspects include: integrated environment and decision-making; and Information for decision-making (Department of Environmental Affairs and Tourism 1997);

(iv) THE LAND: Land resources are defined as those terrestrial features that exist above mean sea level. They include the landforms that compose the landscape elements, the soils developed from the regolith, or weathered rock zone, together with the vegetational cover and faunal biomas (including human population)

supported by this. From an economic or political viewpoint, land resources contain mineral and fossil fuel deposits, potential natural and farmed timber harvests, crops, animals and fish;

(v) INLAND WATERS: Defined as the surface and underground water resources not associated with the seas (thus excluding estuaries and coastal lagoons). Such waters may be permanent or temporary and constitute important inland ecosystems, including: wetlands, rivers, lakes, streams, aquifers, ponds and flood plains;

(vi) SEAS AND ESTUARIES: At present oceans and estuaries are subjected to multiple uses, operating within may jurisdictions and within multiple forms of management. The national coastal zone policy initiative seeks to initiate integrated management within an eco-system management framework. It is therefore important that the proposed planning approach be considered for possible inclusion within that integrated framework;

(vii) NATURAL AND CULTURAL HERITAGE: Heritage sites and heritage objects have been defined in the literature (Pearson et al. 1998). Heritage sites are those natural and cultural sites, structures, areas or regions that have 'aesthetic', historic, scientific or social significance or other special value for future generations as well as for the present community. Heritage objects are those which provide material evidence of the country's natural and cultural life and biophysical evolution. They may be *in situ* at significant sites or held in collecting institutions, archives, libraries, museums, galleries, zoos, herbaria, botanic gardens, or historic buildings. Intangible aspects may underpin natural and cultural heritage, for example, sites and objects may have heritage significance because of the meanings that people attach to them. Therefore, they may reflect the values of their times;

(viii) HUMAN SETTLEMENTS: The process of urbanization and settlement has an ongoing impact on the natural environment, through the resources used by urban areas, and through the pollutants and waste generated through the activities of large concentrations of people. In the rural context there are a wide range of settlement types, which vary in terms of location, size, land ownership, role and function, population density or land use intensity, land use composition, socio-economic factors, etc. These characteristics of human settlement exhibit varying impacts in terms of the social, economic and natural environments. Judicious planning aims to reduce these impacts while at the same time enhancing livability on the Land (Von Weizsacker, Lovins & Lovins 1997 cited in Newton *et al.*1998; DEST 1996);

(ix) BIODIVERSITY: Biodiversity provides the critical ecosystem processes that make life possible, and healthy functioning ecosystems are necessary to maintain the quality of the atmosphere and to maintain and regulate the climate, fresh water, soil formation, cycling of nutrients and disposal of wastes. The definition of biodiversity is the variety of all life forms - the different plants, animals and

micro-organisms, the genes they contain and the ecosystems of which they form part;

(x) ATMOSPHERE: The focus on atmospheric indicators is on human health, rather than atmospheric impacts on ecological systems. While regional, district and local scale of this study focusses of the measures of air quality driven by local rather than national or global factors, the major difference between these two extremes of the scale is the life-time of the atmospheric pollutants that lead to pressures on the associated systems. For example smoke, sulphur dioxide and lead emissions are short lived compared with the principle effects of the greenhouse gases, but their effect can be equally devastating to the systems and the organisms which both directly and indirectly depend on them. The possible impact of the location of a paper pulp mill, an aluminium smelter or a sugar refinery is therefore important in this context. Each of these domain areas should be identified and delimited in the context of the region, district or local study area, and the key issues should be identified in terms of their relationship with each of the various domains;

Step 6: *Identify and list key indicator categories that are supportive of each domain.*

The South African examples of key indicator categories have not been developed beyond the Agenda 21 list. However, Australian environmental indicator research (DEST 1996, Hamblin 1998; ANZECC 1996; Ward, Butler & Hill 1998; Fairweather & Napier 1998; Sanders, Margules & Hill 1998; Manton & Jasper 1998; Newton et al.1998; Pearson et al. 1998; Alexandra, Higgins & White 1998) has identified a complex framework of domains and related key indicator categories. These two sets of key indicator categories can be combined to form a useful framework for application in KwaZulu-Natal as follows:

DOMAIN CATEGORY	KEY INDICATOR CATEGORY
Human Settlements	Energy; Water; Settlement design; Transport and accessibility; Population; Housing; Environmental health; Noise; Waste.
Social Aspects	Poverty; Unemployment; Demographic Dynamics; Human Health; Human Resources Development.
Inland water	Groundwater; Human health; Environmental water quality; Surface water quality; Physical change; Biotic habitat quality; Effective management.

Step 7: *Classify, by cross-tabulation, the key indicator categories according to the previously identified objectives for each of the Programmes, and according to each domain.*

For example:

PROGRAMME	DOMAIN	KEY ISSUE	PRELIMINARY PROGRAMME OBJECTIVE	KEY INDICATOR CATEGORY
Eradication of poverty	Social aspects	High levels of unemployment and low levels of income amongst inhabitants of the subregion	To facilitate an appropriate increase in employment and income levels within the subregion.	Unemployment
Protecting and promoting human health	Inland water	High levels of ground and surface water pollution within the subregion.	To identify and contain contamination of inland waters (both surface and groundwater), particularly by faecal coliforms (such as *Escherichia coli*) and faecal streptococci (enterococci), that would impact on humans, at levels below national guidelines or established environmental criteria, by 2002, while preventing the pollution by new sources.	Groundwater quality

A *key indicator category* may appear under a number of Programmes and Domains depending on their nature. For example, under the domains inland water and biodiversity, the *key issue* may be environmental water quality, which would relate to specific environmental indicators such as the pH, or the amount of dissolved oxygen, that would impact on the environmental health, i.e. aquatic fauna and flora, of a surface water resource.

Step 8: *Initiate the preparation of a Status Report for each issue by Programme and by Domain.*

This report is to be prepared in three stages, namely: according to the procedures described in this Step and in Steps 9 and 10. The first phase in this approach is to initiate the preparation of a report for each of the Key Issues identified in Step 2, by programme and by domain identified in Step 5 (refer to Tables 10.2 and 10.3), through the following:

- list the preliminary objective as prepared in Step 4; and
- identify and list the Key indicator category as identified in Step 6.

Step 9: *On completion of the first phase of the preliminary Status Report, the second phase entails the reassessment and review of the preliminary objective.*

This Step is proposed to ensure the preliminary objective's continued validity in respect of the process and that it remains in support of the procedures for the collection, analysis and synthesis of the data, and for the purposes outlined in Steps 4 to 7 above.

PHASE III: SOLUTION GENERATION AND ANALYSIS

Step 10: *Select a set of initial or proto-indicators and the proto-targets to serve or support each issue and objective.*

This is the third phase of the Status Report which entails the iterative participation of the public in the design and implementation of the processes and research required for the selection of indicators as described in Chapter 8. This includes the selection and testing of proto-indicators and proto-targets for each Key Issue, according to each domain and for each programme. This selection is to include the three areas, namely: *Pressure indicators*; *State indicators* and *Response indicators* in each case. The following characteristics should be recorded (Refer to Tables 10.2 and 10.3) :

- description of indicator;
- rationale;
- means of analysis and interpretation;
- description of the proposed monitoring strategy;
- description of the reporting period or scale;
- description of the expected content and format of the output or result;
- description of the expected or identified data sources; and
- identification and description of the links between this and other indicators, in this and other domains.

Environmental indicators are physical, chemical, biological, social, economic or institutional measures that best represent the key elements of a complex institutional, economic, social or ecological issue. To be effective, an indicator should not be seen in isolation, but form part of a well-developed, integrated interpretive framework of indicators, which is capable of addressing the whole environment, rather than just a component thereof, and has meaning well beyond the measure of a single indicator, or subset, in isolation. Where appropriate, each set should include the following:

- indicators that describe the cause of the *state* or *condition* of all important elements at each level within the relevant systems;
- indicators of the extent of the major *pressures* exerted; and
- indicators that describe the *responses* to either the *state* or to changes in the state of the systems and their elements brought about by the strategies and actions (DEST 1996).

Research has demonstrated that the assembly of the information detailed in Step 8 into status report (DEST 1996, Hamblin 1998; ANZECC 1996; Ward, Butler & Hill 1998; Fairweather & Napier 1998; Sanders, Margules & Hill 1998; Manton & Jasper 1998; Newton et al.1998; Pearson et al. 1998; Alexandra, Higgins & White 1998) guides the indicator selection process. The process of identifying indicators and targets is iterative, and begins in Step 8 with the selection of the key indicators categories. An environmental status report is prepared for each issue, according to each Domain and for each Programme. However, it may not always be possible to identify measurable indicators in all three instances, i.e. in some cases only one or two of either the pressure, state or response indicators may be capable of application. These indicators and targets would be based initially on desk-top research using the available literature and research records. However, the data requirements should not be so large as to be unwieldy. Rather, a set of proto- indicators should represent the minimum set which, if rigorously applied and monitored, will describe the condition, trends, and impacts on social, economic and ecological systems.

The following represent the aims of the process whereby the state of the environment is measured and evaluated in the identification of appropriate environmental indicators:

- determine and select standards and benchmarks relating to the social, natural and economic environment;
- assess of the state of the environment relative to the selected standards and benchmarks, using the environmental indicators.
- identify the nature, location and extent of the pressures exerted on the environment
- identify appropriate response mechanisms;
- formulate policies, strategies and design of action plans
- implement and manage the response mechanisms (DEST 1996).

The aims of each environmental indicator has been determined as follows:

- to ensure that each indicator is rigorously defined and is measurable and clearly within an interpretive framework comprising all indicators;
- to identify suitable monitoring strategies for each indicator, including measuring techniques, appropriate temporal and spatial scales for measurement and reporting, data storage and presentation techniques, and appropriate geographical monitoring;
- to identify relevant data sources for each indicator; and to define information that is needed to properly interpret the behaviour of the indicators (DEST 1996).

Recent research (Hamblin 1998) has recommended the following criteria to guide indicator selection. Each indicator should:

- serve as a robust indicator of environmental change;
- reflect a fundamental or highly valued aspect of the environment;
- be either national in scope or applicable to regional environmental issues of

national significance;

- provide an early warning of potential problems;
- be capable of being monitored to provide statistically verifiable and reproducible data that show trends over time and, preferably, apply to a broad range of environmental regions;
- be scientifically credible;
- be easy to understand;
- be monitored regularly with relative ease; be cost-effective;
- have relevance to policy and management needs;
- contribute to monitoring of progress towards implementing commitments in nationally significant environmental policies;
- where possible and appropriate, facilitate community involvement;
- contribute to the fulfilment of reporting obligations under international agreements;
- where possible and appropriate, use existing commercial and managerial indicators; and
- where possible and appropriate, be consistent and comparable with other countries' and national, provincial and regional indicators.

However, the selection and use of environmental indicators does not remain static, and it is recommended (DEST 1996) that a reassessment be conducted at regular, scheduled intervals, as follows:

- re-assess, at regular intervals, the state of the environment relative to the selected standards and benchmarks, using the environmental indicators;
- evaluate the efficacy of the response mechanisms, and the policies, strategies and action plans which underpin these mechanisms;
- redesign and/or amend/adjust the response mechanisms, and, where appropriate, the policies, strategies and action plans; and
- re-implement and manage the response mechanisms of the Programme towards the achievement of their goals and objectives, within the context of sustainable development.

A useful tool in this research and definition process in respect of each of the indicators is the preparation of status reports. Tables 10.2 and 10.3 represent an example of the approach followed in the recent compilation of such status reports (Fairweather, Gillian & Napier 1998) and has been adapted to illustrate this reporting phase for individual environmental indicators. By way of example, the Status Report No. 1, addresses a physical characteristic which is more obvious from a spatial point of view, and the second example, Status Report No. 2, addresses a socio-economic characteristic.

Table 10.2: Environmental Status Report and Indicator Selection - No. 1 (Modified after DEST 1996)

PROGRAMME:	Protecting and promoting human health
DOMAIN:	Inland water
KEY ISSUE:	High levels of ground and surface water pollution within the subregion
OBJECTIVE (Preliminary):	To identify and contain contamination of inland waters (both surface and groundwater) by bacterium in the Family *Enterobacteriaceae*, particularly by faecal coliforms (such as *Escherichia coli*) and faecal streptococci (enterococci) such as *Streptococci faecalis, S. gallinarium* and *S. avium*, that would impact on humans, at levels below national guidelines or established environmental criteria, by 2002, while preventing the pollution by new sources.
KEY INDICATOR CATEGORY:	Groundwater quality.
TARGET:	To contain the *E.coli* count in ground and surface water samples to below: 1) Department of Health and Population Development limits by the year 2002; and 2) World Health Organisation limits by the year 2004.
STATE INDICATOR IDENTIFICATION	
State Indicator:	Proportion of settlements served or reliant on contaminated ground or surface water supply, identified per quarter, during a continuous monitoring programme.
Description:	The extent and severity of contamination depends on the source of the contamination, the land uses in the catchment areas, and the effectiveness of the pollution controls, if any exist. This indicator provides a measure of the proportion of the population that has access to uncontaminated water for consumption and general living purposes. This includes water for drinking, cooking, bathing, washing, garden watering, etc.
Rationale:	In remote areas and small rural settlements, the provision of treated water to dwellings may be limited. This is due primarily to cost, and resource/environmental limitations. Due to the high cost of treated water provision to remote and dispersed settlements, the inability to provide treated water to all settlements may have a negative impact on the health, hygiene and general living standards of those settlements.
Analysis and Interpretation:	Analysis and interpretation may be performed to determine whether any correlations exist between settlements without treated water supplies and health problems. It may also be useful in identifying whether settlements without treated water supply are the result of geographic or economic impediments.
Monitoring Strategy:	Monitoring should be carried out across all settlements within the region, as it is expected that the more remote the settlement, the less likely it is to be connected to treated water supplies. In the event that this is prohibitively costly, sample settlements may be identified that are representative of the various areas.
Reporting Scale:	This indicator should be measured on a 6-monthly basis, and reported on a ward, Tribal Authority, district and regional basis.
Output:	Tabulation and spatial mapping of population with access to contaminated water
Data Source:	(i) Surveys of the location and depth of boreholes, wells and open water sources in area using unsealed pit latrines, to determine and map: - the height of the watertable during the high rainfall period, and - the existence and extent of contamination of the groundwater; and (ii) the proportion of settlements served with treated water should be obtainable from the regional government and water authorities.

Links to Other Indicators:	This indicator may also be linked to the indicator measuring the supply of treated water to settlements, and water quality guidelines for the suite of bacteriological and chemical water quality.
PRESSURE INDICATOR IDENTIFICATION	
Pressure Indicator:	The number of contamination point sources identified per quarter, during a continuous monitoring programme.
Description:	This indicator provides a measure of the number and type of point sources of contamination, such as unsealed pit latrines.
Rationale:	In rural settlements within Traditional tenure areas, a high proportion of human waste is disposed of into pit latrines that leach directly into the groundwater and into open water sources. This same water is extracted from boreholes, wells and open water areas and utilised by the inhabitants in it's untreated state. This form of pollution is particularly prevalent in areas where the watertable is close to the surface and the waste disposal source.
Analysis and Interpretation:	Analysis and interpretation may be performed to determine whether any correlations exist between settlements without treated water supplies and health problems. It may also be useful in identifying whether settlements without treated water supply are the result of geographic or economic impediments.
Monitoring Strategy:	Monitoring should be carried out across all settlements within the region, as it is expected that the more remote the settlement, the less likely it is to be connected to treated water supplies. In the event that this is prohibitively costly, sample settlements may be identified that are representative of the various areas.
Reporting Scale:	This indicator should be measured on a 6-monthly basis, and reported on a ward, Tribal Authority, district and regional basis.
Output:	Tabulation and spatial mapping of contamination point sources.
Data Source:	Surveys of the location and depth of boreholes, wells and open water sources in area using unsealed pit latrines, to determine and map: – the height of the watertable during the high rainfall period, and the existence and extent of contamination of the groundwater; and – the proportion of settlements served with treated water should be obtainable from the regional government and water authorities.
Links to Other Indicators:	This indicator may also be linked to the indicator measuring the supply of treated water to settlements, and water quality guidelines for the suite of bacteriological and chemical water quality.
RESPONSE INDICATOR IDENTIFICATION	
Response Indicator:	The measure which indicates the response to the process being implemented, i.e. to the strategies and actions, for example: A change in the status of the proportion of settlements served or reliant on contaminated ground or surface water supply.
Description:	The regional government authority should develop a policy for the protection of surface and groundwater resources. Pit latrines, particularly those located in areas with high watertables, are the most prevalent and serious contaminant points. This indicator provides a measure of the proportion of the existing contamination points which have been converted to sealed or protected points, compared with the proportion of existing and new unprotected points over time.
Rationale:	This indicator measures the trend in the provision of pit latrines, particularly in high watertable areas.

Analysis and Interpretation:	Determine whether any correlations exist between (i) the results of the measure of response and those of the pit latrine replacement/protection programme, and (ii) the proportion of sealed point sources and the extent of the pollution of ground and surface water sources. This information is likely to provide an insight into identifying the most important point source of water contamination.
Monitoring Strategy:	Monitoring should be carried out across all settlements within the region.
Reporting Scale:	This indicator should be measured on a 6-monthly basis, and reported on a ward, Tribal Authority, district and regional basis.
Output:	Tabulation and spatial mapping of proportion of the protected points with the existing/remaining points of contamination.
Data Source:	Surveys of the proportion of unsealed pit latrines, compared with the proportion of unprotected points of contamination of the groundwater should be obtainable from the regional government or the implementing agency.
Links to Other Indicators:	This indicator may also be linked to the indicator measuring the supply of treated water to settlements, and water quality guidelines for the suite of bacteriological and chemical water quality.
Implications:	Besides the human impacts of contamination, there are considerable implications for ecological impacts. Severe contamination of surface water resources can the decline in the health and diversity of vegetation, and extreme concentrations can cause death of plants and animals.

A similar report developed in a social or economic context is shown in Table 10.3 below.

Table 10.3: Environmental Status Report and Indicator Selection - No. 2 (Modified after DEST 1996)

PROGRAMME:	Eradication of poverty
DOMAIN:	Social aspects
KEY ISSUE:	High levels of unemployment and low levels of income amongst inhabitants of the subregion.
OBJECTIVE (Preliminary):	To facilitate an increase in employment and income levels within the subregion.
KEY INDICATOR CATEGORY:	Unemployment
TARGET:	Increase formal and informal employment to levels of 20% of the eligible population.
STATE INDICATOR IDENTIFICATION	
State Indicator:	Proportion and location of unemployed person relative to the location and availability of existing employment opportunities.
Description:	The location, household identity and socio-economic characteristics of each household is available on a Medical research Institute GIS data base. However, the location and extent of employment opportunities is unknown.
Rationale:	This information can assist in the more efficient and effective allocation of resources aimed at developing entrepreneurial skills and assisting in the incubation, development and support of small business opportunities.
Analysis and Interpretation:	The information provided via the pressure-state-response indicators, together with the results of data integration and analysis can inform a structured programme of entrepreneurial skills development and small business initiation, development and support could significantly improve the economic situation within this subregion.
Monitoring Strategy:	Monitoring should be carried out across the entire subregion, as it is expected that the more remote the settlement, the less likelihood of the inhabitants possessing entrepreneurial skills, and having access to small business support services.
Reporting Scale:	This indicator should be measured on a 6-monthly basis, and reported on a ward, Tribal Authority, district and regional basis.
Output:	Tabulation and spatial mapping of unemployed and employed population relative to the location and extent of employment opportunities.
Data Source:	(i) Surveys of the location and socio-economic characteristics of both the employed and unemployed members per household; (ii) Surveys of the proportion of employed to the unemployed per household(dependency ratio).
Links to other Indicators:	This indicator may also be linked to the indicator measuring the income per capita and per household
PRESSURE INDICATOR IDENTIFICATION	
Pressure Indicator:	The proportion of persons unemployed by location.
Description:	This indicator provides a measure of the dependancy ratio per location
Rationale:	The dependancy ratio provides important indicator of the level of economic well-being.
Analysis and Interpretation:	Analysis and interpretation may be performed to determine whether any correlations exist between the location of unemployed persons and their location relative to other aspects such as to services infrastructure, to markets, to large income generators, etc.

Monitoring Strategy:	An audit of all settlements within the region should be conducted to ascertain the impact of , as it is expected that the more remote the settlement, the higher the dependancy ratio. The regional government should develop and implement a strategy and programme to develop entrepreneurial skills in the local inhabitants, and in initiating, incubating and supporting small business opportunities.
Reporting Scale:	This indicator should be measured on a 6-monthly basis, and reported on a ward, Tribal Authority, district and regional basis.
Output:	Tabulation and spatial mapping of the dependancy ratio using isolines.
Data Source:	Surveys of the proportion and location of unemployed persons would need to be specifically designed and undertaken; – Socio-economic data such as family/dependant size, income per household is available from the Medical Research Institute; and – Surveys of the location and characteristics of locations of employment would need to be specifically designed and undertaken.
Links to Other Indicators:	This indicator may also be linked to the indicator measuring the income per capita and per household.
RESPONSE INDICATOR IDENTIFICATION	
Response Indicator:	The measure of the location and number of new jobs and businesses created.
Description:	This measure indicates the response to the process being implemented, i.e. to the entrepreneurial skills training and small business support strategies and actions.
Rationale:	This indicator measures the trend in the provision of pit latrines, particularly in high watertable areas.
Analysis and Interpretation:	As above.
Monitoring Strategy:	Monitoring should be carried out across all settlements within the region.
Reporting Scale:	This indicator should be measured on a 6-monthly basis, and reported on a ward, Tribal Authority, district and regional basis.
Output:	Tabulation and spatial mapping of the proportion and the of number of new jobs and businesses created to the number and location of existing employment locations and businesses.
Data Source:	Surveys of the proportion of unsealed pit latrines, compared with the proportion of unprotected points of contamination of the groundwater should be obtainable from the regional government or the implementing agency.
Links to Other Indicators:	This indicator may also be linked to the indicator measuring This indicator may also be linked to the indicator measuring the income per capita and per household.
Implications:	The development of business skills creation of employment and business opportunities can relieve some of the pressure on the demand for resources from the environment, and can increase the mobility of the population to areas where these skills are required.

Step 11: *Identify and allocate responsibilities for the design and implementation of the methodologies for data collection, analysis and synthesis.*

The responsibility for the co-ordination of the collection, analysis and synthesis of the entire environmental indicator programme would ideally rest with the agency or agencies possessed with the statutory responsibility for the management and regulation of land use and development, i.e. at the national level: the National Department for Environmental Affairs and Tourism. While at the provincial level, the provincial Department for Local Government and Housing would take responsibility. It is proposed that the responsibility for the individual domain research areas would be held by the relevant government departments or specialist agencies currently responsible for these areas, or alternately a combination of those departments and agencies that possess the specialist expertise and capacity. An example of the allocation of these responsibilities is shown below:

DOMAIN RESEARCH AREA	***RESPONSIBLE DEPARTMENT OR AGENCY***
Social Aspects	National Dept. of Health and Welfare; and Provincial Dept. of Health; and Provincial Dept. of Local Government and Housing
Economic Aspects	National Dept. of Environmental Affairs and Tourism; and Provincial Dept. of Economic Affairs and Tourism; and Provincial Dept. of Local Government and Housing
Institutional Aspects	National Dept. of Health and Welfare; and Provincial Dept. of Health; and Provincial Dept. of Local Government and Housing
The Land	National Dept. of Environmental Affairs and Tourism; and Provincial Dept. of Local Government and Housing; Provincial Department of Agriculture; and KwaZulu-Natal Nature Conservation Service (Via Provincial Dept. of Traditional Affairs and the Environment)
Inland Waters	National Dept. of Water Affairs and Forestry; and KwaZulu-Natal Nature Conservation Service (Via Provincial Dept. of Traditional Affairs and the Environment)
Estuaries and the Sea	National Dept. of Environmental Affairs and Tourism; and KwaZulu-Natal Nature Conservation Service (Via Provincial Dept. of Traditional Affairs and the Environment)
Human Settlements	Provincial Dept. of Local Government and Housing
Natural and Cultural Heritage	Provincial Dept. of Local Government and Housing; and KwaZulu-Natal Nature Conservation Service (Via Provincial Dept. of Traditional Affairs and the Environment)
Biological Diversity	KwaZulu-Natal Nature Conservation Service (Via Provincial Dept. of Traditional Affairs and the Environment)
Atmosphere	National Dept. of Environmental Affairs and Tourism

Step 12: *Design and implement the data collection, analysis and synthesis methodology in detail to address each issue, in accordance with the procedure described in each of the status reports.*

Utilising the approach shown in the previous examples to guide the preparation of status reports in each case, the responsible agency would design the data collection and analysis for each Programme, by Domain, in order to address each key issue. For example: in the case of the domain - Inland Water, key issues may include the following: high levels of ground and surface water pollution; and receding surface water supplies. The responsible department or agency would establish the data required and would collect, analyse and synthesise these data through a series of iterations. These data are to be entered into the Pressure-State-Response Matrix for each key issue (an example is shown in Table 10.4). This process would include a systematic approach to the revision of the preliminary objectives, the formulation of the strategies and actions required to meet the target or threshold, the testing and verification of the proto-indicators and proto-targets for each issue, and incorporates a process of adaptive management described in section 8.2.5 and illustrated in Figure 8.9. This adaptive management method follows a process of strategic interventions during which the proposed strategies and actions are tested and reformulated over time, through a series of iterations, until the appropriate result is obtained. The following example represents a single iteration of the process of preparing the Pressure-State-Response Matrix for each key issue as shown in Table 10.4:

(i) Identify the pressure indicator;
(ii) Identify the indicator of the condition or state;
(iii) Insert the objectives as converted from the key issues;
(iv) Set the target or thresholds, in each case, which must be achieved if these objectives are to be met and issues satisfactorily addressed;
(v) Formulate the strategy/ies and actions necessary to achieve the target in terms of the objectives;
(vi) Identify and where necessary, develop a measure which indicates the appropriateness of the process/es to be implemented, i.e. the environmental indicator, referred to as the response indicator in terms of the P-S-R model;
(vii) Prepare a spatial representation of the location or area where these measures are to be applied;
(viii) Implement these strategies through a series of successive and iterative periods using the various indicators; and
(ix) Assemble the findings for evaluation through the preparation of the Pressure-State-Response Matrix.

Table 10.4: An Example of the Application of the Pressure-State-Response Matrix Documenting Environmental Indicator Selection by Programme for a Single Domain (Modified after Alexandra, Higgins & White 1998)

PROGRAMME: PROTECTING AND PROMOTING HUMAN HEALTH
DOMAIN: INLAND WATER

The nature of the issue, in terms of specific provincial, regional, district or local area strategy.	The cause of the issue, bearing the indicator in mind.	The current condition or state of the environment, considering the indicator.	The objective for the issue, as outlined in the specific strategy.	A reasonable target within the overall objective; qualified where possible.	Actions required to meet this target.	The measure used to show the appropriateness of the processes being implemented.
KEY ISSUE	**CAUSE OF THE ISSUE (pressure proto-indicator)**	**STATE (State proto-indicator)**	**OBJECTIVE**	**TARGET**	**STRATEGIES AND ACTIONS**	**PROCESS (Response proto-indicator)**
High levels of groundwater pollution within the subregion.	The practice of unregulated waste and unrestrained waste disposal, and the extensive use of unsealed pit latrines, particularly within areas with high water tables.	Presence of *E. coli* and other pollutants at levels determined through monitoring of water quality.	To identify, contain and reduce contamination of inland waters by bacterium in the Family *Enterobacter-iaceae,* particularly by faecal coliforms (such as *Escherichia coli*) and faecal streptococci.	To contain the *E.coli* count in ground and surface water samples to below: 1) Department of Health and Population Development limits by the year 2002; 2) World Health Organisation limits by the year 2004.	i) To identify and map the location of all dwellings together with their associated unsealed pit latrines; ii) To identify and map all boreholes, wells and surface water resources; iii)To monitor water quality of all boreholes, wells and surface water resources, and to map the result. iv) To map the level of groundwater table throughout the seasons. v) To determine strategy to fund the conversion and sealing of all existing unsealed pit latrines; vi) To fund an education and development programme designed at encouraging and partly funding the development of new sealed pit latrines; vii) To replace/convert all existing pit latrines to a sealed type. vii) To restrict residential development and the disposal of waste to areas with water tables in excess of World Health organisation standards.	i)To monitor and map the results of the continuous monitoring of water quality, at intervals of 6 months, and to correlate the results with the results of the pit latrine conversion/replacement programme. ii) To report evaluate trends and modify the various programmes towards increased efficiency and effectiveness accordingly.

PHASE IV: EVALUATION AND SELECTION OF ALTERNATIVES

Step 13: *Collectively evaluate and interpret the results of the exercise which prepared strategies and actions according to the three indicators within EACH Pressure-State-Response Matrix, i.e. by key issue and MAP all the physical features of the relevant areas of application so that the identified strategies and actions may be placed in context according to each domain.*

The spatial representation represents the base map for use during the later positioning of the appropriate plot domains in terms of a Geographic Information System (GIS). Initially these maps would be prepared using technologies such as Global Positioning Systems (GPS). This mapping exercise would position physical features rivers, streams, wetlands, forest areas, grasslands, individual dwellings in dispersed settlements, delimit the boundaries of dense human settlements, and locate roads and certain other structures, where appropriate.

Step 14: *Develop a number of the land use scenarios or alternatives, and evaluate the strategies and actions, and test the objectives against each scenario.*

Scenarios or alternatives may include the following examples:

(i) a formally managed, widely dispersed, low density (specified accordingly) settlement pattern with no reticulated services and a high number of specified nodal settlements with full services reticulation, i.e self sufficiency via a combination of subsistence agriculture and cash cropping together with other income supplements;

(ii) a formally managed, dispersed settlement (at a higher specified density than (i)) with certain reticulated services, and a low number of existing nodal settlements with full reticulation, i.e self sufficiency via a combination of subsistence agriculture and cash cropping together with other income supplements; and

(iii) the maintenance of the current status, i.e a mixture of informally managed dispersed and nodal settlements settlement with a low, *ad hoc* provision of certain basic reticulated services as and when affordable whilst pursuing self sufficiency via a combination of subsistence agriculture and cash cropping together with other income supplements.

Step 15: *Select the preferred scenario or alternative in each case (following appropriate procedures for stakeholder involvement and participation), and spatially define the various areas or zones within which the land uses that are supportive of the preferred scenario may be undertaken.*

Using the results and maps prepared in Steps 13 and 14, define and map the boundaries and spatial extents of the areas or zones, by analysing existing land use and the results of the performance indicators relative to the objectives, in the context of their social, economic and ecological environmental characteristics, and an example is shown in Figure 10.2.

Ideally, each zone should be named and categorised according to each Programme and

Domain. This may be undertaken on the basis of the predominant characteristic, and each zone would be rated or classified according to the zones relative sustainability status. In this regard the priority rating may comprise an indication of the state, trend, and rate of improvement or deterioration, relative to the sustainability target. Zone names may be used to describe the physical characteristics or the predominant land use, such as the following examples:

Rural: Agriculture - restricted;
Rural: Agriculture - arable;
Rural: Agriculture - pastoral;
Rural: Agricultural - subsistence;
Rural: Agriculture - Small holding;
Rural: Residential;
Conservation: Wilderness area;
Conservation: Core protected area;
Conservation: General protected area;
Ecotourism: Conservation;
Ecotourism: Low density resort;
Ecotourism: Intensive development;
Rural: Industry - noxious;
Rural: Industry - general;
Rural: Industry - light/service; and
Rural: Public services.

Step 16: *Complete the Monitoring and Management Matrix.*

Once the data of the implementation programme are collected, analysed and synthesized these data are to be entered into the Monitoring and Management Matrix as shown in Tables 10.5, 10.6 and 10.7 and mapped as shown in Figure 10.3 respectively. The Monitoring and Management Matrix represents a further extension of Pressure-State-Response Matrix (Table 10.4). This process has involved modifying and adapting certain categories of a table prepared by Alexandra, Higgins & White (1998). This table has been extended to permit the inclusion of a management and regulation function for the following purpose:

(i) to detail the implications of the monitoring programme's findings for the management according to the status of the zone in question, i.e. identify and formulate management regulations and implications for each zone, by translating the actions required as listed in pressure-state-response matrix in each case into standards for effective and efficient promotion and regulation of land use and development. Include the spatial and temporal dimensions; and

(ii) to describe the implementation procedure, which includes monitoring, evaluation and review, i.e. formulate the process, procedure and schedule for the monitoring, evaluation and review of the zone boundaries and management regulations, and implement this procedure through the collection and analysis of the relevant data as outlined in Steps 9 and 10 as compared with the previous results.

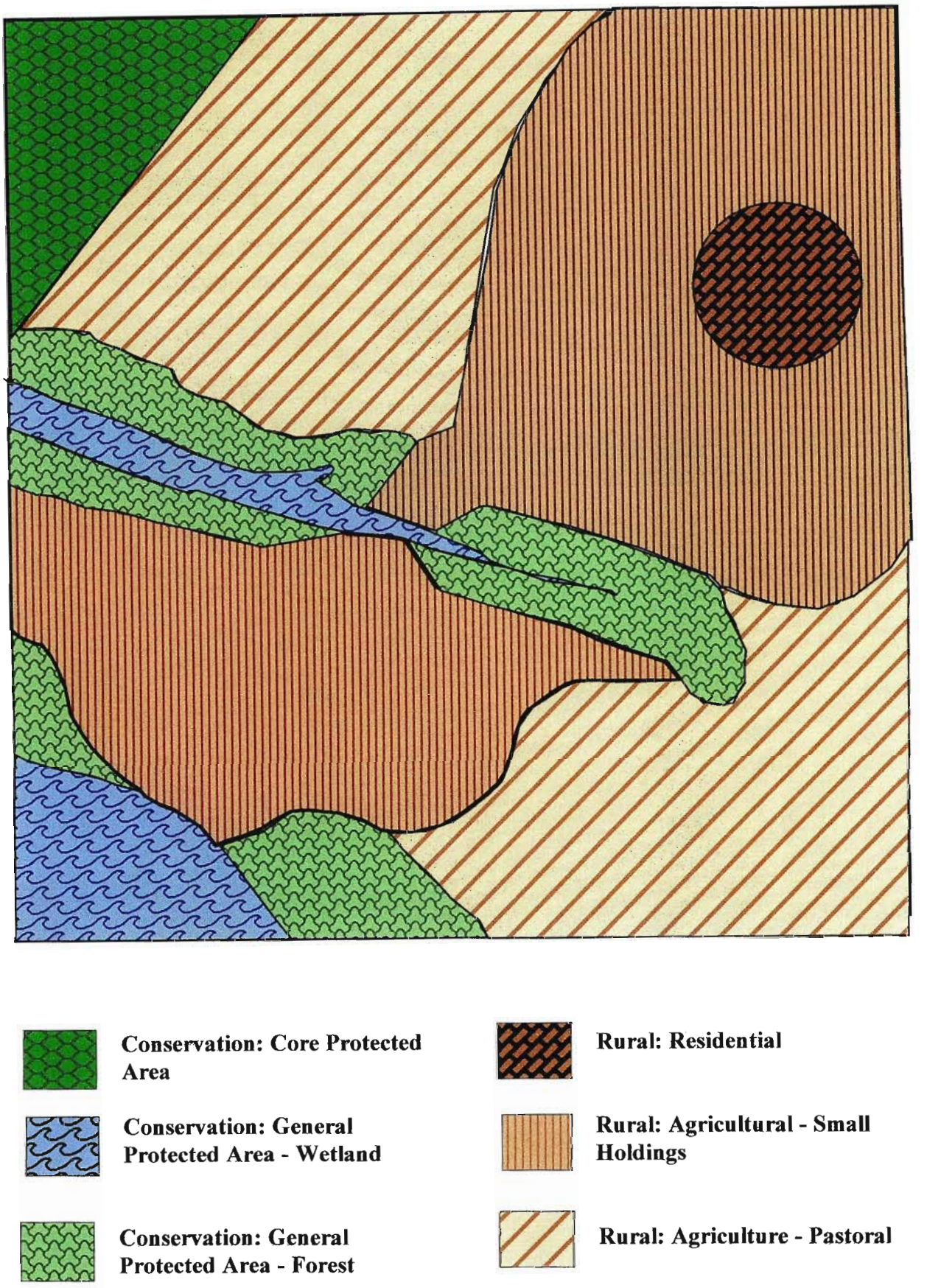
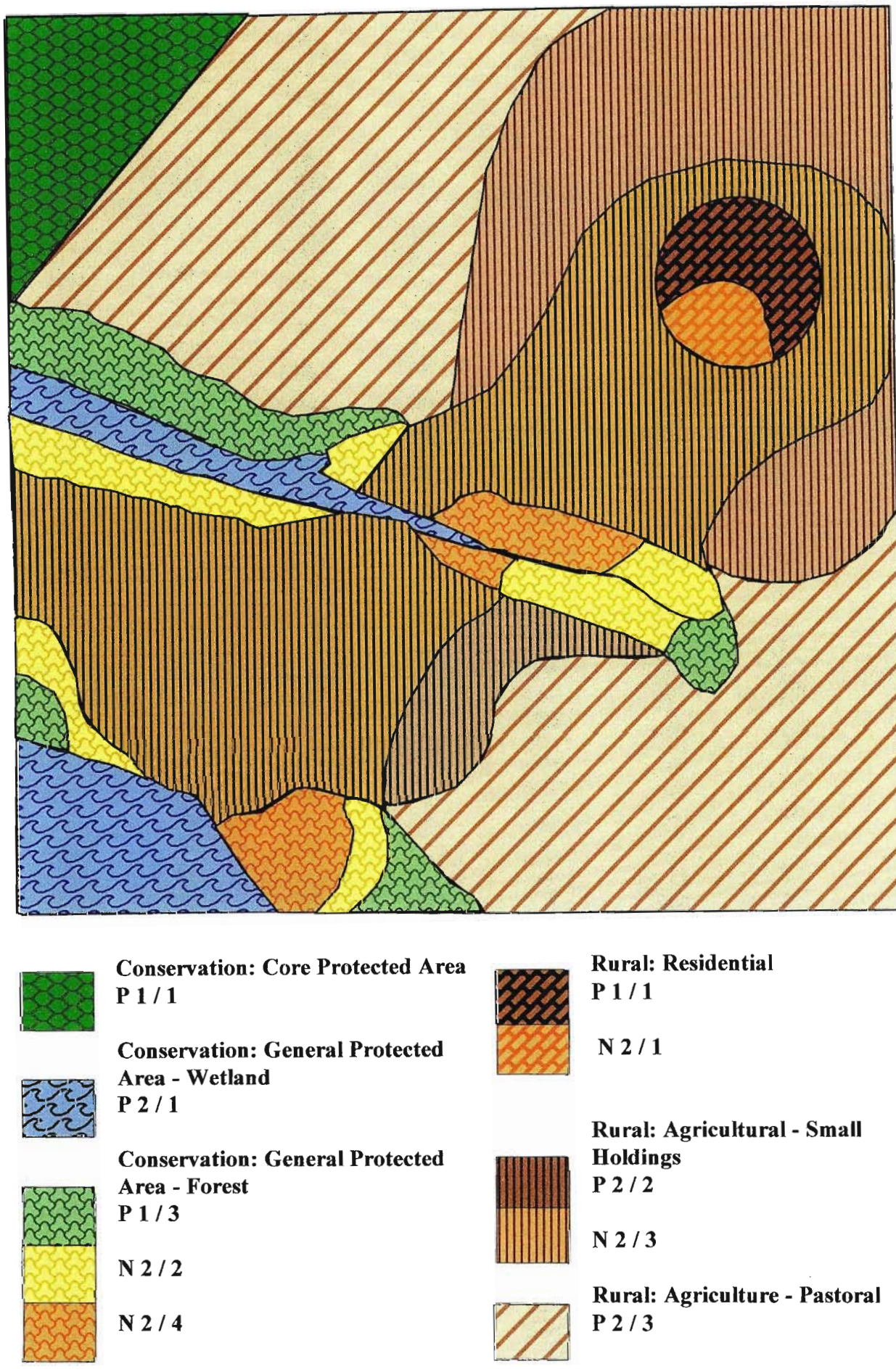


Figure 10.2: Theoretical Example of an Extract from the Proposed Integrated Rural Planning Scheme Map* *Prepared in accordance with Steps 1 to 15 (Modified after Western Australian Planning Commission 1999b)



PROGRAMME: PROTECTING AND PROMOTING HUMAN HEALTH
DOMAIN: INLAND WATER

Figure 10.3: Theoretical Example of the Mapping of Response Indices, for a Single Domain, to Inform the Preparation and Administration of the Proposed Integrated Rural Planning Scheme Map (Refer to Steps 16 and Tables 10.5, 10.6 and 10.7)

The relevant information is entered into the monitoring and management matrix, which, together with the various maps showing the zones, should form an integral component of the plan, both informing and guiding the implementation, management and regulation process. The Monitoring and Management Matrix is illustrated in Table 10.5, 10.6 and 10.7. The state of the zone may be classified according to the status of the zone in question relative to the preset target, i.e. positive where the required criteria have been met, or, negative, where the status does not meet the sustainability target. For example, P for positive, and N for negative relative to the predetermined target. While the trend may be classified according to the direction of the trend, i.e. an increasing trend towards sustainability may, for example, be numbered 1 or lettered I, and a increasing trend away from sustainability may be numbered 2 or lettered D.

The rate at which this trend occurs may be described using either a ratio scale relative to the previous measure, or a nominal scale of 1 to 5, where for example 1 = 0-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61-80%, and 5 = 81-100%, and where 5 represents the a exceptionally rapid increase towards sustainability or decline away from susatainability relative to the previous result, depending on the trend. Therefore, a portion of a zone may be rated: N 2 / 3, to indicate that the groundwater contamination level within this zone is below the target, is trending towards further deterioration at a rapid rate, while a portion may be rated P 2 / 3, to indicate that the contamination within this area is above the target, but this condition is deteriorating rapidly, while another area of the same zone may be rated P 1 / 1, which indicates that groundwater contamination within this area is above the target and improving still further, albeit at a slow rate.

Therefore, while the proposed conceptual rural planning scheme map is shown Figure 10.2, the conceptual map in Figure 10.3 illustrates the conceptual results of the implementation of the pressure-state-response framework within the proposed model. Figure 10.3 reflects the conceptual results of a theoretical monitoring and evaluation programme. Having identified a conceptual pressure in the Environmental status reports in step 10, designed and implemented a series of strategies, actions, management conditions and directives, the monitoring and evaluation programme would include a series of measurements of the response to these strategies, actions, management conditions and directives. Therefore, Figure 10.3 shows the most current conceptual state or condition of the domain: **Inland Water**, which forms part of the programme: **Protecting and Promoting Human Health**.

The results of these measurements may be interpreted using the key within Tables 10.5,10.6 and 10.7 and are shown for illustrative purposes for three of the zones, i.e. Conservation: General Protected Area - Forest; Rural: Agriculture - Small Holdings; Rural: Residential respectively. The interpretation of the response reflected by the conceptual response indices shown in Figure 10.3 and is discussed below as follows:

Conservation: Core Protected Area :

P 1 / 1: The response is extremely favourable and no changes to the Zone, Objective, Strategy, Actions, Management Conditions or Implementation Directives are proposed.

Recommendation: Continue to implement Management Conditions and Implementation Directives in terms of Response Index P 1.

Conservation: General Protected Area - Wetland:

P 2 / 1: While the Status remains positive, there is a slow trend towards decreasing sustainability. The cause for this trend is probably the increase in ground water pollution within areas in the adjoining Rural: Ariculture - Small Holdings Zone. This source should be verified and if so, then the Strategies, Actions, Management Conditions or Implementation Directives within that Zone will be required to be suitably amended to address this situation.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index P 2.

Conservation: General Protected Area - Forest:

P 1 / 3 This area of the Zone remains positive relative to the Target, although there is a reasonably rapid trend towards unsustainability which will require to be addressed as per the interpretation given under the Zone **Conservation: General Protected Area - Wetland.**
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index P 2 (Refer to Table 10.5).

N 2 / 2 This area of the Zone reflects a negative rating relative to the Target, and there is an increasing trend towards further unsustainability.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index N 2 (Refer to Table 10.5).

N 2 / 4 This area of the Zone reflects a negative rating relative to the Target, and there is a rapid trend towards further unsustainability.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index N 2 (Refer to Table 10.5).

Rural: Residential

P 1 / 1 The response is extremely favourable and no changes to this area of the Zone, Objective, Strategy, Actions, Management Conditions or Implementation Directives are proposed.
Recommendation: Continue to implement Management Conditions and Implementation Directives in terms of Response Index P 1 (Refer to Table 10.7).

N 2 / 1 This area of the Zone reflects a negative rating relative to the Target, and there is an increasing trend towards further unsustainability. The cause for this trend is probably the increase in ground water pollution within areas in the adjoining **Rural: Residential** Zone. This source should be verified and if so, then the Strategies, Actions, Management Conditions or Implementation Directives within that Zone will be required to be suitably amended to address this situation.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index N 2 (Refer to Table 10.7).

Rural: Agriculture - Small Holdings

P 2 / 2 While the Status remains positive, there is a trend towards decreasing sustainability. The cause for this trend is probably the increase in ground water pollution within areas in the adjoining **Rural: Residential** Zone and areas within the **Rural: Agriculture - Small Holdings** Zone. This source should be verified and if so, then the Strategies, Actions, Management Conditions or Implementation Directives within that Zone will be required to be suitably amended to address this situation.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index P 2 (Refer to Table 10.6).

N 2 / 3 This area of the Zone reflects a negative rating relative to the Target, and there is a fairly rapid trend towards further unsustainability.The cause for this trend is probably the increase in ground water pollution within areas in the adjoining **Rural: Residential** Zone and areas within the **Rural: Agriculture - Small Holdings** Zone. This source should be verified and if so, then the Strategies, Actions, Management Conditions or Implementation Directives within that Zone will be required to be suitably amended to address this situation.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index N 2 (Refer to Table 10.6).

Rural: Agriculture - Pastoral

P 2 / 3 While the Status remains positive, there is a fairly rapid trend towards decreasing sustainability. The cause for this trend is probably the increase in ground water pollution within areas in the adjoining **Rural: Residential** Zone and areas within the **Rural: Agriculture - Small Holdings** Zone. This source should be verified and if so, then the Strategies, Actions, Management Conditions or Implementation Directives within that Zone will be required to be suitably amended to address this situation.
Recommendation: Implement Management Conditions and Implementation Directives in terms of Response Index P 2.

Table 10.5: An Example of the Application of the Monitoring and Management Matrix as applied to the Zone Conservation: General Protected Area - Forest (incorporating the P-S-R approach to both identify environmental indicators and to detail the implications for both management and implementation) (Modified after Alexandra, Higgins & White 1998).

Each domain should be addressed in turn.	*The title of the zone.*	*The main issue in terms of both the program-me and the domain*	*The programme objective for the key issue, as outlined in the Status Plan.*	*The target within the overall objective; qualified where possible.*	*Strategy and actions required to meet this target.* *Interpretation of response index:* *Status: P=Positive; N=Negative, relative to the Target.* *Trend: 1=increasing sustainability; 2=decreasing sustainability.* *Rate: /1=slow; /5=rapid.*	*An index indicating the appropriate-ness of the conditions and directives implemented.*	*The implications of the required strategies and action/s. translated into identifying. describing and scheduling the management requirements.*	*These directives describe the implementation process. in terms of the requirements for monitoring. evaluation and review.*
PROGRAMME: PROTECTING AND PROMOTING HUMAN HEALTH								
DOMAIN	**ZONE**	**KEY ISSUE**	**OBJECTIVE**	**TARGET (T)**	**STRATEGIES AND ACTIONS**	**RESPONSE INDEX**	**MANAGEMENT CONDITIONS**	**IMPLEMENTATION DIRECTIVES**
Inland Water	**Conservation: General Protected Area - Forest.** *Refer to Rural Planning Scheme map in Figure 10.2 and to theoretical example of the mapping of response indices proposed for this domain in Figure 10.3 which informs the land use management and regulation process.*	Pollution of ground and surface water resources	To limit the *E. coli* count within the water to below national guidelines.	To restrict the pollution levels and the *E. coli* count in particular, to below the national statutory limits by 2002, and to below the World Health Organisation limits by 2004.	STRATEGY i) To restrict the disposal of solid and liquid waste to areas with water tables in excess of World Health Organization standards ACTIONS: *Pit latrines* i) To identify and map the location of unsealed pit latrines; ii) To determine strategy to fund the conversion and sealing of all existing pit latrines; iii) To fund the replacement/conversion of all existing pit latrines to a sealed type, commencing with those areas where the water tables exceed the set standard. *Boreholes, wells and surface water resources* i) To identify and map all boreholes, wells and surface water resources; ii)To monitor water quality of same, to map the result at regular predetermined intervals, and to correlate the results with the results of the pit latrine conversion/ replacement programme; iii) To map the level of groundwater table throughout the seasons. iv) To evaluate trends and report on same; v) To modify the various management conditions and directives towards increased efficiency and effectiveness.	P1	i) All solid waste within this area must be disposed of via the disposal system.	i) Regulate and limit waste disposal within this zone. ii) Monitor and map groundwater quality on 6 monthly basis.
						P2	i) All solid waste within this area must be disposed of via the disposal system; ii) No unsealed pit latrines may be constructed or maintained within identified high watertable areas.	i) Restrict the use of unsealed pit latrines within areas with high water tables; ii) Restrict waste disposal to sanitary landfill areas; iii) Monitor and map groundwater quality on 6 monthly basis.
						N1	i) All solid waste within this area must be disposed of via the disposal system; ii) No unsealed pit latrines may be constructed or maintained within this area.	i) Limit the impacts of residential development on groundwater to predetermined levels; ii) Restrict the use of all unsealed pit latrines; iii) Monitor & map groundwater quality on 3
						N2	i) No new residential development is permitted in this area; ii) All solid waste from existing dwellings must be disposed of via the disposal system; iii) No unsealed pit latrines may be constructed or maintained within this area.	i) Restrict new residential development within this area; ii) Limit pit latrines in existing settlements to sealed type only; iii) Monitor groundwater quality-record/map on 3 monthly basis; iv) Monitor and record residential development; v) Monitor and record pit latrine development and type.

Appendix 1 Illustration of the Monitoring and Management Matrix as applied to the **Zone Rural Agriculture: Small Holdings** (incorporating the P-S-R approach to both identify environmental indicators and to detail the implications for both management and implementation) (Modified after Alexandra, Higgins & White 1998).

Each domain should be addressed in turn.	*The title of the zone.*	*The main issue in terms of both the programme and the domain*	*The programme objective for the key issue, as outlined in the Status Plan.*	*The target within the overall objective; qualified where possible.*	*Strategy and actions required to meet this target.* *Interpretation of response index:* *Status: P=Positive; N=Negative, relative to the Target.* *Trend: 1=increasing sustainability; 2=decreasing sustainability.* *Rate: /1=slow; /5=rapid.*	*An index indicating the appropriate-ness of the conditions and directives implemented.*	*The implications of the required strategies and action/s, translated into identifying, describing and scheduling the management requirements.*	*These directives describe the implementation process, in terms of the requirements for monitoring, evaluation and review.*
PROGRAMME: PROTECTING AND PROMOTING HUMAN HEALTH								
DOMAIN	**ZONE**	**KEY ISSUE**	**OBJECTIVE**	**TARGET (T)**	**STRATEGIES AND ACTIONS**	**RESPONSE INDEX**	**MANAGEMENT CONDITIONS**	**IMPLEMENTATION DIRECTIVES**
Inland Water	**Rural: Agriculture - Small Holding.** *Refer to Rural Planning Scheme map in Figure 10.2 and to theoretical example of the mapping of response indices proposed for this domain in Figure 10.3 which informs the land use management and regulation process*	Pollution of ground and surface water resources	To limit the *E. coli* count within the water to below national guidelines.	To restrict the pollution levels and the *E. coli* count in particular, to below the national statutory limits by 2002, and to below the World Health Organisation limits by 2004.	STRATEGY i) To restrict residential development and the disposal of solid and liquid waste to areas with water tables in excess of World Health Organisation standards. ACTIONS: *Pit latrines* i) To identify and map the location of unsealed pit latrines; ii) To determine strategy to fund the conversion and sealing of all existing pit latrines; iii) To fund an education and development programme designed at encouraging the development of new sealed pit latrines; iv) To fund the replacement/conversion of all existing pit latrines to a sealed type, commencing with those areas where the water tables exceed the set standard. *Boreholes, wells and surface water resources* i) To identify and map all boreholes, wells and surface water resources; ii)To monitor water quality of same, to map the result at regular predetermined intervals, and to correlate the results with the results of the pit latrine conversion/replacement programme; iii) To map the level of groundwater table throughout the seasons. iv) To evaluate trends and report on same; v) To modify the various management conditions and directives towards increased efficiency and effectiveness.	P1	i) All solid waste within this area must be disposed of via the disposal system.	i) Regulate and limit waste disposal to sanitary landfill areas; ii) Monitor and map groundwater quality on 6 monthly basis.
						P2	i) All solid waste within this area must be disposed of via the disposal system; ii) No unsealed pit latrines may be constructed or maintained within identified high watertable areas.	i) Restrict the use of unsealed pit latrines within areas with high water tables; ii) Restrict waste disposal to sanitary landfill areas; iii) Monitor and map groundwater quality on 6 monthly basis.
						N1	i) All solid waste within this area must be disposed of via the disposal system; ii) No unsealed pit latrines may be constructed or maintained within this area.	i) Limit the impacts of residential development on groundwater to predetermined levels; ii) Restrict the use of all unsealed pit latrines; iii) Monitor & map groundwater quality on 3 monthly basis
						N2	i) No new residential development is permitted in this area; ii) All solid waste from existing dwellings must be disposed of via the disposal system; iii) No unsealed pit latrines may be constructed or maintained within this area.	i) Restrict new residential development within this area; ii) Limit pit latrines in existing settlements to sealed type only; iii) Monitor groundwater quality-record/map on 3 monthly basis; iv) Monitor and record residential development; v) Monitor and record pit latrine development and type.

Table 10.7: An Example of the Application of the Monitoring and Management Matrix as applied to the Zone Rural: Residential (incorporating the P-S-R approach to both identify environmental indicators and to detail the implications for both management and implementation) (Modified after Alexandra, Higgins & White 1998).

Each domain should be addressed in turn.	*The title of the zone.*	*The main issue in terms of both the programme and the domain*	*The programme objective for the key issue, as outlined in the Status Plan.*	*The target within the overall objective; qualified where possible.*	*Strategy and actions required to meet this target. Interpretation of response index:* *Status: P=Positive; N=Negative, relative to the Target.* *Trend: 1=increasing sustainability; 2=decreasing sustainability.* *Rate: /1=slow; /5=rapid.*	*An index indicating the appropriate-ness of the conditions and directives implemented.*	*The implications of the required strategies and action/s, translated into identifying, describing and scheduling the management requirements.*	*These directives describe the implementation process, in terms of the requirements for monitoring, evaluation and review.*
PROGRAMME: PROTECTING AND PROMOTING HUMAN HEALTH								
DOMAIN	**ZONE**	**KEY ISSUE**	**OBJECTIVE**	**TARGET (T)**	**STRATEGIES AND ACTIONS**	**RESPONSE INDEX**	**MANAGEMENT CONDITIONS**	**IMPLEMENTATION DIRECTIVES**
Inland Water	**Rural: Residential** *Refer to Rural Planning Scheme map in Figure 10.2 and to theoretical example of the mapping of response indices proposed for this domain in Figure 10.3 which informs the land use management and regulation process.*	Pollution of ground and surface water resources	To limit the *E. coli* count within the water to below national guidelines.	To restrict the pollution levels and the *E. coli* count in particular, to below the national statutory limits by 2002, and to below the World Health Organisation limits by 2004.	STRATEGY i) To restrict the disposal of solid and liquid waste to areas with water tables in excess of World Health Organization standards ACTIONS: *Pit latrines* i) To identify and map the location of unsealed pit latrines; ii) To determine strategy to fund the conversion and sealing of all existing pit latrines; iii) To fund the replacement/conversion of all existing pit latrines to a sealed type, commencing with those areas where the water tables exceed the set standard. *Boreholes, wells and surface water resources* i) To identify and map all boreholes, wells and surface water resources; ii)To monitor water quality of same, to map the result at regular predetermined intervals, and to correlate the results with the results of the pit latrine conversion/ replacement programme; iii) To map the level of groundwater table throughout the seasons. iv) To evaluate trends and report on same; v) To modify the various management conditions and directives towards increased efficiency and effectiveness.	P1	i) All solid waste within this area must be disposed of via the disposal system .	i) Regulate and limit waste disposal within this zone. ii) Monitor and map groundwater quality on 6 monthly basis.
						P2	i) All solid waste within this area must be disposed of via the disposal system; ii) No unsealed pit latrines may be constructed or maintained within identified high watertable areas.	i) Restrict the use of unsealed pit latrines within areas with high water tables; ii) Restrict waste disposal to sanitary landfill areas; iii) Monitor and map groundwater quality on 6 monthly basis.
						N1	i) All solid waste within this area must be disposed of via the disposal system; ii) No unsealed pit latrines may be constructed or maintained within this area.	i) Limit the impacts of residential development on groundwater to predetermined levels; ii) Restrict the use of all unsealed pit latrines; iii) Monitor & map groundwater quality on 3 monthly basis
						N2	i) No new residential development is permitted in this area; ii) All solid waste from existing dwellings must be disposed of via the disposal system; iii) No unsealed pit latrines may be constructed or maintained within this area.	i) Restrict new residential development within this area; ii) Limit pit latrines in existing settlements to sealed type only; iii) Monitor groundwater quality-record/map on 3 monthly basis; iv) Monitor and record residential development; v) Monitor and record pit latrine development and type.

PHASE V: SEEK STAKEHOLDER CONSENSUS

Step 17: *In view of the need for transparency, and stakeholder support, review the key issues and reaffirm or revise them in accordance with the implications in terms of the preferred scenario or alternative.*

The results arising from Phase IV: Evaluation and Selection of Alternatives, as shown within the various Pressure-State-response matrices (example shown in Tables 10.4) and illustrated on the various domain maps (example shown in Figure 10.2) are to be workshopped with the stakeholders accordingly. The results of the this process are reflected in the value of the various response indices. It is proposed that these values would clearly illustrate the status, trend and rate of change of the delimited areas within the zones regarding sustainability. This information would provide a clear indication of the effectiveness of management conditions and would assist in the review of these and the implementation directives as per Steps 18, 19 and 20, as well as post implementation steps, including guiding the review of zone boundaries and the composition and content of the zone tables.

Step 18: *Review the various objectives and reaffirm or revise them in accordance with the implications in terms of the preferred scenario or alternative.*

The various objectives, are to be reviewed by the stakeholders and amended or reaffirmed where appropriate.

Step 19: *Review the strategies and actions and reaffirm or revise them in accordance with the implications in terms of the preferred scenario or alternative.*

The various strategies and actions are to be reviewed by the stakeholders and amended or reaffirmed where appropriate

Step 20: *Review and reaffirm the management regulations, and where necessary, amend or revise them in accordance with the implications in terms of the preferred scenario or alternative.*

The various management regulations are to be reviewed by the stakeholders and amended or reaffirmed where appropriate

PHASE VI: IMPLEMENTATION, MONITORING AND REVIEW

Step 21: *Initiate implementation of the Plan.*

Step 22: *Monitor progress and measure and evaluate results in accordance with the previously detailed directives and schedules.*

This step includes a series of iterative monitoring and evaluation steps which feed back to various stages of the management cycle. Feedback takes place on a variety of time scales. In the short term, it is necessary to determine whether the agreed actions have been properly carried out. Over the medium-term, it is possible to ascertain whether, and to what extent targets are achieved. While, in the longer term strategies, objectives, management regulations and directives and may be reviewed and revised.

Step 23: *Evaluate the findings and formulate recommended courses of action regarding the existing issues, objectives and strategies.*

Step 24: *Review the entire process as scheduled, and regularly (in the short to medium term) review management regulations, the zone configuration and land use practices. In the longer term, review and amend the plan, including the monitoring and evaluation process, where necessary.*

10.3 Guiding Decision-Making on the Management and Regulation of Rural Land Use

The adoption and implementation of the proposed alternative planning approach provides for an integrated management and regulation system using a set of tables and maps (refer to Tables 10.5, 10.6 and 10.7 and Figures 10.2 and 10.3) and interactive coverages, is consistent with the principle of sustainability. It is proposed that all land uses, projects and developments would be capable of being objectively evaluated, managed and regulated according to their conformity with the adopted strategies and objectives. These strategies should strive towards sustainability, not only of the particular activity or development, but of all interactions within the subject spatial area, including their relationship with and impact on the social, economic and ecological environment. However, the implementation of this system requires the co-ordination and integration of the research, evaluation and monitoring programme. The procedure described in Section 10.2 will result in a series of domain plans for each local area, or region. It is envisaged that each plan will reflect the various land use zones, over which the response indices will be plotted or displayed. Each area domain plan will be accompanied by the monitoring and management matrix for each objective, which will reflect the respective target, strategies and actions, management conditions and implementation directives, which will both guide decision-making, and guide the monitoring and land use regulation process by the responsible authority. An illustrative example of the hierarchal relationship between the various sustainable development elements within the proposed model is presented in Table 10.8.

The dynamic nature of the implementation process ensures that the plan is under continuous review, as new information emerges, and as the implications of this information are provided to the decision-makers. In this way, decisions regarding investment in for example: new agricultural infrastructure or a new access road or a new health or education facility, may be related to existing service and social or community infrastructure and various aspects such as the current state of the social, economic and biophysical environment may be readily taken into account when investigating the impact of such decisions.

Table 10.8: An Illustrative Example of the Hierarchal Relationship Between the Various Sustainable Development Elements within the Proposed Model using the Conceptual Programme

Programme	Domain	Key issue	Programme Objective	Key indicator category	Key indicator subcategory (Where applicable)	P-S-R indicator sets		
						Pressure	State	Response
Protecting and promoting human health.	Inland water.	To limit count *E. coli* within the water to below national guidelines.	To identify, contain and reduce contamination of inland waters by bacterium in the Family *Enterobacteriaceae*, particularly by faecal coliforms (such as *Escherichia coli*) and faecal streptococci.	Groundwater quality.	Not applicable in this instance.	The number of contamination point sources identified per quarter, during a continuous monitoring programme.	Proportion of settlements served or reliant on contaminated ground or surface water supply, identified per quarter, during a continuous monitoring programme.	A change in the status of the proportion of settlements served or reliant on contaminated ground or surface water supply.
						P	S	R
						P	S	R
					Key indicator subcategory			
					Key indicator subcategory			
				Key indicator category				
				Key indicator category				
				Key indicator category				
				Key indicator category				
				Key indicator category				
			Programme Objective					
			Programme Objective					
			Programme Objective					
			Programme Objective					
			Programme Objective					
		Key issue						
		Key issue						
		Key issue						

10.4 Suggested Advantages of the Proposed Model

The deterministic, integrated system of land use management proposes a system represented by a dynamic plan that is guided through a continuous research and reporting programme of pressure-state-response indicators. Planning has been defined as future-orientated, public decision making directed toward attaining specific goals (Fainsten & Fainstein 1996) Once enacted, such a plan constitutes a politically determined public policy, although this policy differs from other kinds of political decisions in that it is based on rationality and is explicit about ends and means. The discipline of planning aims to design and manage the complex spatial activities within our rural and urban areas in accordance with public policy, that is rationally derived through the development and application of technical knowledge, and by using increasingly sophisticated technologies. The standard, current methodological steps in the planning process have been addressed in Chapter 7 and are illustrated in Table 7.2. A significant shortcoming of the current planning system as highlighted in Section 7.2, is the uncertainty surrounding the outcome of the policy implementation process. A further aspect identified as contributing to this uncertainty is the compartmentalised nature of the various functions and levels of government. This institutional and functional separation contributes to the difficulties associated with attempting to co-ordinate and implement local, regional, provincial or national policy programmes across departments and between the tiers of government. It is suggested that the proposed theoretical model has the potential to successfully address these shortcomings through the following specific advantages of including environmental performance indicators (modified after DEST 1996):

(i) The introduction of the *environmental performance indicators* concept formalises the link between the plan or policy and the concept of ecologically sustainable development in an integrated context, i.e. including the social, economic and biophysical environment;

(ii) The measurement of environmental performance indicators requires the explicit use of indicators, along with the setting of thresholds and the implementation of a system, which will facilitate the scheduling of on-going and explicit evaluation and review, of both the content of the plan or policy and the implementation process;

(iii) The selection of *environmental performance indicators* provides a tangible opportunity for the community/inhabitants to participate in the planning process;

(iv) The inclusion of *environmental performance indicators* provides a tangible measure and illustration for the community/inhabitants of the cause-and-effect relationship in terms of the pressure exerted by their land use and activities and the resultant impact on environmental performance indicators;

(v) The existence of *environmental performance indicators* provides for more effective and efficient formulation, evaluation and review of policy and planning objectives;

(vi) On-going research into the identification of *environmental performance indicators*, is likely to facilitate the identification of indexes, thresholds and performance standards which would permit the more accurate determination of the limits of acceptable change i.e. sustainability thresholds, and thereby facilitate the introduction, evaluation and review of a more accurate and accountable system of land use and activity regulation in rural areas; and

(vii) The transparency of the cause-and-effect relationship and the inclusive nature of the indicator selection procedure is likely to enhance the public/ community/inhabitants' understanding of the need for a land use management and regulation system, and therefore facilitate implementation and compliance with the system.

(vii) It is suggested that the intentions expressed in the following objectives could be achieved through the incorporation of *environmental performance indicators* via the proposed performance evaluation system for rural land use planning and development within KwaZulu-Natal:

- To regularly provide the public in general, the rural inhabitants of KwaZulu-Natal in particular, managers and policy makers with accurate timely and accessible information about the condition of, and prospects for the social, economic and natural environment within rural KwaZulu-Natal.

- To increase public understanding of the condition of, and prospects for the social, economic and natural environment within rural KwaZulu-Natal;

- To facilitate the development of, and review and report on, an agreed set of provincial, regional and local area environmental indicators;

- To provide an early warning of potential problems;

- To report on the effectiveness of policies and programmes designed to respond to environmental change, including progress towards achieving environmental standards and targets;

- To contribute towards the assessment of rural KwaZulu-Natal's progress towards achieving ecological sustainability;

- To contribute to the assessment of rural KwaZulu-Natal's progress in protecting ecosystems and maintaining ecological processes and systems;

- To create a mechanism for integrating the biophysical environments information with the social and economic information of the same areas, thus providing a basis for incorporating environmental considerations in the development of long-term, ecologically sustainable, economic and social policies for rural KwaZulu-Natal;

- To identify gaps in rural KwaZulu-Natal's knowledge of the social, economic and biophysical environments conditions and trends, and recommend strategies for research and monitoring to fill these gaps;

- To contribute towards fulfilling South Africa's international environmental obligations; and

- To assist decision-makers make informed judgements about the consequences of policies and plans on the social, economic and biophysical environment.

11. CONCLUSIONS

This work set out to develop a theoretical model of a rural land use management and regulation system. This aim required a number of objectives to be investigated and the following conclusions have been drawn from this exercise:

11.1 Conclusions concerning the Objectives

The following conclusions are drawn from the investigation of the studies objectives:

(i) Describe rural planning and development

Rural research within South Africa and more particularly KwaZulu-Natal has been described as historically inhibited (Mather 1992). The past decade has seen this research move towards the interpretation of a new paradigm. This new approach is less concerned with the contrasts between the rural and urban space-economies, and focusses rather on the processes and interactions within this rural-urban space-economy and their influence on particular economic activities within the regions, sub-regions or areas. These findings have emphasized the need to identify and evaluate the characteristics within the various rural zones (Ginsburg, Koppel & McGee 1991). The inadequacies of traditional zoning regulations and controls to regulate land use within the rural-urban continuum has been recognised since rural and urban land use systems exhibit fundamentally different characteristics (Field 1998). Therefore, to be successful, the management and regulation of the rural land use system will need to identify and specifically address the different characteristics of the space-economy within the rural areas relative to its goal.

(ii) Define sustainable development

A global strategy and international cooperative programmes have been developed to implement the concept of sustainable development. Agenda 21, a non-binding international agreement, provides a framework for implementation by all nations and communities. The concept represents an integrated approach to the management of human communities and activities. There is a need to provide clear examples at local level in South Africa of how sustainable development can be measured and monitored (Walmesley & Pretorius 1996). The investigation of the sustainability principles suggests that inter-generational and intra-generational equity, together with the precautionary principle, should be seen as the unifying principles. This study was persuaded to adopt a centrist definition of ecologically sustainable development (ESD) as presented by Diesendorf & Hamilton (1997), namely: Ecologically sustainable development is interpreted as the creation of an ecologically and economically sustainable, socially equitable society . This concept describes an ideal state or condition for which societies and governments should strive.

(iii) Describe traditional land tenure

The traditional land tenure system was found to provides a measure of social security for the tribal inhabitants, and that any threat to the system were likely to be viewed as

constituting a threat to the community and to the individual. In this regard it was deemed wise to heed the lesson from the previous government's *betterment planning* initiative, which had a disastrous impact on local community organization and social survival networks at ground level. Therefore, any proposals involving the monitoring, management and regulation of land use and development, within the areas under traditional land tenure, are required to be soundly based, to be clearly in the community's own interest, and for this fact to be transparently evident. All stakeholders would be required to be involved and to participate in decision making regarding all matters concerning land use management and regulation.

(iv) Describe current status of rural land use management and investigate the need for an alternative system

Rural areas, particularly those under traditional land tenure, contain a wide variety of land uses, including agriculture, ranging from subsistence to various forms of commercial agriculture. These areas are characterised by: high and rapidly increasing populations; conditions of poverty, hunger, illiteracy, unemployment and a degraded environment (Ngobese & Cock 1995; Walmsley & Pretorius 1996). Options for land use regulation include the extension of urban-style rural planning schemes, although their use has been labelled as inappropriate (Houston 1991; Western Australian Planning Commission 1997c). To date, South African town and regional planning legislation contains no mechanism designed specifically to monitor, measure or evaluate the system's performance against the post-implementation achievement of policies, programmes and regulatory provisions. While previously unregulated, land use within these areas has recently been brought under legislative control via a series of statutes relating to the environment and to land use planning. Currently, a dual system of land use regulation exists within KwaZulu-Natal where rural land use outside of traditional land tenure areas has been subject to a low level of statutory regulation via general legislation, while more specific and detailed regulation is applied within areas of limited spatial extent that have special needs in this regard. Land use in rural traditional land tenure areas remains complex and notwithstanding the existence of various legislation, these areas remain largely unregulated from a land use perspective and unsustainable resource utilization prevails. This current land use management and regulation system is deemed to lack both the systematic and strategic strengths and a process to permit sensitive, continuous review and gathering of consequential intelligence to permit the calibration of the set policies and regulatory provisions. Rural land use regulation in KwaZulu-Natal has been compared with an example from Australia, where the government applies a similar land use regulation rationale to that used within urban areas. The results show that the Australian example of land use regulation does not employ systematic performance measurement Although unlike South Africa, almost all of the rural area is subject to the provisions of statutory Schemes which strictly regulate land use in terms of forward-looking statutory structure plans. Moreover, extensive Australian research into these rural Scheme provisions has revealed substantive criticism of the current rationale. This criticism points to the fact that these Australian rural planning schemes merely extend and employ urban-style scheme rationale, which it is argued does not adequately address the specific needs of rural areas. The identified need for an integrated approach to planning and development underscores the importance for this aspect to be incorporated

within land use management and regulation systems.

(v) Evaluate the content and approach of planning methodologies in terms of inclusion of rural land use management and regulation components

A review of the evolution of the planning process suggests that the current approach represents an integrated planning approach which strives towards the achievement of sustainable development. A review of planning methodology indicates that the basic appearance of the methodological process has remained substantially the same since the 1960's. Stakeholder participation has been implicit within this process. The change in approach over time appears to have been more in the realm of implementation, with a shift from stakeholder consultation through representatives towards the direct involvement of the stakeholders themselves in the planning and decision-making process. In addition, these methodologies have both included the monitoring and implementation plans with the view to informing stakeholders of the performance of the respective policies, strategies and programmes. Despite being well intentioned, these efforts have hitherto been hampered by the difficulties surrounding evaluation and measurement of this performance. The recent advances in environmental performance indicator research offers an opportunity to successfully address this issue.

(vi) Investigate the feasibility of measuring progress towards sustainable development

The drive towards sustainable development has prompted the search for a model which had wide international acceptance. The *state of the environment* reporting programme by the Organisation for Economic Co-operation and Development (OECD) laid the foundation for the search for a viable means of measuring environmental performance by individual OECD member countries, and the United Nations Commission for Sustainable Development' (CSD). The OECD-developed Pressure-State-Response model, with its capability of being policy relevant, of addressing the cause and effect relationship between the implementation of policies, plans and programmes and the result of this implementation process, of linking the environment with social and economic activities and agents, and of being both readable and robust, is now widely used internationally to guide the process of performance evaluation. The South African government has recognised the value of this initiative and has appointed the national environmental agency to coordinate the country's participation in the UN CSD-led testing of national environmental indicators. Recent research has developed models and various techniques relating to performance which may be adapted and used in the development of a management and regulation system for sustainable rural land use (Newton *et al.* 1998). South African state of the environment reporting forms part of a UN CSD-led global initiative to develop national sets of environmental indicators. The process of selecting national indicators has been linked to the adaptive management cycle, which allows strategic interventions within the context of the pressure-state-response model.

Models have played an important role in land use planning and development research. Originally addressing the inter-relationship between economic and ecological systems, increasing attention has been focussed on environmental problem-solving, modelling issues such as global change (ICSU 1996), the biosphere (Steyaert 1993) and

environmental performance (OECD 1994). It is proposed that the environmental performance measurement should be integrated both institutionally and spatially i.e. institutionally, through the integrated involvement of the provincial, the regional and the local government departments, multi-disciplinary institutions and agencies and the full participation of the host communities, i.e. including all stakeholders; and spatially, by guiding decision-making concerning the regulation of land use and the design and implementation of land use management practices, and including regional, district and local rural planning schemes which strive towards the achievement of sustainability.

(vii) Investigate the development of a model of the process described in (v) above

This method proposes a model with the following properties:

- founded on the principle of sustainable development;
- functioning within the context of the original Pressure-State-Response model;
- incorporating the state of the environment reporting model;
- wherein indicators of the performance of the social, economic and biophysical environment are researched and selected using strategic planning and the adaptive management cycle; and
- requiring the participation and consensus of all stakeholders.

The sensitivity of the rural political and local economy precludes the imposition of a scientist-led land use regulation system. What is proposed is a system with the following attributes:

- is based on extensive sand continuous stakeholder participation and decision-making;
- is guided by transparent indicators of the condition or *state* of the economic, social and biophysical environment, of the nature and extent of the *pressures* exerted on these environments and of the *response* of these environments to the various policies, plans, programmes and projects; and
- which strives towards the sustainability of the social, economic and biophysical environments.

The specific advantages of utilising environmental performance indicators are detailed, and a list of policy objectives that may be considered for application within KwaZulu-Natal are developed. The deterministic, integrated approach is compared with the existing approach to urban land use management and regulation. Amendments to the existing planning approach are detailed and a revised deterministic, integrated planning process is proposed initially as a process of guiding and facilitating the public's understanding and acceptance of the process. It is envisaged that this system would play an important role in the statutory management and regulation of land use with traditional land areas.The model proposes a system which aims to:

- encourage the inclusion and integration of the policies and programs of all public and private agencies;
- strive towards the collective achievement of sustainability as the underlying goal

within the planning and plan implementation process;

- develop the capability of measuring the achievement of planning policies, goals and programs which guides their review and reformulation and thereby strengthens the link between land use planning and land use management; and
- initially guide land use towards sustainability by non-statutory means and later to fulfil a statutory function in this regard.

The result is a blended model, which draws on the work of Canton and Molye (1997, cited in Alexandra, Higgins & White 1996), that is applicable within a regional context and is capable of being implemented at a district and even at a local community level. This system proposes:

1. an integrated planning process involving the coordinated identification of multi-disciplinary issues;
2. the preparation and implementation policies, plans and programmes aimed at addressing these issues;
3. the identification of pressure-state-response mechanisms within the context of the identified models using performance indicators;
4. the monitoring of the condition of the economic, social and biophysical environment, of the nature and extent of the pressures exerted on these environments, and of the response of these environments, to the implementation of the various policies, plans and programmes;
5. the monitoring of these pressures, states and responses through an iterative process of transparent research, identification, testing and selection of suitable indicators of performance;
6. the results are to be evaluated;
7. the findings are to inform decision-making regarding the review of the policy, plans and programmes; and
8. the entire process is to include the participation of all the stakeholders.

(viii) Investigate the extent to which such a theoretical model might succeed in guiding the management and regulation of land use towards sustainability, initially as a non-statutory guide and later as a statutory instrument

The deterministic, integrated approach to land use management proposes a system represented by a dynamic process that is guided through a continuous research and reporting programme of pressure-state-response indicators. The standard, current methodological steps in the planning process have been addressed in Chapter 7 and are illustrated in Table 7.2. A significant shortcoming of the current planning system has been highlighted as being the large measure of uncertainty surrounding the outcome of the policy implementation process. A further aspect identified as contributing to this uncertainty is the compartmentalised nature of the various functions and levels of government (Metroplan 1996). This institutional and functional separation contributes to the difficulties associated with attempting to coordinate and implement local, regional, provincial or national policy programmes across departments and between the tiers of government. Agenda 21 (Wynberg 1992) represents a powerful initiative which requires

the integrated efforts of all stakeholders, including all levels and departments within government, to strive for the common global strategy of sustainable living. The appointment of the national committee to coordinate Agenda 21 activities (Walmsley & Pretorius 1996) is likely to add weight to the need for increased integration between and within government. It has been submitted that the application of a similar rationale to that employed in state of the environment research (DEST 1996) using environmental indicators, would facilitate the integration of the stakeholders into the design and implementation of a development system in KwaZulu-Natal. It has been demonstrated that the current planning process is capable of being expanded to accommodate the proposed system for application to rural areas under traditional land tenure in particular. The proposed theoretical system has been developed initially as a non-statutory guide decision making on the management and regulation of land use. Although, the opportunity exists for this system to be refined on application and applied in a statutory capacity in this regard.

The relationships between land use and land cover changes are complex (Turner II *et al.* 1995). The existing rural land use planning system's capacity to effectively and efficiently monitor and evaluate the character, extent and rate of change of land cover, and of social, economic and biophysical domains has been hindered by the lack of an effective system of measurement (Metroplan 1997). The previous shortage of accurate data on land use and land covers and the lack of a coordinated and integrated effort has hindered efforts on the parts of governments and non-governments agencies and institutions. While much work remains to be done to fill in these increasingly critical gaps in knowledge and understanding, the advent of geographical information systems, with more precise and geographically referenced data on land cover and land use information has created opportunities for improved analysis through the more precise determination of the location and extent and rates of change.

11.2 Conclusions concerning the Hypotheses

It is submitted that the revised conceptual planning approach proposed in Chapters 9 and 10 provides a sound basis for an alternative land use management and regulation system which has demonstrated that:

- the relative state or condition of the social, economic and biophysical environment is measurable, in terms of the principal of sustainable development, via a set of environmental performance indicators that are capable of accurately, effectively and efficiently representing the state of the environment within rural areas under traditional land tenure,

- the relative pressure exerted on the social, economic and biophysical environment in terms of negative impacts within areas where traditional land tenure is practiced, can be modelled.

This study has demonstrated that the proposed revised planning approach is consistent with the national, provincial or regional policies and strategies, and would therefore be

capable of integration across all levels of government, and of linking into the existing statutory structure, and that:

- the potential capability of this theoretical model to better inform and guide decision-making by stakeholders in respect of existing and proposed land use planning and development, including motivating and guiding the use and allocation of resources within rural areas under traditional land tenure, towards social, economic and ecological sustainability, has been demonstrated.

Moreover, it is suggested that the dynamic nature of this conceptual, integrated rural planning process, would enable decisions, whether relating to the location of for example: a public health clinic, or an irrigation project, or a private or public ecotourism development, to be guided throughout the lifetime of the land use, project or development.

7 March, 2000

12. GLOSSARY

Betterment planning, a programme of land use restrictions and soil conservation, which was a major initiative of the government of the 1950's to attempt to improve agricultural production of the *Homeland* areas.

Commons originally referred to resources, in the form of grazing areas. Fish ponds and tributaries which were collectively owned and used by communities of peasants in Saxon England. (Jurgensmeyer & Wadley 1974).

Ehrlich state, which postulates that as the number of people grows and the amounts of goods and services provided per person increase, the associated demands on resources, technology, social organization, and environmental processes become more intense and more complicated, interactions among these factors become increasingly consequential (Ehrlich, Ehrlich & Holdren 1977).

Hicksian concept of income, which postulates that income is equal to maximum sustainable consumption, and no account was taken of the ability or capacity of the source of the consumed products to sustain these levels of consumption indefinitely (Hicks 1946, p. 172).

Hartwick model states that given a constant population consuming a non-renewable resource for which a human-made substitute (in economic terms) exists, then economic sustainability can be achieved if the profits of this consumption are invested to balance this consumption. In this way, economists are said to seek the maximum constant rate of per capita consumption that can be maintained indefinitely (Common 1995, pp. 46-49).

Homeland areas are areas set aside by statutes which set aside land areas for the exclusive use of certain tribal communities. These acts defined separate amenities based on racial criteria and referred to as apartheid legislation. This legislation was initiated during the late 1940s and was repealed in the early 1990s.

Inkosi, the Zulu title meaning the chief, as the tribal head is known.

Izinduna, are traditional heads of the tribal wards or districts which together comprise the tribal area, presided over by an *Inkosi. Izinduna* are either appointed by the *Inkosi* or nominated by the community within the district.

Town Planning Scheme is defined as the main statutory planning and development regulation instrument within urban areas, which is prepared and enacted in terms of the various provincial Ordinances and Acts within South Africa.

Use: Means the purpose (type and extent) for which land or a building is arranged, designed, or intended to be used, or for which either land or a structure is occupied or maintained, i.e. within a *zone* certain *uses* are either permitted, conditionally permitted or prohibited.

Zone: The demarcation or zoning of areas of land for particular *use* purposes in terms of the *Town Planning Scheme*, subject to certain regulations pertaining to *use*.

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APPENDIX A: EXTRACT FROM SOUTHERN MAPUTALAND INTEGRATED DEVELOPMENT PLAN (Metroplan 1996, p.83-85, (a)-(d)).

"PROPOSED LAND USE ZONING SYSTEM

3.2.5 AIM

The aim of the proposed land use zonation is to both guide potential nature conservation and development programmes within the study area and to facilitate rapid decision-making in respect of development applications.

In the former instance a prospective ecotourism operator or developer is able to unambiguously assess the opportunities and constraints in terms of each area's potential and development regulations, while in the latter instance the zonation system sets clear guidelines for decision-making by the land use and development regulating authorities.

Moreover any proposed change in land use or development within the study area would be subject to certain restrictions and/or requirements being met by the applicant. These include the approval of building and development plans and applications, subject to the provision of certain services, the treatment of effluent and waste and certain suitable conditions of establishment or development, as may be imposed by the authority charged with the responsibility for regulating land use and development, and of protecting both the environment and the amenity of the area.

Notwithstanding the above, it is important to ensure that the proposed land use zonation is consistent with that proposed in terms of the international model of a biosphere, proposed in the Man and the Biosphere programme of UNESCO (1987) (Refer to Volume 1, Section 3.2.6. and Volume 2, Appendix 2, sections 2 and 3, for justification).

The aims and objectives of the Man and the Biosphere programme of UNESCO are to:

- Encourage sustainable development, and conservation of biodiversity resources and the physical environment;
- Promote the conservation and protection of unique and sensitive environments outside existing protected areas, for their intrinsic value and potential for ecotourism;
- Promote compatibility between potentially conflicting land uses with the proposed area, and voidance of conflicts between primary land uses of the area, which included agriculture, nature conservation and ecotourism;
- Establish effective buffer zones peripheral to the core protected area, to protect the integrity of the area and its nature, environmental conservation and ecotourism functions, and transition. zones, where resources may be sustainable used by local communities;
- Promote participation in global base line, environmental monitoring research projects, to improve understanding in changes in the global environment and the effects of development on the environment, and extension and demonstration projects related to sustainable land use methods.

The Man and the Biosphere programme is particularly suited to subregions where significant Protected Areas are surrounded by disadvantaged communities, who could potentially benefit from such Protected Areas.

Biosphere reserves are areas of terrestrial and coastal/marine ecosystems,- which are internationally recognised within the framework of UNESCO's Programme of Man and the

Biosphere (MAB) which has been developed in terms of the Statutory Framework of the World Network of Biosphere Reserves. (Biosphere Reserves The Seville Strategy and Statutory Framework of the World Network, UNESCO, MAB). Biosphere Reserves are nominated by national governments, and each reserve must meet a minimal set of criteria and adhere to a minimal set of conditions before being admitted to the Network. Each biosphere reserve is intended to fulfil three complementary functions : a conservation function, to preserve genetic resources, species, ecosystems and landscapes; a development function, to foster sustainable economic and human development; and a logistic support function, to support demonstration projects, environmental education and training, and research and monitoring related to local, national and global issues of conservation and sustainable development.

Physically, each biosphere reserve should contain three elements : one or more core areas, which are securely protected sites for conserving biological diversity, monitoring minimally disturbed ecosystems and undertaking non-destructive research and other low-impact uses (such as education); a clearly identified buffer zone, which usually surrounds or adjoins the core areas, and is used for cooperative activities compatible with sound ecological practices, including environmental education, recreation, ecotourism and applied and basic research; and a flexible transition area, or area of co-operation, which may contain a variety of agricultural activities, settlements and other uses and in which local communities, management agencies, scientists, non-government organizations, cultural groups, economic interests and other stakeholders, working together to manage and sustainably develop the area's resources.

The Southern Maputaland Biosphere Reserve area has therefore been zoned in accordance with these principles and objectives.

The proposed land use zoning system is depicted in Map 2 and comprises 5 zones namely :

- Zone 1: Protected Area Zone
- Zone 2: Sensitive Area Zone
- Zone 3: General Development Area Zone
- Zone 4: Ecotourism Area Zone
- Zone 5: Intensive Development Node Zone

In line with the three elements as required by the MAB Programme, the Core Area or Areas would be located within the Protected Area Zone (Zone 1) and may coincide with the approximate location of the currently identified -Wilderness Areasalthough this is not necessarily the case. The Buffer Area or Areas would include the balance of the Protected Areas Zone (Zone 1), while the Flexible Transition Area would include the proposed Sensitive Area Zone (Zone 2), the General Development Area Zone (Zone 3), the Ecotourism Area Zone (Zone 4) and the Intensive Development Node Zone (Zone 5).

Each of these zones is subject to certain principles which guide and regulate development therein, for example:

3.2.5.1 Protected Area Zone

3.2.5.1.1 This zone is subject to the principle of minimal development, where the principle land use is Conservation. Other land uses permitted within this zone include ultra low density residential / tourism accommodation developments which are located and designed in sympathy with the natural environment.

3.2.5.1.2 The various categories / classes of this zone are determined in terms of land tenure and include:

- Wilderness areas (no development or vehicular access (1A)
- State owned Conservation areas (1 B)
- Privately owned Conservation areas (1 C)
- Communally (community) owned Conservation areas (1 D)

3.2.5.2 Sensitive Area Zone

3.2.5.2.1 While this zone occurs across all the categories of land tenure, and covers areas which are developable in principle, but are subject to special status by virtue of EITHER their locational proximity to either neighbouring Protected Area and General Development Area Zones OR the existence of sensitive environmental conditions, landscapes, habitats or elements such as wetlands or riverine areas.

3.2.5.2.2 The principle regulating development within this zone is that development applications within this zone would be subject to careful scrutiny in terms of the Integrated Environmental Management (IEM) procedures as provided by the Environment Conservation Act, No. 73 of 1989, to ensure that neighbouring amenities andlor sensitive environmental areas and nature conservation interest are afforded proper protection. Consequently, development within this zone would be either conditional or in some cases may even be prohibited.

3.2.5.2.3 The various categories of use within this zone are:

- Aesthetically Sensitive Areas (2A)
- Environmentally Sensitive Areas (2B)

3.2.5.3 General Development Area Zone

3.2.5.3.1 In principle, low density agricultural and agriculturally related development (subject to the statutes relating thereto) and low density tourism and tourism related development are permitted within this zone, subject to the approval of building plans and subject to certain restrictions and requirements relating to the land use intensity and environmental concerns, including the provision of services, the disposal and treatment of effluent and waste, which may be imposed by the authority charged with the responsibility for regulating land use and development accommodation and meals icon, and include the following:

- Existing Ecotourism Area (4A)
- Potential Ecotourism Area (4B3)

3.2.5.4.2 It is intended that location of existing zoned ecotourism areas and those areas which have been identified in terms of the Plan (or in the course of amendments thereto) as being suitable for such development, would be zoned as potential ecotourism areas, and developed within the framework of the Integrated Environmental Management (IEM) procedure.

3.2.5.5 Intensive Development Node Zone

3.2.5.5.1 This zone defines areas suited for high visual and environmental impact such as high density residential, commercial, industrial, agricultural and tourism developments. Consequently, existing and future villages and towns, factories and tourism nodes including day visitor facilities, various forms of tourist accommodation and intensive tourist recreation nodes are included in this zoning.

3.2.5.5.2 The various categories / classes of use within this zone are determined by the level of impact and include existing Commercial/Industrial Areas (including agricultural industry) for example:

- Existing formal Urban Area (5A)
- Proposed formal Urban Area (5B)
- Existing Informal Urban Development node
- Proposed informal Urban Development node."

APPENDIX B: SOUTH AFRICAN INDICATORS PROPOSED FOR THE MONITORING OF PRIORITY ISSUES (Department of Environmental Affairs and Tourism 1997)

South Africa does not have a National Council for Sustainable Development and a strategy for Sustainable Development has not yet been formulated. Consequently, there is no single document which outlines National priorities. However, the following is a preliminary list of key issues prepared by the Department of Environment Affairs and Tourism.

- Eradication of poverty;
- Provision of water for all;
- Development of international conventions and linkages;
- Energy;
- urban environment;
- coastal zones management;
- Education, including environmental education;
- Waste management;
- Human resource's development.

SOCIAL INDICATORS

- Combatting Poverty
  - Unemployment Rate
  - Head Count Index of Poverty
  - Poverty Gap Index
  - Gini Index of Income inequality
  - Ratio of Average Female Wage to Male Wage
  - Demographic Dynamics and Sustainability
  - Population Growth Rate
  - Net migration Rate
  - Total Fertility
  - Population Density
  -
- Protecting and Promoting Human Health
-
  - Basic sanitation: % of population with adequate excreta disposal facilities
  - Access to safe drinking water
  - Life expectancy at birth
  - Infant mortality
  - Maternal mortality rate
  - Nutritional status of children
  - Immunization against infectious childhood diseases
  - Contraceptive prevalence
  - Proportion of potentially hazardous chemicals monitored in food
  - National health expenditure devoted to local health care
  - Total national health expenditure related to GNP

- Promoting Sustainable Human Settlement
  - Rate of growth of urban population
  - Per capita consumption of fossil fuel by motor vehicle transport
  - Human and economic loss due to natural disasters

- Percent of population in urban areas
- Areas and population of urban and informal settlements
- Floor area per person
- House price to income ratio
- Infrastructure expenditure per capita

- Promoting Education, Public Awareness and Training

  - Rate of change or school going age
  - Primary school enrolment ratio-gross
  - Primary school enrolment ratio-net
  - Secondary school enrolment ratio-gross
  - Secondary school enrolment ratio-net
  - Adult literacy rate
  - Children reaching grade 5 of primary education
  - School life expectancy
  - Difference between male and female school enrolment ratios
  - Women per hundred men in the labour force
  - GNP spent on education

ECONOMIC INDICATORS

- International cooperation to accelerate sustainable development in countries and related domestic policies

  - GDP per capita
  - Net investment share in GDP
  - Sum of exports and imports as a percentage of GDP
  - Environmentally adjusted Net Domestic Product
  - Share of manufactured goods in total merchandise exports

- Changing consumption patterns

  - Annual energy consumption
  - Share of natural-resource intensive industries in manufacturing value-added
  - Proven mineral reserves
  - Proven fossil fuel energy reserves
  - Lifetime of proven energy reserves
  - Intensity of material use
  - Share of manufacturing value-added in GDP
  - Share of consumption of renewable energy resources

- Financial resources and mechanisms

  - Net resource transfer/GNP
  - Total ODA given or received as a percentage of GNP
  - Debt/GNP
  - Environmental protection expenditures as a percentage of GDP
  - Amount of new or additional funding for sustainable development

- Transfer of environmentally sound technology, cooperation and capacity-inputs

  - Capital goods imports
  - Foreign direct investment

- Share of environmentally sound capital goods imports
- Technical cooperation grants

ENVIRONMENTAL INDICATORS

- Protection of quality and supply of freshwater resources

  - Annual withdrawals of ground and surface water
  - Domestic consumption of water per capita
  - Ground water reserves
  - Concentration of faecal coliform in freshwater
  - Biochemical oxygen demand in water bodies
  - Waste-water treatment coverage
  - Density of hydrological networks

- Protection of the Quality and Supply of Fresh Water Resources

  - Population growth in coastal areas
  - Discharges of oil into coastal waters
  - Releases of nitrogen and phosphorus to coastal waters
  - Maximum sustained yield for fisheries
  - Algae index

- Managing fragile ecosystems: Combatting desertification and drought

  - Population living below poverty line in dryland areas
  - National monthly rainfall index
  - Satellite derived vegetation index
  - Land affected by desertification

- Managing fragile ecosystems: sustainable mountain development

  - Population change in mountain areas
  - Sustainable use of natural resources in mountain areas
  - Welfare of mountain populations

- Integrated approach to the planning and management of land resources

  - Land use change
  - Changes in land condition
  - Decentralised local-level natural resource management

- Promoting sustainable agriculture and rural development

  - Use of agricultural pesticides
  - Use of fertilizers
  - Irrigation percent of arable land
  - Energy use in agriculture
  - Arable land per capita
  - Area affected by salinization and water-logging
  - Agriculture education

- Combatting deforestation

- Wood harvesting intensity
- Forest area change
- Managed forest area ratio
- Protected forest area as a percentage of total forest area

- Conservation of biological diversity

  - Threatened species as a percent of total native species
  - Protected area as a percent of total area

- Environmentally sound management of biotechnology

  - Research and Development expenditure for biotechnology
  - Existence of national bio-safety regulations or guidelines

- Protection of the atmosphere

  - Emissions of greenhouse gases
  - Emissions of sulphur oxides
  - Emissions of nitrogen oxides
  - Consumption of ozone depleting substances
  - Ambient concentrations of pollutants in urban areas
  - Expenditure on air pollution abatement

- Environmentally sound management of solid wastes and sewage-related issues

  - Generation of industrial and municipal solid waste
  - Household waste disposal per capita
  - Expenditure on waste management
  - waste recycling and reuse
  - Municipal waste disposal

INSTITUTIONAL INDICATORS

- Integrated environment and development in decision-making

  - Sustainable development strategies
  - Programme for integrated environmental and economic accounting
  - Mandated environmental impact assessment
  - National councils for sustainable development

- Science for sustainable development

  - Potential scientists and engineers per million population
  - Scientists and engineers engaged in R&D per million of population
  - Expenditure on research and development as a percentage of GDP

- International legal instruments and mechanisms

  - Ratification of global agreements
  - Implementation of ratified global agreements

- Information for decision-making

- main telephone lines per 100 inhabitants
- Access to information
- Programmes for national environmental statistics

- Strengthening the role of major groups

  - Representation of major groups in national councils for sustainable development
  - Representatives of ethnic minorities and indigenous people in national councils for sustainable development
  - Contribution of NGOs to sustainable development

APPENDIX C: EXAMPLES OF CORE ENVIRONMENTAL INDICATORS DETERMINED BY AUSTRALIAN STATE OF THE ENVIRONMENT RESEARCHERS (DEST 1996).

THE LAND

- Change in total exposed soil surface contributing to erosion, as a percentage of land area per land-cover region, stratified by major land use
- Change in land use by catchments, and land-cover regions.
- Total grazing pressure
- Rate of extension of exotic species into each catchment and land cover are, and of change and their abundance.

INLAND WATERS

- Depth of water table/water table levels.
- Net rate of groundwater abstraction or discharge/Number of boreholes x average rate of extraction.
- Percent exceedances of water quality guidelines for a suite of bacterial and chemical water quality parameters for human health and recreation/Percentage of key river sites meeting criteria for ambient concentrations of pollutants.
- Number of water treatment plants and the levels of water treatment or filtration adopted/Level of sewage treatment.
- Number of pollution point sources/sewage discharges.
- The distribution of surface water resources by drainage division.
- River flow regimes.
- The degree of clearance in the catchment as a percentage of original tree cover remaining.
- The number of waterbirds of different species on wetlands and the breeding of colonially nesting species of waterbirds.
- Natural river or wetland habitat lost or converted to another land use.
- Wetland extent.

ESTUARIES AND THE SEA

- Dune vegetation(area of dunes covered by vegetation)
- Intertidal sand/mudflat area.
- Mangrove area.
- Salt-marsh area.
- Fish stocks.
- Coastal population.

HUMAN SETTLEMENTS

- Total energy use indicator bu type/Level of energy consumption per house.
- Percentage of annual energy supplied from renewable sources indicator.
- Total annual water use by sector indicator.
- Land converted from non-urban(settlement) to urban(settlement) uses indicator.
- Population and household growth rates indicator.
- Domestic solid waste generated indicator.
- Domestic solid waste disposed to landfill.

HERITAGE

- Number of sites listed on heritage registers.

BIODIVERSITY

- Extent and rate of clearing, or major modification of natural vegetation or marine habitat.
- Location and configuration or fragmentation of remnant vegetation and marine habitat.
- Number and percentage of species presumed extinct, endangered or vulnerable.
- The number, identity, condition and area of native vegetation types.
- The area of native vegetation cleared by type compared with the area re-vegetated(e.g. affected by slash and burn agriculture).

THE ATMOSPHERE

- Average daily rainfall.
- Number of exceedances of air quality.
- Concentrations and duration of pollutant emissions(sulphur dioxide. Lead, smoke, flouride, etc.)

APPENDIX D: EXAMPLES OF AUSTRALIAN PRESSURE-STATE-RESPONSE ENVIRONMENTAL INDICATORS (Ward, Butler & Hill 1998).

Australian Environmental Indicators: Key Indicators for Estuaries and the Sea

Class by Issue or Element	Indicator Type: Condition (C), Pressure (P) or Response (R)	
Class 1: Cited species/taxa		
Protected species	1.1 marine species rare, endangered or threatened	R
Cited species/taxa	1.2 protected species populations	C
Cited species/taxa	1.3 seabird populations	C
Class 2: Habitat Extent		
Habitat extent	2.1 algal bed area	C
Habitat extent	2.2 beach and dune area	C
Habitat extent	2.3 coral reef area	C
Habitat extent	2.4 dune vegetation	C
Habitat extent	2.5 intertidal reef area	C
Habitat extent	2.6 intertidal sand/mudflat area	C
Habitat extent	2.7 mangrove area	C
Habitat extent	2.8 saltmarsh area	C
Habitat extent	2.9 seagrass area	C
Class 3: Habitat Quality		
Habitat quality	3.1 algal bed species	C
Habitat quality	3.2 algal blooms	P
Habitat quality	3.3 beach species	C
Habitat quality	3.4 coral reef species	C
Habitat quality	3.5 dune species	C
Habitat quality	3.6 fish populations	C
Habitat quality	3.7 intertidal reefs species	C
Habitat quality	3.8 intertidal sand/mudflat species	C
Habitat quality	3.9 islands and cays species	C
Habitat quality	3.10 mangrove species	C
Pests (exotic)	3.11 pest numbers	P
Habitat quality	3.12 salt-marsh species	C
Habitat quality	3.13 seamount species	C
Habitat quality	3.14 seagrass species	C
Pests (native)	3.15 species outbreaks	P
Habitat quality	3.16 sub-tidal sand/mudflat species	C
Habitat quality	3.17 chlorophyll concentrations	C
Class 4: Renewable Products		
Aquaculture	4.1 aquaculture effort	P
Aquaculture	4.2 aquaculture production	C
Seafood	4.3 fish stocks	C
Seafood quality	4.4 seafood quality (contamination)	C
Effects of fishing	4.5 trawl fishing area	P
Effects of fishing	4.6 fishing gear	P
Class 5: Non-renewable Products		
Mining	5.1 ocean exploration	P
Mining	5.2 ocean mining	P
Class 6: Water/Sediment Quality		
Sediment quality	6.1 sediment quality (contaminants)	P
Water quality	6.2 sentinel accumulator program	P
Water quality	6.3 turbidity	P

Water quality	6.4 water nutrients (nitrogen)	P
Water quality	6.5 seabird eggs (contamination)	P
Class 7: Integrated Management		
Integrated management	7.1 beach stabilisation	R
Integrated management	7.2 catchment development	P
Integrated management	7.3 catchment management programs	R
Integrated management	7.4 coastal care community groups	R
Integrated management	7.5 coastal discharges	P
Integrated management	7.6 coastal population	P
Integrated management	7.7 coastal tourism	P
Integrated management	7.8 fishing effects on non-target biodiversity	R
Integrated management	7.9 Great Barrier Reef management	R
Integrated management	7.10 integration of management	R
Integrated management	7.11 marine network participation	R
Integrated management	7.12 marine protected areas	R
Integrated management	7.13 Commonwealth Government marine management	R
Integrated management	7.14 ship visits	P
Integrated management	7.15 shipping accidents	P
Integrated management	7.16 State Government marine management	R
Integrated management		

APPENDIX E: **EXTRACT FROM NATIONAL STATE OF THE ENVIRONMENT INDICATOR TESTING PROGRAMME - EXAMPLE OF INDIVIDUAL INDICATORS** (Department of Environmental Affairs and Tourism 1997)

- **SOCIAL INDICATORS**
  - **Head Count Index of Poverty**
  - **Concentration of Faecal coliform in Freshwater**
- **ECONOMIC INDICATORS**
  - **Unemployment Rate**

NAME OF INDICATOR: *Head count index of poverty*		
Category:	Placement in Agenda 21:	Placement:
Social	*Chapter 3*	*State*

SUMMARY

Brief Definition:	*The proportion of the population with a standard of living below the poverty line.*
Units of measurement:	*%*
Set Targets - International:	*Not available*
Set Targets - National:	*Unknown*
Current level:	*Poor households (3 126 647)* *Poor individuals (18 099 652)*
Other related indicators used in South Africa:	

1. INFORMATION ON INDICATOR SELECTION

1.1. Was the indicator already being used in your country (Yes / No) ?

Yes, it is used by all tiers of government, policy-makers, development planners, development researchers, gender forums.

1.2. Please give an assessment to the extent possible of the appropriateness of the indicator for describing trends for the issue addressed. This may be in terms of how adequate, useful and problem oriented the indicator is.

Agriculture -This indicator show progress in poverty alleviation. It could also put special emphasis on the role of agriculture in this regard and by implication the role of the Department of Agriculture.

Development Bank of South Africa - This indicator is crucial for poverty alleviation and policies.

2. INFORMATION REGARDING THE METHODOLOGY SHEET FOR THIS INDICATOR

2.1. Please give a brief overall assessment of the methodology sheet for this particular indicator.

Agriculture - The methodology sheet is useful, with regard to definitions and concepts.

Development Bank of South Africa - It is comprehensive and also clarify the grey areas.

2.2. Please describe the underlying definitions and concepts if different from the CSD list of indicators and explain why these differing definitions and concepts were chosen:

2.3. Describe the measurement method if different from the one in the CSD list of indicators and explain why this differing method was chosen:

3. ASSESSMENT OF DATA

3.1. The following information regarding data quality, quantity and availability is requested. Indicate with a (X) or report as appropriate.

Does Copyright apply?	No ✖	Yes, specify				
Restrictions on use?	No ✖	Yes, specify				
Additional cost involved to obtain data, if any	Specify:					
Method of data collection	Monitoring		Surveys		Questionnaires	
	Yes ✖	No	Yes ✖	No	Yes ✖	No
Update frequency	Weekly	Monthly	Quarterly	Annually ✖	Other	
Period of records	1994					
Units of measurement						
Agency responsible for compilation	Human Sciences Research Council					
Source if published	A Profile of Poverty, Inequality and Human Development in South Africa: HSRC, Andrew Whiteford, 1995					

3.2 Please assess the applicability and accuracy of the data for the compilation of the indicator.

It is a good income indicator which helps to decompose the poverty situation of the country for different geographical regions, population groups, gender etc..

3.3 Are the data complete (please point out possible gaps)?

No, the data must be obtained from the Human Science Research Council.

4. INPUTS RECEIVED FROM:

- *Development Bank of South Africa*
- *Department of Agriculture*

NAME OF INDICATOR: *Concentration of faecal coliform in freshwater*		
Category:	**Placement in Agenda 21:**	**Placement:**
Environmental	*Chapter 18*	*State*

SUMMARY

Brief Definition:	*The proportion of freshwater resources containing concentrations of faecal coliforms which exceed the levels recommended in the World Health Organization (WHO).*
Units of measurement: percent :	*%*
Set Targets - International:	*0 %*
Set Targets - National:	*0%*
Current level:	*Unknown.*
Other or related indicators used in South Africa:	*Escherichia coli, F. streptococci; often used in conjunction with Faecal coliforms for evaluating the microbiological status of water resources.*

1. INFORMATION ON INDICATOR SELECTION

1.1. Was the indicator already being used in your country (Yes / No) ?

Yes, the indicator is widely used in South Africa by Department of Water Affairs and Forestry, Department of Health, Municipal authorities, water Boards etc. The indicator is mainly used for evaluating the chlorination (water disinfection). It is also used in the National Biological Monitoring programme which is currently being developed to characterize the status of feacal pollution of water resources.

1.2 Please give an assessment to the extent possible of the appropriateness of the indicator for describing trends for the issue addressed. This may be in terms of how adequate, useful and problem oriented the indicator is.

Yes, the indicator is useful for national decision-making in terms of evaluating ground water sources requiring disinfection or not before use. Targets are not defined as % of sources exceeding guideline limits but only in terms of individual guideline limits being 0 counts/ 100 ml (target guideline value).

2. INFORMATION REGARDING THE METHODOLOGY SHEET FOR THIS INDICATOR

2.1. Please give a brief overall assessment of the methodology sheet for this particular indicator.

The Commission for Sustainable Development methodology sheet is not useful with regard to definitions and concepts, because of the confusion between the use of E.coli and Faecal coliforms.

The Commission for Sustainable Development methodology sheet not useful for the measurement method, because of inadequate detail provided.

2.2. Please describe the underlying definitions and concepts if different from the CSD list of indicators and explain why these differing definitions and concepts were chosen:

Differs from the WHO definition in that the WHO specifies Eschericia coli, not faecal coliforms. WHO measures only 0 counts /100ml, whilst Department of Water Affairs and Forestry also measures 1 or 10 counts /100 ml.

2.3. Describe the measurement method if different from the one in the CSD list of indicators and explain why this differing method was chosen:

Water resources are invariably contaminated with F coliforms. It will be useful to know % exceeding 1/count/100 ml and 10 counts /100 ml. The % exceeding the ideal guideline for coliforms of 0 gives very little information as almost all sources are contaminated. The degree of contamination is very relevant.

3. ASSESSMENT OF DATA

3.1. *No response.*

4. INPUTS RECEIVED FROM:

- *Department of Water Affairs and Forestry: Institute of Water Quality Studies*

SOUTH AFRICAN GUIDELINE LEVELS FOR BOTH FAECAL COLIFORM AND E.COLI COUNTS IN DOMESTIC AND RECREATIONAL WATERS

(count per millilitre)

USE		RISK		
		Negligible	Slight	Significant
Domestic	Faecal Coliforms	0-5	5-100	>100
	E. coli	0	0-10 (20)*	> 20
Recreational (swimming)	Faecal Coliforms	0-150	150-600	>600
	E. coli	0-126	126-200	>200

Notes:

- Occasional exposure - risk slight

  Continuous exposure - risk significant

Source: Water Research Commission: Dr S Mitchell, 1997

Verified by the Water Research Commission, Dr S Mitchell

NAME OF INDICATOR: *Unemployment rate*		
Category:	Placement in Agenda 21:	Placement:
Social	*Chapter 3*	*Driving Force*

SUMMARY

Brief Definition:	*Unemployment rate is the ratio of unemployed people to the labour force. (South Africa makes use of data using both a strict international definition of unemployment and a more relaxed definition without the need to prove that work has been sought during the past week).*
Units of measurement:	*Percentage or actual numbers*
Set Targets - International:	*Unknown*
Set Targets - National:	*No targets are available. The number of jobs to be created should be targeted and not a specific lower unemployment rate. The reason for this is the fact that job creation acts as a pull factor for others who are normally outside the labour market. It is therefore impossible to target a specific unemployment rate.*
Current level:	*32,6% (Central Statistical Services: Statistics in Brief 1994)*
Other related indicators used in South Africa:	*Percentage of labour force outside formal employment*

1. INFORMATION ON INDICATOR SELECTION

1.1. Was the indicator already being used in your country (Yes / No) ?

Yes, by all tiers of government, policy-makers, economists, development planners, development researchers, labour research institutes etc. Due to the magnitude of the South African unemployment problem, this indicator is widely used. It is specifically used by The Department of Labour, Department of Welfare, the National Population Unit as well as the Reserve Bank.

1.2. Please give an assessment to the extent possible of the appropriateness of the indicator for describing trends for the issue addressed. This may be in terms of how adequate, useful and problem oriented the indicator is.

Agriculture -This indicator is useful in giving an indication of the economic welfare of society. A high employment rate is critical for sustainable development.

Development Bank of South Africa - Unemployment is a strategic factor in all the economic and development plans at national level and is also one of the core issues in the Reconstruction and Development Programme for South Africa.

National Population Unit - It shows the level of manpower potential being wasted in the economy.

2. INFORMATION REGARDING THE METHODOLOGY SHEET FOR THIS INDICATOR

2.1. Please give a brief overall assessment of the methodology sheet for this particular indicator.

The methodology sheet for this indicator is comprehensive and it also clarify the grey areas.

The definition as mapped out on page 5 is in accordance with the experience of the National Population Unit.

South Africa has found that using population census data is not useful in measuring this indicator. Data from unemployment records is unreliable in the South African context. For this reason data usually is sought through household sample surveys.

2.2. Please describe the underlying definitions and concepts if different from the CSD list of indicators and explain why these differing definitions and concepts were chosen:

Not applicable.

2.3. Describe the measurement method if different from the one in the CSD list of indicators and explain why this differing method was chosen:

South Africa has found that using population census data is not useful in measuring this indicator. Data from unemployment records is unreliable in the South African context. For this reason data usually is sought through household sample surveys.

3. ASSESSMENT OF DATA

3.1. The following information regarding data quality, quantity and availability is requested. Indicate with a (X) or report as appropriate.

Does Copyright apply?	No	Yes, specify				
Restrictions on use?	No ✖	Yes, specify				
Additional cost involved to obtain data, if any	Specify: Yes the costs may vary, depending on the status of the institution requesting the data.					
Method of data collection	Monitoring		Surveys		Questionnaires	
	Yes ✖	No	Yes ✖	No	Yes ✖	No
Update frequency	Weekly	Monthly	Quarterly	Annually ✖	Other	
Period of records	1996 to 1995 Development Bank of South Africa and 1993-1995. National Population Unit					
Units of measurement	Numbers and % (percentages)					
Agency responsible for compilation	Development Bank of South Africa / National Population Unit					
Source if published	Central Statistical Service - October Household Survey, Statistical Release, 1995 p 0317					

Note: Data sets: Labour force / Number of unemployed / Unemployment Rate.

3.2 Please assess the applicability and accuracy of the data for the compilation of the indicator.

3.3 Are the data complete (please point out possible gaps)?

4. INPUTS RECEIVED FROM:

- *Development Bank of South Africa*
- *Department of Agriculture*
- *Welfare -National Population Unit*

UNEMPLOYMENT RATE			
Years	1991	1993	1994
Unemployment as a % of the population	14.25%	29%	32.6%

Sources: Provincial draft national report. Fourth World Conference on Women. September 1995. Unpublished data

CSD Report 1997, Country profiles. Department of Environmental Affairs and Tourism, Pretoria, December 1996.

CSS: Statistics In Brief 1994

APPENDIX F: **LOCATION OF TRADITIONAL LAND TENURE AREAS WITHIN KWAZULU-NATAL** (Department of Local Government and Housing 1997)

KWAZULU - NATAL

MOZAMBIQUE

SWAZILAND

MPUMALANGA

Free State

LESOTHO

Eastern Cape

1 Uthungulu

2 Zululand

3 Umzinyathi

4 Uthukela

5 iNdlovu

6 Ilembe

7 Ugu

INDIAN OCEAN

Tribal Authorities

Farm Boundaries

Regional Council Boundaries

Small Towns

N

Eastern Cape

DATA	METHOD OF CAPTURE	SOURCE
Roads	Digitized from 1:50 000 and QPS	S. N. A.
Rivers	Digitized from 1:50 000	Dept of Transport
Farm Boundaries	Digitized from 1:50 000 orthophotos	S. G. O.
Tribal Boundaries	Surveyed	Planning & Survey
Land Capability	500 Contour and Diagonal	Planning & Survey
Regional Council Boundaries	500 Contour and 1:50 000	Planning & Survey
Road Parks Board Areas	Digitized from 1:50 000 and 500 Contour	Road Parks Board

DRAWN IN THE DRAWING OFFICE: LAND, PLANNING & SURVEY : INLAND REGION, KWAZULU-NATAL

SCALE 1 : 1 500 000

14 JULY 1997

W.A VAN DER WALT

PLOTFILE NAME : TRB_1500 000

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