

Chapter 6

LAND DEGRADATION

6.1 A conceptual framework

The study has used a very simple conceptual framework for understanding land degradation. As noted, land degradation incorporates the water, soil and vegetation resources of an area and includes a plethora of hydrological and ecological processes. Land degradation occurs as a result of the disruption of the normal functioning of these processes. The study concentrates primarily on climatic and human's roles during land degradation. In addressing the role that human influences play in the process of land degradation, the study focuses on several issues including the role of land use, demography, history, poverty and policy. While climate has a profound effect on the human society, the influence of both is mediated by biophysical characteristics of a particular area. South Africa is not a uniform, flat landscape but is characterised instead by considerable geological, topographic and bioclimatic variation across the country. For some of these variables, shallow gradients often exist while for others, abrupt transformations occur over relatively short distances. The same climatic or human impact is likely to have a very different outcome in different areas, largely dependent on the biophysical characteristics of the area. For example, the influence of a heavy downpour on a landscape is going to be very different for areas possessing different slope angles, slope lengths, soil textures and soil depths. It is thus through the biophysical characteristics of an area that the influence of climate and human society ultimately impacts on water, soil and vegetation resources. *Table 6.1* summarizes some of the most important biophysical characteristics influencing land degradation. The variables are, for the most part, very general in nature and poorly tested. Garland (1995) has warned against the uncritical acceptance of many biophysical variables. He has suggested that South African studies have frequently either modified them or rejected their values for use under local conditions. Despite this caution, it is suggested that it is of interest to list key

variables, which may have an important moderating effect on the impact of the climate and land use on our environment.

Table 6.1. *Source of the most important biophysical variables, which modulate the impact of climatic and land use factors on a catchment, landscape or region*

Variable	Description and influence
Rainfall erosivity	This is the product of the kinetic energy of falling rain (mass, diameter and velocity) of the raindrops and its intensity and duration. It describes the ability of raindrops to break up soil aggregates. It is measured in iso-erodents, which are lowest for the Western Cape and Northern Cape and highest for the Eastern Cape, KwaZulu Natal and Northern Province (Smithen & Schulze, 1982). Several studies have, however found it to be a poor predictor of erosion in South Africa (see Garland, 1995).
Geology	The parent material influences soil texture and therefore the erodibility of soils.
Topography	This includes measures of (i) slope steepness (in degrees) that influences raindrop splash, run-off velocity and (ii) slope length (the distance that water flows downhill) that influences the volume and velocity of run-off, which in turn affects the cutting power and transport capacity of run-off (Matthee, 1984). Although poorly researched in South Africa, the influence of slope steepness and length on soil erosion appears to be complex (Garland, 1995).
Soil erodibility	It defines the susceptibility of soil aggregates to detachment and transport. Largely the texture, structure, organic material, chemical content and infiltration capacity of a soil determine it. Some soils such as the duplex soils of KwaZulu Natal and parts of the Eastern Cape, with a permeable top soil overlying a relatively impermeable sub-soil, are particularly susceptible to soil erosion (Matthee, 1984). Garland (1995) highlights some difficulties of measuring soil erodibility.
Plant cover	Plants intercept and reduce the kinetic energy of water, which in turn influences soil erosivity. All things else being equal, the closer to the ground the canopy is, the more effective it is at reducing raindrop energy on the soil surface (Matthee, 1984). Snyman (1998) has demonstrated the importance of plant cover in influencing soil erosion. Plant covers influence sub-surface flow and in the riparian zones may also influence stream bank erosion and stability. The role of plants in facilitating chemical sedimentation has not been studied extensively in South Africa.

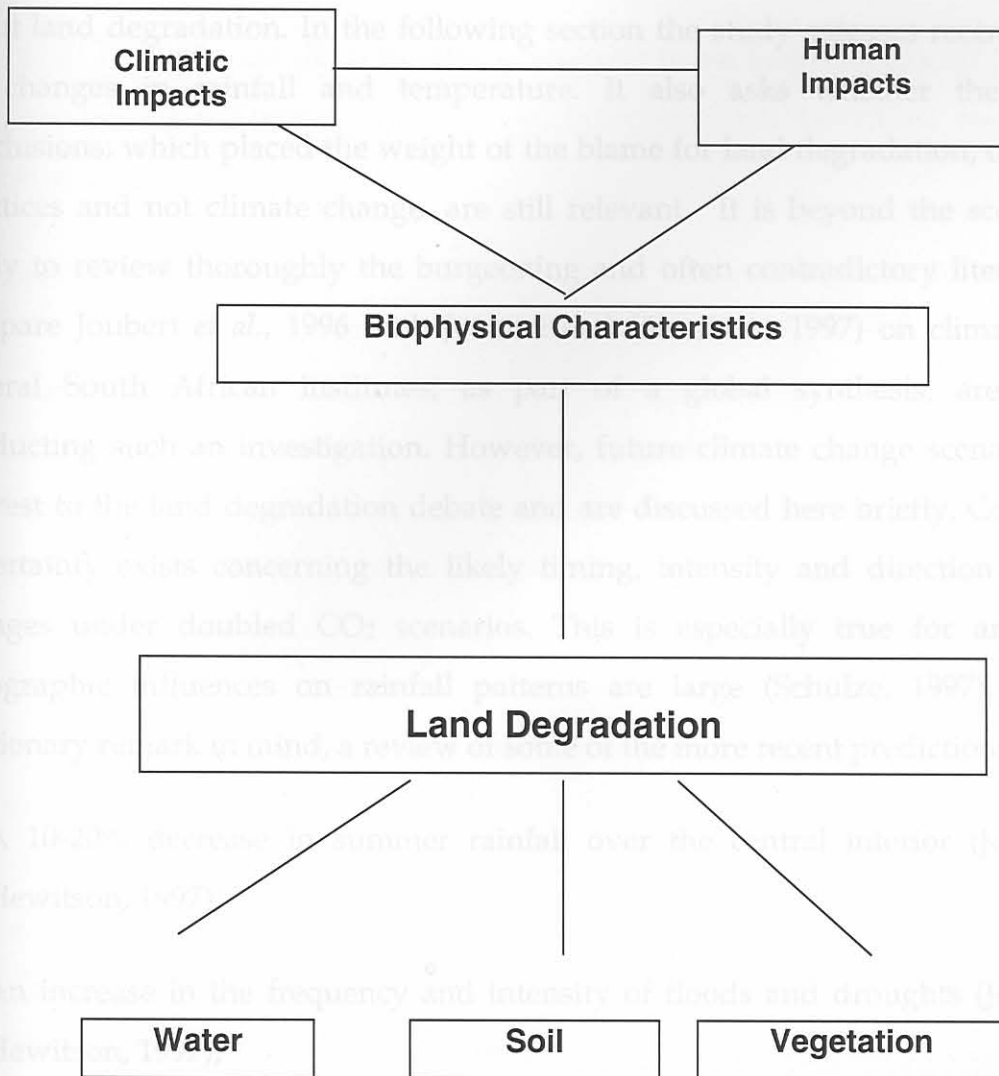


Figure 6.1. A conceptual framework for showing how climatic and human impacts influence, through the biophysical environment, the hydrological and ecological processes associated with an area's water, soil and vegetation resources.

6.2 The Role of Climate

It is extremely difficult to separate the influence of people and climate on land degradation. Despite this, the conclusion of most historical reviews and investigations in the past has been that it is people and their land use practices and not climate that should be blamed for the state of environment (Anon, 1923; Kokot, 1948; anonymous, 1951; Acocks, 1953 and Wilcocks, 1977). While prolonged drought may form a catalyst for desertification (Tyson, 1986), it has generally been stated that it is the removal of vegetation by overgrazing and trampling, subsequent soil erosion

and the resultant impoverished hydrological status of the soil that ultimately bring about land degradation. In the following section the study assesses recent evidence for changes in rainfall and temperature. It also asks whether the historical conclusions, which placed the weight of the blame for land degradation, on land use practices and not climate change, are still relevant. It is beyond the scope of this study to review thoroughly the burgeoning and often contradictory literature (e.g. compare Joubert *et al.*, 1996 with Joubert and Hewitson, 1997) on climate change. Several South African institutes, as part of a global synthesis, are presently conducting such an investigation. However, future climate change scenarios are of interest to the land degradation debate and are discussed here briefly. Considerable uncertainty exists concerning the likely timing, intensity and direction of rainfall changes under doubled CO₂ scenarios. This is especially true for areas where topographic influences on rainfall patterns are large (Schulze, 1997). With this cautionary remark in mind, a review of some of the more recent predictions suggests:

- A 10-20% decrease in summer rainfall over the central interior (Joubert and Hewitson, 1997);
- An increase in the frequency and intensity of floods and droughts (Joubert and Hewitson, 1997);
- Gradual and linear increases in temperature with rising CO₂ levels, with mean temperatures 1,5 - 2,5^oC hotter than at present by 2050 (Joubert and Hewitson, 1997; Schulze, 1997), with an associated increased frequency of higher temperature episodes (heat waves) (Schulze, 1997);

The implications of these scenarios for land degradation, agricultural production and human society in general are profound. Hulme (1996) have suggested that some of the most important, as they relate to land degradation, are:

- Increased potential evapotranspiration rates of 5 - 20% across Southern Africa;
- An increase in runoff of up to 30% in the eastern parts of Southern Africa with an associated increase in the variability of runoff and consequently less reliability;

The Role of People

- A shift in biome distribution with grasslands being largely replaced by savanna vegetation due to increased runoff variability, less reliable runoffs, and increased temperatures;
- A significant impact on about 20% of Southern Africa's largest nature reserves.

In summary, long-term changes in rainfall patterns have still not been conclusively demonstrated. More time is needed to determine if the generally drier and hotter spell of the last 15 years is part of a sustained downward trend in our regional climate, or simply part of the expected inter-decadal variability. Current climate change scenarios suggest that we can expect less rain in the future and increased variability in rainfall amounts. For temperature there appears to be some consensus that there has been an increase and that this is probably in response to greenhouse gas increases. Temperatures are also likely to increase in the future with increasing CO₂ concentrations. Unlike previous investigations into land degradation in South Africa (e.g. Anonymous, 1923, 1951) this analysis suggests that climatic conditions, especially those since the late 1970s, might have had a more important influence on land degradation patterns than is currently acknowledged. In the past, much of the blame for land degradation has been placed on people's use or abuse of the soil and vegetation resources, without recognizing the often-subtle interactions that exist between climate patterns and land use. Certainly our custodianship of the land is important and we cannot ignore stark fence-line contrasts that can be attributed to management regimes. Moreover this is supported by the knowledge that despite the last 15 years, changes in the way people have used the land, have resulted in significant perceived improvements in soil and veld degradation rates in many magisterial districts. Climatic influences are however equally important and should not be summarily dismissed.

6.3 The Role of People

6.3.1 The nature of human influence

This study has identified an interdependent triangle of causative factors that underlies land degradation. Biophysical characteristics are the apex of the triangle that relates most directly to land degradation. Climatic and human-induced factors have a range of causative impacts on the status of land resources, and all three sets of factors influence each other in various ways. Of the three bundles of factors, those arising from human influence are probably the most complex to unravel.

Here the study will establish the nature of human influence on land resources, and provide a profile of the bundle of factors that form the triangle of causation:

- the central form of human influence is the use of land resources for productive purposes: agriculture, collection of plant resources for purposes like fuel and building, and, to a much lesser and more localized extent, mineral extraction and water collection;
- a secondary form of human influence is the use of land resources for other economic and social purposes that does not directly depend on resource extraction or interference with biotic processes: settlements, infrastructure and recreation;
- a tertiary set of influences is incidental but often significant. It comprises the unintended and often remote impacts of economic activity on land resources: for example, pollution of (sub)surface and atmospheric water resources by industry or river impoundment for urban water use;
- finally, and often more positive, is the set of influences associated with human efforts to enhance the natural environment: for example, natural resource management programmes within protected areas like nature reserves, or the South African government's current efforts to remove thirsty exotic plant species from catchments, *i.e.* the LandCare programme.

This assessment of the role of people in land degradation focuses on the central form of human influences: the use of land resources for productive purposes. Despite the

common significance of the secondary and tertiary sets of influences outlined above, there is little evidence that their causative role in land degradation is remotely comparable to that of agriculture and resource extraction. The strongest potential impact that these non-productive uses can have, is when settlement and infrastructure consume land resources without appropriate planning or assessment of environmental effects. This is a significant problem in some parts of South Africa.

6.3.2 Influences on productive land use

At the heart of this analysis, and central to national debate about land degradation, is how people's agricultural and extractive resource uses may affect the status of the land. As will be shown in the study, it is a complex and frequently political set of issues. At the base of the arguments, however, are some crude realities. The way in which the soil is cultivated, exposed, covered and drained by farmers can have profound effects on rates of soil generation and soil erosion (both of which, of course, are natural processes). The way farmers farm can help decide whether agricultural areas maintain, enhance or lose their productivity. Droughts are sometimes a natural phenomenon, but often reflect human mismanagement of the land. The way in which livestock graze the veld - for example, as stock species, numbers and timing of grazing can have a major impact on ground cover, soil loss and maintenance or decline of economically valuable plant resources (Turner and Ntshona, 1998). Direct human collection of plants for food, fuel, building materials and medicine can have an equally strong effect. What has to be explained, is why people use resources, through cultivation or extraction, in ways that enhance, maintain or damage the land. The causative influences on productive land use can be roughly categorized as follows:

- **production goals** are a fundamental determinant of how farmers use their land. In particular, the number and nature of economic purposes that the production is intended to fulfill, will explain the nature of the farming enterprise. A highly focused large-scale beef ranch, for example, can be compared with multipurpose cattle production in a marginal area. Cattle varieties, stocking and offtake rates,

quantities and timing of grazing resource use, drought coping strategies and drought impacts on vegetation cover will all vary widely between the two situations and will offer different potentials for land maintenance or degradation. Similarly, the production goals of cropping enterprises can explain wide variations in agricultural practice, with concomitant variations in environmental risk. Highly capitalised cash crop monocultures may maintain key agronomic and financial variables in a precarious and often temporary balance, but may lead to fertility decline, soil pollution or soil erosion. Subsistence agriculture is often effectively a monoculture too, and may also lead to poor fertility maintenance and soil erosion. Indigenous or adapted multicropping systems that aim to meet a wider range of household nutritional requirements may generate much lower returns per unit of labour and contribute relatively little to national production of major staples, but be more effective in maintaining land resources;

- **environmental and agricultural knowledge systems** vary more widely than is sometimes realised, and have a significant influence on the ways in which land resources are used for productive purposes. At the risk of oversimplification, two broad 'systems' can be identified: the 'western' or 'scientific' body of environmental and agricultural knowledge, and the 'indigenous' or 'vernacular' knowledge systems that exist in rich profusion through much of human society. The western or 'developed' world - including, until recently, the dominant strata in South African society - has typically exaggerated the competence of the former type of knowledge and underestimated the latter, where it recognized it at all. Recently, more balanced appraisals of the two broad approaches to agricultural and environmental understanding have emerged. The depth and integration of vernacular ecological knowledge have come to be widely appreciated - sometimes even exaggerated. Neither kind of knowledge system is static, of course. For example, western agricultural science in semi-arid countries likes to react to the erosive power of water on cultivated soil with conservation techniques that diverted water off fields, sometimes causing new dongas in the process. Now, 'scientific' agriculture is increasingly recognizing the importance of techniques that keep water on cultivated soil but slow its movement and promote its

absorption. Human influences on land status are directly affected by the ways in which people understand natural processes and appropriate agricultural practice;

degradation, the more important it becomes that the risks to such resources

- **technology** is one direct expression of agricultural knowledge systems. It also reflects the economic context within which land users work. Fencing is a simple technology that has major impacts on the way in which livestock production and veld use are organized. The extent to which it is used, depends on a variety of socio-economic factors such as costs and vulnerability to theft, as well as production goals and farmer knowledge about its advantages and drawbacks. In crop production, ploughing and cultivation technologies have major direct impacts on soil status and can variously stimulate or restrain soil erosion and soil compaction. Technologies for fertility promotion and pest control can enhance or destroy land resources. In other sectors, energy and building technologies in rural and urban areas can greatly affect rates and impacts of plant resource extraction from the natural environment;

Africa today, this framework is in flux. Indigenous

systems of resource management through tribal authorities have lost much

- **the socio-economic context** provides a diverse, complex and interdependent range of determining influences over human impact on land resources, and helps to explain the disposition of production goals, knowledge systems and technology with which people use land resources. Key components of this context include:

(c) land distribution arrangements are an obvious reflection of the political

- (a) **economic structures and relationships** within society exert a range of influences over land user behaviour. Product and credit prices, for instance, affect the discount rates that both commercial and subsistence producers apply in their farming and resource conservation practices. Labour costs affect the kinds of farming technology and the structure of farming enterprises through which land is used, and help determine human influences on natural resource status. A crude generalization would be that more labour intensive techniques are typically more compatible with natural resources conservation goals. The range and potential of alternative income generating opportunities in the local and national economy directly affect farming practices in both the commercial and the subsistence

sectors. Another broad generalization, from international experience, about the opportunities facing land users is that the greater the risk of land degradation, the more important it becomes that the risks to such resources should be minimized;

(b) **social, political and institutional** factors are often hard to disentangle. One key issue around which they combine to affect land use practice, is **gender**. The differentiated ways in which the labour resources of women and men, and their respective authorities, are deployed and rewarded in land use and land management, help to explain what technologies, production systems, conservation practices and management arrangements function in a given landscape - and how they affect the conservation or degradation of land resources. Overall, **the political and institutional framework** within which people live and use, protect, manage and exploit will often drive the type of impact. In South Africa today, this framework is in flux. Indigenous systems of resource management through tribal authorities have lost much of their influence. There is an emerging commitment to more participatory and economically rewarding modes of resource use, however, this revised model is not yet fully in place.

(c) **land distribution arrangements** are an obvious reflection of the political dispensation in a country. Again, South Africa very clearly displays in its landscape the way in which land rights have been distributed and administered. The definition and distribution of land access rights would normally be considered an integral part of a land tenure system. There is however a cruder sense in which it is sometimes necessary to distinguish the way in which land access rights are distributed from the way in which tenure is structured. This is particularly true in South Africa. Other things being equal, the extent of productive land available to a land user group or population sector will significantly influence land use practice and the potential for land degradation. If land distribution arrangements specifically expand or reduce

the areas available to different groups, this is likely to have direct impacts on spatial variation in land uses and land use impacts;

(d) **land tenure systems** reflect the economic, social, political and institutional conditions that prevail in a particular agrarian context. Internationally, there has been extensive debate about the relationship between land tenure and incentives to produce from and conserve the land. The central concern of this debate has been whether land users' rights to land resources are secure enough to make agricultural investment - including investments aimed at long term conservation benefits - worth their while (Turner and Ntshona, 1998). The focus of this debate has moved from the outward forms of tenure security (such as freehold versus 'communal' tenure) to the actual practices and perceptions of land authorities and land users. Commonly it has been shown that users in non-freehold systems do feel secure enough to invest in production and conservation; but that the detailed design of such systems, and a range of locally variable factors affecting their performance, will determine whether this is so in any particular instance. Conversely, it has been recognized that private ownership is not a guarantee for environmentally responsible behaviour. Freehold farmers may also be led by ignorance or external economic incentives into land degradation or land mining practices; and

(e) **rural livelihoods** structure and functioning is a useful way to formulate a focused perspective on how people use land and potentially contribute to its degradation. The livelihoods approach looks at the full range of assets, claims, rights, economic opportunities and economic activities that shape a household's quality of life: not just its income and consumption, but its broader ability to participate meaningfully in society. The strength of the livelihood concept in analysis of land use is that it fully recognizes the diversity of economic strategies and resource bases on which a rural household may rely.

6.3.3 Demography and land degradation

To invert the title of the now famous book by Tiffen *et al.*, (1994), Do more people mean more erosion? The original answer, based on the work of Malthus, would have been yes. Human populations would always outstrip the capability of land resources to feed them. Famine would bring human population into check, unless people took their own measures by delaying marriage or limiting their fertility. Writing in the late 18th century, Malthus assumed that the productivity of the land was generally fixed, and could not normally be enhanced by improved agricultural technology (Marquette, 1997a). Despite its antiquity, the argument that increasing human population densities in rural areas beyond a certain point will lead to degradation, is still intuitively appealing in many settings, including South Africa. Malthus did not ignore the possibility of agricultural inventions (such as the plough) increasing the productive capacity of the land (Marquette, 1997b), but the implication was that these were comparatively rare events. Most fundamentally, his argument suggested that the population size in a rural society would be determined by land capability and available technology.

The best known proponent of an alternative view is Ester Boserup (1965, 1981). She had the advantage of assessing the issue two centuries later (after the European agricultural revolution and during the Green Revolution) and of observing the very high human population densities and agricultural productivity in parts of Indonesia. The core of her argument is that population is the determining variable. As population densities increase, rural populations will respond with agricultural intensification, developing new technologies to attain the necessary increases in food production from their land. This is what Tiffen *et al.*, (1994) describes as happening in the Machakos area of Kenya over the past half century. Whether such intensification is sustainable or leads to land degradation, will depend on a range of local and external factors. Tiffen *et al.*, (1994) believe that the Machakos intensification is sustainable, and attributes this to "a conjunction of increasing population density, market growth [much produce is sold in Nairobi] and a generally supportive economic environment. The technological changes...were mothered by necessity"

(Mortimore and Tiffen, 1995). Adams and Mortimore (1997) quote a number of other instances of agricultural intensification in Africa, although they point out that, because of generally low population densities, such cases have been the exception rather than the rule on this continent. They also point out the risks and costs of intensification, and warn that a variable range of factors determine whether it happens at all or is environmentally sustainable.

Marquette (1997a,b) describes various approaches to explaining people-land relationships that go beyond the linear arguments of Malthus and Boserup. She quotes multiplicative perspectives, such as the 'I=PAT' equation which introduces the important consideration of standard of living, levels of consumption and hence environmental demand (a key issue in the grossly skewed consumption patterns). This equation proposes that *environmental impacts = (population size) • (level of affluence or per capita consumption) • (level of technology)*. She goes on to quote mediating perspectives, which more explicitly recognise the range of socio economic and policy factors that may affect how a given rural population uses, conserves or degrades its land resources. Another, more direct approach (called development-dependency perspectives by Marquette) subsumes all explanation of local people-land relationships within an international and national theory of development and underdevelopment. In the millennium it is tempting to expand these arguments to take account of accelerating globalisation trends. Rural South Africans, for example, have long been directly affected by international economic trends through the gold price; but the current globalisation of food and other markets may add many new constraints to local economic growth and development options.

Much of this debate assumes relatively self-contained rural economies, within which land and environment relationships must be worked out according to local agrarian conditions. The key to applying and resolving the opposing arguments in circumstances is to recognise the diversity and only partly agrarian nature of the rural livelihoods whose performance may affect land resources. 'Mediating perspectives' are clearly necessary, even if we do not fully subscribe to the theories of dependency and underdevelopment. As this study will show, a variety of external

political and economic forces have affected people-land relationships in the rural areas of this country; and a range of off-farm, sometimes geographically remote livelihood strategies are pursued by rural South Africans. This complicates the relationship between demography and land degradation.

6.4 Land Tenure: Favoured (FA) and Marginal Areas (MA)

Political history and the impact on land use and degradation are more starkly delineated in the South African national experience than in most other countries. In exploring the role of people in land degradation in South Africa, this analysis therefore begins with one of the starkest features of the bleak South African experience: the distribution of land rights among the population. It will show that racial distribution of land rights was gradually linked to a spatial distribution of racially defined rights in areas where different tenure systems were applied. This process of racial and spatial distribution has led to the division of the rural landscape and economy into large scale and small scale farming areas. The arrogation of land rights to the ruling white minority in South Africa passed through two phases. In the first phase, land was acquired through colonial conquest and settlement. Legislation played a supporting role in codifying tenure arrangements for the land acquired. In some circumstances, it was possible for limited Blacks to have land rights on the basis of these arrangements. In the second phase, following the consolidation of settler authority over the national territory, legislation played the leading role in extinguishing the few Black land rights in predominantly white owned areas, and in restricting Black land ownership to specified 'homeland' areas within which non freehold tenure systems were to operate. The colonial and apartheid history has created a patchwork of **marginal areas (MA)** within a matrix-comprised predominately of **favoured areas (FA)**. What is less known, however, is the precise location of these marginal areas and the quality of the biophysical resources and climatic environments associated with these marginal areas.

Despite numerous attempts, the study could not locate an up to date digital map of magisterial districts showing the proportion of the district managed under a marginal

and favoured land tenure system. Available statistics often do not reflect the post-1994 situation. The information used here was derived from 12 degradation workshops held in the three provinces during 1999. At each meeting, participants were requested to estimate the percentage of the magisterial district, which was managed under marginal land tenure and the percentage that was managed under favoured land tenure system. The definition used was as follows: If an individual had property rights over a particular area and could sell the land for individual profit, then it was considered to be held under a form of favoured land tenure. The study suggested that the former TBVC states (homelands) and self-governing territories were largely managed under a marginal land tenure system, even though numerous favoured ventures might currently be underway within such areas. Participants at the workshops usually had little difficulty in assigning percentage values to the two different land tenure categories, as most districts were either under 100% favoured or 100% marginal tenure.

How can the areas comprising these two land tenure systems best be described? To answer this question, the study calculated mean values for each magisterial district for a suite of 31 variables, including those that defined the district in terms of its biophysical and climatic characteristics, land use practices, and its demographic, labour and employment and economic production characteristics (*Table 6.2*). These variables are used to identify the important correlates of land degradation in South Africa. The biophysical and climatic variable were derived from a GIS analysis of several data sets contained in Schulze *et al.*, (1997) and van Riet *et al.*, (1997). Land use indicators were taken from the results of the degradation workshops. Stocking values were taken from the 1995/96 census of the Department of Agriculture. Demographic, labour and employment and economic production values were assembled from the DBSA's macro-economic reviews for each province, which were published, mostly in 1995, and which were derived predominantly from the 1991 and 1996 population census of South Africa.

Table 6.2: Comparisons between the 262 magisterial districts which have more than 50 % of their surface area managed under a favoured land tenure system and 105 magisterial districts which have more than 50% of their surface area managed under a marginal land tenure system. Significant differences were tested using a non-parametric Mann – Whitney U test: NS = not significant different; *= $p < 0.05$; ** = $p < 0.01$; *** = $pp < 0.001$

Variable and Mean for Unit of measurement	Mean for Favoured districts	Mean Marginal districts	Test statistics
Biophysical variables			
Area (km ²)	4 009	1 652	5.5***
Altitude (m)	1 094	816	5.6***
Slope (%)	1.3	1.7	-3.7***
Runoff (m ³ per km)	54 759	84 452	-4.6***
Erodibility index	11.5	9.5	4.8***
Fertility index	4.2	4.2	0.4NS
Climatic variables			
Mean annual rainfall (mm)	568	710	-5.8***
Coefficient of variation (%)	29.5	26.3	6.0***
Summer Aridity Index	3.7	3.2	5.9***
Ratio MAP: PET	1.2	1.3	-5.6***
# of grow days	47	63	-8.5***
Mean annual temperature (°C)	16.5	18.5	
Land use			
%Croplands	24	25	-2.3*
% Grazing	60	49	3.6***
% Commercial Forests	3	4	4.3***
% Conservation	3	1	2.6*
% Settlements	9	20	-11.9***
Stocking density (LSU/ha)	0.17	0.38	-9.7***
Demography			
Population density (#people/km ²)	173	199	-8.9***
% Males	51	45	12.2***
% 15- 64 years	61	48	11.9***
% Rural	43	88	-12.7***
Labour and Employment			
% Unemployed	14	32	-10.9***
% Employed in agriculture	29	17	5.3***
Agric employment growth index	102	149	2.5*
# of dependents	1.	6.0	-12.5***
Economic production			
GDP per capita	6 946	1 599	13.2***
% Agric contribution to GGP	26.9	13.2	5.2***
% Annual growth in agriculture	0.1	4.2	-4.9***
% Annual growth in GGP	1.5	7.0	-9.4***

The results of this analysis show that FA and MA are significantly different in all but one of the 31 variables (*Table 6.2*). MA districts are, on average, smaller in size and are at lower altitudes than the favoured districts. They have significantly steeper slopes, greater run off and increased erodibility (Van Riet *et al.*, 1997). Soil fertility between the two land use systems is not significantly different. Land use differences derived from the degradation workshops suggest that marginal areas have, on average, more of their area used for crops, plantations, and settlements and less for grazing lands, conservation areas and/or mines.

The brief summary in *Table 6.2* of the population census shows, however, that human population density is significantly higher in marginal areas. (The somewhat surprisingly high value in *Table 6.2* for favoured districts is a result of the inclusion of Gauteng, Cape Town and the Durban metropolitan areas). There are also significantly fewer males in the marginal areas and fewer people in the economically active age category range from 15-64 years. MAs have, on average, more than twice as many people living in rural, as opposed to urban areas, when compared to the mean for FAs. Unemployment figures for the 1991 and 1996 census' are generally more than twice as high in MAs, with fewer people formally employed in the agricultural sector, even though this sector grew more rapidly in the marginal than in the favoured areas for the period 1981-1991 (*Table 6.2*). On average, more than three times the number of people is dependent on single wage earner's salary in marginal areas compared with FAs.

Finally, a general poverty index, derived from the 1991 census, and defined as the GGP per capita, indicates that MAs possess an index more than four times lower than that of the FAs (*Table 6.2*). The contribution of agriculture to the GGP in marginal magisterial districts is about half that of the FAs, although it is growing at a much higher annual rate (1981-1991) than for FAs. A significantly higher annual growth rate in GGP is experienced in MAs when compared to favoured areas for the period 1981-1991.

6.5 LAND USE PRACTICE

An understanding of land use patterns provides an important context for the understanding of degradation. In this section, the study first discusses the % area used for each of the six main land use types (LUT) within the three provinces and within FAs and MAs separately. Next it describes historical cropping and livestock practices and how the percentage area is perceived to have changed for LUT over the last 10 years. Finally, the study discusses perceived changes in the intensity of land use over the last ten years. The study recognizes six main land use types (LUT), defined in *Table 6.3* below.

Table 6.3: The six land use types (LUT) used in the participatory workshops. Definitions generally follow those in Linger & Van Lynden (1998).

Land use type	Definition
Crop land	Land used for the cultivation of crops, including fallow land (over the last 10 ears); land used for annual field cropping (e.g. maize, wheat, vegetables, lucerne), perennial field cropping (e.g. sugar cane, banana, pineapple); tree and shrub cropping (e.g. tea, grapes, apple, avocado, etc.)
Grazing land	Land used for animal production on natural veld (deserts, grasslands, woodlands) and includes planted pastures used for grazing animals. It also includes favoured wildlife ventures owned by individuals or farmer consortiums.
Commercial plantations	Land used mainly for commercial wood production and in some cases, protection.
Conservation area/or	Declared national, provincial, and municipal conservation areas as well as state land (e.g. South African National Defence Force property).
Settlement	Includes both rural settlements and urban areas, roads and construction sites.
Other	Predominantly mining areas and lakes or dams.

6.5.1 Land Use Patterns

Of the nine provinces, **cropping** occupies the greatest area in the Western Cape, the Free State, Mpumalanga and the North West Provinces. Because of its aridity, cropping forms the smallest proportion of the magisterial districts in the Northern Cape. For both favoured and marginal magisterial districts croplands occupy, on average, about a quarter of the surface area of each district. Districts, which are at the arid end of the gradient, tend to have a greater area of **grazing lands** or **veld** than the wetter magisterial districts. The Northern Cape and Eastern Cape (especially in the west) possess, on average, the highest proportion of grazing lands. The highly urbanised districts of Gauteng have less than 20% of their area used for grazing. In the favoured magisterial districts, nearly two-third of the area is used for grazing animals, while less than half of the MAs are comprising grazing lands. **Commercial plantations** occupy the greatest area in KwaZulu Natal and Mpumalanga, while they are absent from the Free State, Gauteng, and the arid Northern Cape and North West Provinces. **Conservation** areas comprise the greatest area in Mpumalanga and do not make up more than 3% in any other Provinces. Both the favoured and marginal areas have similarly low values for forests and conservation areas. It is not surprising that Gauteng possesses by far the greatest proportion of **settlement** area. The Northern Cape has particularly low settlement areas while all other provinces range between 5% and 14%. On average, the marginal districts contain about twice the settlement areas recorded in the favoured magisterial districts. Mining areas comprise the greatest proportion of the "other" category. Values are highest for Gauteng and to a lesser extent the North West Province and the Free State. The land use type "other" occurs in similarly low proportions in favoured and marginal areas. These land patterns are shown in *Table 6.3*.

Table 6.4: *The mean values for each province and favoured and marginal districts used for each Land Use Type in each magisterial district (N=367 magisterial districts).*

Province	The mean % area of a magisterial district used for each Land Use Type						
	No. of Dist	Croplands	Veld	Plantations	Cons	Settle	Other
Eastern Cape	78	20	64	5	1	10	0
Gauteng	22	22	19	0	1	50	8
KwaZulu Natal	51	17	58	8	3	13	0
Mpumalanga	30	30	46	8	7	7	2
Northern Cape	26	2	96	0	1	1	0
Northern Province	39	22	58	1	2	14	1
North West	28	30	54	0	1	11	3
Western Cape	42	36	43	4	3	13	1
Favoured districts ¹	262	24	60	3	2	9	1
Marginal districts	105	25	49	4	1	20	1

¹A district is considered favoured if more than 50% of its area is managed under a commercial land tenure system and marginal if more than 50% of its area is managed under a communal land tenure system. This convention is used in all tables, which follow, unless specifically stated otherwise.

6.5.2 Area Trend

6.5.2.1 Cultivation and croplands

This section shows how the area of each land use type is perceived to have changed over the last 10 years, and provides the most important reasons for these changes. The major crops, in terms of area cultivated, in the favoured magisterial districts are maize, wheat, sunflower seeds and sugar cane. Together these four crops comprised more than 80% of the total cultivated area in South Africa in 1981 (when the last major agricultural census took place). Since 1990 the mean area cultivated has dropped to around 6.2 million ha. The combined production of these four crops has fluctuated considerably since 1980, following an impressive increase from 1911-1980. In 1997 production values were the highest on record, at just under 34.7 million tonnes. The patterns that are seen for the four most important cultivated crops are also reflected in **cropland** area trends. *Table 6.5* shows that over the last 10 years there has been a slight decrease in cropping area. This decrease has been greatest in Gauteng, the Free State and KwaZulu Natal, while the Northern Cape (especially for

favoured areas along the Orange River), and the Northern Province have shown an increase in the area used for crops in the past 10 years. Overall, both favoured and marginal areas display declining cropping areas.

Table 6.5: The mean provincial, favoured and marginal) changes in area of each Land Use Type per magisterial districts over the last 10 years (N=367 magisterial districts). Change was scored by workshop participants on a scale of -2 (rapidly decreasing area of more than 2% per LUT per year) to +2 (rapidly increasing area of more than 2% per LUT per year)

Province	The mean change in area of each Land Use Type: 1989 - 1999						
	No of Dist	Croplands	Veld	Plantations	Cons	Settlements	Other
Eastern Cape	78	-0.3	-0.5	0.0	0.1	0.9	0.0
Free State	51	-0.4	0.0	0.0	0.0	1.0	0.0
Gauteng	22	-1.0	-0.9	0.0	0.0	1.2	0.1
KwaZulu Natal	51	-0.4	-1.0	0.5	0.0	1.0	0.0
Mpumalanga	30	0.1	-0.5	0.2	0.0	0.7	0.3
Northern Cape	26	0.5	-0.3	0.0	0.1	0.2	0.0
Northern Province	39	0.4	-1.2	0.0	0.0	1.2	0.1
North West	28	-0.3	-0.4	0.0	0.0	0.9	0.4
Western Cape	42	0.1	-0.7	0.0	0.20	0.7	0.0
Favoured districts	262	-0.2	-0.4	0.1	0.1	0.7	0.1
Marginal districts	105	-0.1	-1.1	0.1	0.0	1.4	0.0

Box 6.1: Reasons for decline in area of cropland are given as:

- An increase in settlements, commercial forest plantations and to a lesser extent in ecotourism ventures (including – commercial wildlife production or ecotourism ventures) that often occurs at the expense of croplands.
- The conversion scheme in favoured areas has meant that marginal croplands have been replaced by planted pastures;
- Input costs have risen dramatically over the last 10 years and it is now no longer economically viable to crop, especially in marginal areas where costs are sometimes high and risks often great;
- Droughts in the mid-1980s discouraged many farmers from cropping;
- Violence in some areas has meant that people are reluctant to spend lengthy periods in the fields and cultivation has declined as a result;
- Collapse of infrastructure (especially protective fencing) has made it more difficult to crop;
- Inadequate resources, such as ploughing implements and training and no access to loans to purchase equipment;
- Invasion of croplands by weeds has reduced the area.

Box 6.2: Reasons for increases in the area of croplands

- More irrigation water is now available;
- New crops (especially orchards) are being planted;
- Conversion of dense bushveld to croplands through active bush clearing programmes;
- People in the marginal settlement are demanding more land for their cropping needs in an attempt to sell their produce and combat poverty;
- Better technology and soil preparation methods have both also led to an increase in cultivated areas in some districts.

Box 6.3: The main reasons provided for decreases in grazing land

- An expansion of croplands on high potential soils, together with development of irrigated lands, orchards and the clearing of sometimes low potential grazing land;
- An expansion of commercial forests, conservation areas, and mining;
- Sand-mining in some areas has also physically removed grazing areas;
- Soil erosion of the veld has reduced the grazing area;
- Invasion of alien plants onto grazing lands;
- The growth and expansion of settlement were regularly cited as the most reasons for the decrease in grazing area in a district.

Box 6.4: The main reasons for increases in grazing land

- Conversion of marginal cropping area to planted pasture and veld, especially for the creation of conservation areas;
- Where irrigation water has been limited or problematic, previous croplands have become grazing lands once more.

6.5.2.2 Plantations, conservation, settlements and other

Commercial plantation areas are perceived to be increasing in nearly all magisterial districts which are suitable and the increases are similar for favoured as well as marginal districts (*Table 6.4*). Perceptions are that it is more economic to change from beef to timber and there has been a major expansion of the forestry industry over the last 10 years. In the Eastern Cape where two magisterial districts show a decrease in forest area, the main reasons cited were that the theft of wood and the burning of plantations have reduced the area of commercial plantations. **Conservation** areas show an increase especially in the favoured magisterial districts of the country (*Table 6.4*). This increase is primarily perceived to result from the acquisition of new areas or enlargement of existing conservation areas by the South African National Parks. There are no districts in South Africa where settlement areas are perceived to be decreasing (*Table 6.4*). In the western parts of the country and in the favoured magisterial districts of several other provinces settlement areas were perceived to have changed very little over the last 10 years. In general, settlement area expansion was twice as great over the last 10 years, in the marginal magisterial districts compared to favoured districts. The increase in the area of "other" over the last 10 years, especially in the northern parts of the country, is largely as a result of new mines being opened, while decreases have resulted from closure of mines (*Table 6.4*). New mines have generally been opened in favoured magisterial districts.

6.5.3 Intensity trend

A change in land use intensity refers to changes that have occurred in magisterial districts over the last ten years due to technical, infrastructural or management inputs for a particular land use type. For **croplands**, most magisterial districts show an increase in land use intensity and mean values for the provinces are positive in all cases, slightly more so in marginal than favoured areas (*Table 6.6*).

The most common scenario for the **grazing lands** was a decrease in land use intensity in many districts, especially in marginal areas, and modest increases in the North

West Province, the Free State and the Northern Cape (Table 6.5). In the marginal areas, the situation is very different.

Table 6.6: The mean values for each province and favoured and marginal districts for the change in land use intensity in the last 10 year within which each Land Use Type in each magisterial district (N=367 magisterial districts). The information provided by workshop participants and the change in land use intensity ranged from -2 (moderate decrease) to +2 (moderate increase)

Province	Change in land use intensity; 1989-1999						
	Number of Dist	Croplands	Veld	Forests	Cons	Settle	Other
Eastern Cape	78	0.7	0.0	0.0	0.0	0.6	0.0
Free State	51	0.9	0.5	0.0	0.2	1.4	0.1
Gauteng	22	0.3	-0.4	0.0	0.0	1.5	0.0
KwaZulu Natal	51	0.9	-0.2	0.6	0.5	0.9	0.1
Mpumalanga	30	0.3	0.0	0.1	0.1	0.9	0.3
Northern Cape	26	0.5	0.5	0.0	0.1	1.0	0.1
Northern Province	39	0.8	-0.5	0.1	0.1	0.2	0.1
North West	28	0.9	0.6	0.0	0.2	1.1	0.4
Western Cape	42	0.6	0.1	0.0	0.3	0.9	0.1
Favoured districts	262	0.6	0.2	0.1	0.2	0.9	0.1
Marginal districts	105	0.9	-0.4	0.1	0.1	1.1	0.1

Box 6.5: Increases in land use intensity for the croplands are as a result of:

- Increased mechanisation driven in part by the introduction of new labour laws which encouraged large scale farmers to downscale their labour forces;
- Stubble cultivation and minimum tillage practices have increased;
- Increase in intensive and specialist crops such as peaches, cut flowers and berries
- More environmentally suitable and improved seed cultivators and varieties now being used;
- Better pest control, harvesting procedures and automated packing sheds;
- Better utilisation of irrigation following change to centre pivots and drip irrigation with the use of liquid fertilisers and better scheduling of irrigation water and drainage systems;
- Improved extension services, both from the government and from the private sector including the wide-scale introduction of soil testing;
- The role of demonstration plots, study groups and Farmers Associations have improved the skills of crop farmers, especially in the large scale sector;
- The drought relief funds (e.g. R35 million in the Northern Province for marginal and favoured farmers) have enabled farmers to invest in fertilizers.

Box 6.6: Increases in land use intensity of veld, which are mostly applicable to favoured districts, are as a result of:

- Better management systems employed, including the use of multi-camp systems and the adoption of research recommendations;
- Improved extension provision and education as well as the use of demonstration farms and the initiation of study groups and Conservation Committees. All these initiatives have improved conservation awareness of large scale farmers;
- Improved infrastructure, including water points, fencing;

Box 6.7: Here it was suggested that land use intensity has decreased largely as result of:

- The encroachment and invasion of settlements onto the grazing lands rendering it increasing difficult to manage livestock;
- The removal of fencing materials, especially near informal settlements and collapse of general infrastructure in the marginal areas such as boreholes, windmills , dipping kraals, shreds;
- Sheep and large stock theft has made both favoured and marginal livestock farming very difficult;
- Increase in stock disease following withdrawal of government dipping schemes in the marginal areas;
- The collapse in institutional control of the livestock industry in some marginal areas.

Land use intensity over the last 10 years shows very similar trends for favoured **plantations** and **conservation areas** (Table 6.6). KwaZulu Natal shows the greatest increase in land use intensity for these two land use types and FAs and MAs are very similar. Although participants felt poorly informed of the details of land use practices in these two land use types, increases in land use intensity have mostly been as a result of improved infrastructure, and better management techniques whether plantation or conservation (Table 6.6). Of the six land use types, changes in land use intensity trends over the last 10 years were greatest for **settlement** areas (Table 6.6). Overall, values were higher for MAs than for FAs and were highest for Gauteng, the Free State and the Northern Province, where numerous housing projects are underway. They were lowest for the Eastern Cape, largely as a result of the lack of growth in settlements in the favoured magisterial districts.

In the mining or “**other**” areas, the perceptions of workshop participants were that land use intensity had also increased and that increases were similar for favoured and marginal areas. Increases in land use intensity trends over the last 10 years were as a

result of improved rehabilitation techniques, better extraction methodologies using improved technologies and equipment.

6.5.4 Land Use Practices in the Favoured Areas

Land use patterns in the favoured areas are determined largely by prevailing ecological conditions. However, unlike in the marginal areas, there are also stringent rules governing land use practices on favoured lands. Laws compel individual landowners to follow strict guidelines when using the land. For example, the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) specifies that the cultivation of virgin soil is prohibited unless written permission is obtained from the National Department of Agriculture. Similarly, the cultivation of steep slopes, and cultivation on certain soil types in specified magisterial districts, are also prohibited without written permission. Specific instructions are also provided concerning general cultivation practices, the erection of soil conservation works, veld management practices, the development of Soil Conservation Committees and, more recently LandCare has been launched. In favoured areas, the South African government, primarily through the National Department of Agriculture, has also spent millions of rands to ensure that responsible land management occurs primarily through subsidy schemes, education programmes, and threats of heavy fines for those transgressing the law. Several other pieces of legislation, such as the Sub-Division of Agricultural Land Act, 1970, (Act 70 of 1970), further control about what landowners in favoured areas may or may not do with their land, also exist. All of these Acts and extension programmes, which have mostly been applied exclusively to favoured areas, have a bearing on the current conservation status of the agricultural resources in the favoured areas.

Throughout this analysis the study has suggested that, with notable exceptions, the agricultural resources of favoured areas are, generally speaking, not as degraded as those in marginal areas. Most importantly, in the majority of favoured districts the perception of agricultural personnel was that the resource conservation status has

improved over the last ten years. The difference in the impact of agricultural land use practices between favoured and marginal land tenure systems is also not incidental.

In conclusion to this section we need to emphasise that for favoured areas, the impact of different agricultural practices on the conservation status is generally well understood. The research that underpins this knowledge has frequently been used to justify new state intervention strategies (e.g. Bruwer *et al.*, 1991). However, the current crisis in the agricultural extension service means that new ways of addressing resource conservation issues in the favoured areas of South Africa need to be developed. In addition, the shift in focus and financial resources to marginal farmers and to emerging small-scale favoured farmers suggests that the benefits enjoyed by the favoured agricultural sector are going to change. It remains to be seen what impact this is going to have on the food security situation.

6.5.5 Land Use Practices in the Marginal Areas

It has been shown above that the South African racial policy has changed the marginal areas of the country into crowded places. Finally, the study has used the available data to suggest that marginal area livelihoods over most of this century have involved a combination of sub-subsistence farming and sub-subsistence labour migration. That combination, overshadowed by hostile land use policies, necessitated heavy dependence on the land while inhibiting adequate investment of labour resources in sustainable production practice. The dependence of marginal area livelihoods on land resources has diminished, although the energy elements and other uses of organic matter in those livelihoods are probably maintaining significant levels of degradation to the present day.

Informed by the analysis in the previous sections (demography, land use policy and livelihoods), the study is now able to put the final link of the central causative chain into place. In this section, the study considers how all of these influences have been expressed in the actual land use practice of people in the marginal areas. It shall look

- Meanwhile, the soil conservation programmes that were imposed on large areas in association with 'betterment' schemes were of dubious technical benefit. Like conventional soil conservation programmes across the country, they did little to retain soil moisture or fertility. Instead, they concentrated on diverting water from fields, which could be disastrous if design errors or maintenance failures led to leaks or spillages. Dongas could easily be started by failed terrace systems. As a result, they often became at best ineffective and at worst positive agents of land degradation.

It must also be recalled that the challenge of sustainable crop production is particularly complex in the marginal areas because of the generally poor and erodible soils that predominate in some of these areas. Some arable land, notably in the former Transkei, is rich, productive and relatively easy to conserve. However, much arable land in marginal areas is susceptible to degradation with any but the best conservation farming practices.

In the former Ciskei approximately 20% of rural households showed a "real interest" in farming (FRD, 1992). "Underfarming" is now widespread, though certainly not universal. In many of the former homelands, large areas of formally cultivated land have been abandoned and are now used only for low intensity grazing (or the expansion of settlements). In my judgment arable land use is rarely a significant cause of land degradation today. Overall the intensity of this land use has declined, and the more intensive field cultivation is better concentrated on stronger soils than was the case for most of this century. Despite some grazing of abandoned fields, some vegetation cover protects most of these areas. On land that is still cultivated, much can still be done to improve conservation farming practices, and sheet and gully erosion does continue. The key question for the future is whether evolving combinations of demographic and economic circumstances will once more increase the significance of food production in marginal areas livelihoods. If that happens – which it has not yet done – there will be a renewed possibility for widespread land degradation to be caused by field cultivation. There will also be greater scope for the introduction of feasible conservation farming practices. Therefore, now is the time for

agricultural services to research and develop those practices, and to begin to introduce them to those emerging field users.

Garden cultivation

The cultivation of gardens has made little contribution to land degradation in marginal areas. Located close to homes (usually on the residential site), gardens have been the object of more labour intensive cultivation practices than fields. These practices would normally act to combat any land degradation that appears. Gardens have been the site of additional water provision to crops, if this is practiced at all. Except on steeply sloping village sites, it has not been normal to divert water soil conservation practice required for fields. Again, where it has happened at all, gardens have been the place where organic matter has been returned to the soil in the form of manure or (occasionally) mulches.

Livestock production

As this study shows, the marginal areas have higher livestock densities than the favoured areas. The debate on the contribution of livestock production and herding practice to land degradation has only recently begun to intensify, after many decades in which it was simply assumed that Africans' obsession with livestock numbers was the major cause of land degradation in the marginal areas.

There can be little doubt that stocking densities in many marginal areas have been a major cause of land degradation. 'Degradation' is certainly a subjective concept, implying deterioration below an agreed norm. The norm for one production system, such as beef ranching, may be very different from the norm for another system, such as multipurpose small herd production by the rural poor. Nevertheless, grazing and browsing in the mostly semi-arid environment of the former homelands have reduced large areas to the condition. The almost total lack of vegetation cover on some veld in these areas has caused extensive sheet and gully erosion and would challenge the optimism of even the most committed advocate of veld resilience.

briefly at different aspects of practice and consider what influence they have had on land degradation.

Field cultivation

Throughout most of this century, field cultivation in marginal areas has been conducive to land degradation. There are five reasons for this:

- rising population densities and land use policies described by this study forced increased cultivation of marginal or unsustainable land; for example, less fertile, more erodible soils, or fields on steep slopes;
- an ecologically excessive dependence on grain crop monoculture (sometimes for urban markets in the 19th and early 20th century, mostly for sub-subsistence purposes since the 1920s);
- in small scale farming systems where capital intensive practices are not feasible, sustainable conservation farming practices are labour intensive.

This study has shown that, despite their high human population densities, the marginal areas available for the agricultural labour force, which has been predominantly female, has had to be divided among a number of livelihood strategies, exposing arable farming practices to significant land degradation risks.

- Agricultural extension advice that might have made conservation farming practice more readily available to land users; has been unsuitable, unavailable or politically unacceptable to local people. There is some evidence that basic farmer ignorance about dangerous farming practices has played a role in land degradation – farming up and down slopes or on land that is too steep, for example. However, these fundamental mistakes have not been widespread. Most marginal area farmers have had a fair idea of the basics of soil conservation, but technically and economically feasible means of soil and water conservation – for example, by modified cultivation practices, crop mixes and maximum ground cover – have not been included in the agricultural extension messages that were presented to them. Furthermore, many marginal area farmers were so alienated by the political experiences of forced removals and ‘betterment’ that they were not inclined to listen to any agricultural extension content;

Table 6.7: Livestock numbers and grazing intensity in favoured farming areas, 1996

Region	Grazed Area	LSU	LSU/100ha
Western Cape	215 796 295	1 367 749	7.9
Northern Cape	22 060 697	1 799 939	8.2
Free State	8 341 534	2 798 837	33.6
Eastern Cape	10 394 399	1 961 894	18.8
KwaZulu Natal	3 150 337	1 326 947	42.2
Mpumalanga	3 116 843	1 303 880	41.8
Northern Province	4 635 338	785 769	16.9
Gauteng	708 739	354 941	50.0
North West	2 221 342	901 532	40.7

Source: DBSA, n.d, and 4.

Table 6.8: Livestock numbers and grazing intensity in marginal areas, 1993

Homeland	Grazed Area	LSU	LSU/100ha
Bophuthatswana	3 682 167	705 809	19.2
Ciskei	761 383	221 263	29.1
Gazankulu	607 236	200 256	33.0
KaNgwane	287 143	97 508	34.0
KwaNdebele	189 040	56 835	30.1
KwaZulu	3 015 680	1 588 167	50.7
Lebowa	1 856 098	601 454	32.4
QwaQwa	55 762	17 224	30.9
Transkei	3 847 483	2 200 239	57.2
Venda	594 202	138 152	23.2

Source: DBSA, n.d, and 4.

The residents of many marginal areas agree that their veld is degraded. This is concurrent with the obvious concern of outsiders who ask such questions. The environmental impact of livestock, and the implications of the veld condition and productivity, are plain. At the same time, concerns about veld degradation are not high in people's overall ranking of their problems. Moreover, many people point to insufficient livestock numbers as the cause for their economic dilemma. They need more animals, not fewer, in order to be able to plough properly and meet their income requirements.

The study has also pointed out that the future role of people in the degradation or enhancement of land resources is uncertain. There are a number of scenarios: (1) globalisation and local growth of other economic sectors may reduce the intensity of rural land use further, probably slowing degradation; (2) a shift in global and national market relationships could stimulate increased rural resource use without allocating adequate labour and other resources to agriculture this could aggravate land degradation; (3) dwindling economic opportunities, deteriorating international terms of trade and continued population increases could lead to confusing local agricultural intensification. The economic circumstances and environmental impacts of livestock production in marginal areas arise directly from the land allocation history, demographic patterns, land use policy and consequent livelihood strategies employed that this study has briefly outlined. Livestock production has been one of the sub-subsistence economic strategies that marginal area residents have had to adopt, in combination with migrant labour, in order to survive. As with field crop production, they have had little opportunity to optimize their herd or veld management strategies for sustainability.

How those herd or veld management strategies should be optimized, is a matter of debate. The received wisdom of western science and ranching has been to limit stocking rates and rotate grazing. The economic strategy employed by marginal area residents has involved much higher stocking rates than the western paradigm would advise. Up to a point, it can be convincingly argued that these higher rates do not irretrievably 'degrade' the veld; and it can be pointed out that definitions of 'degradation' will vary according to production goals. That point has, however, been exceeded in many parts of the former homelands. Rotational grazing is broadly accepted by marginal area stockowners as a desirable practice. They often refer to it as part of their indigenous management system. Much attention in academic debate is being given to the spatial flexibility and tracking strategies that have made livestock production sustainable in many parts of semi-arid Africa. It has, however, been a century since such practices were possible in South Africa, and there is little chance of their becoming feasible in the near future. Ironically, they have become feasible in parts of the highly capitalised favoured ranching sector in Southern Africa,

where livestock are trucked long distances to better-watered ranches in times of drought. The 'betterment' experienced and the political turmoil apartheid years have degraded or destroyed local range management institutions in many former homeland areas, leading to the substitution of open access over extensive grazing areas formerly governed by common property regimes. While academic and policy debates have yet to reach clarity on these matters, there is little doubt among most marginal areas stockowners that local range management institutions need to be rebuilt, and that they should focus on the enforcement of rotational grazing practice. Veld resilience is likely to be proved a reality in many areas if (as I suspect but cannot prove) stocking rates and grazing intensity begin to decline, although the reality of livestock production as a key agent of land degradation in the marginal areas during this century cannot be denied. In some places that degradation will prove to have been so severe that it is irreversible.

6.6 Land degradation in Marginal Areas (MA)

The strongest influence on policy for agriculture and conservation in the marginal areas has been an attitude rather than an explicit assumption or paradigm. As in much of the rest of Africa for most of the 20th century, this attitude has been pejorative. Because of the political dispensation, it has been primarily an attitude of white rulers about their black subjects. Implicitly rather than explicitly, it has been assumed that marginal area land users are both ignorant and irresponsible when it comes to caring for the land. It has been supposed that the African peasant farms only for tomorrow, and is too ignorant and uncaring to consider the longer-term implications of his actions for land degradation. (As throughout the continent, the reality of women as farmers has usually been ignored.)

Similarly, the Black stockowner has been seen as a greedy or unthinking exploiter of marginal rangelands for his private, short-term benefit - again with no consideration of the long-term trends or impacts relating to such practice. One of the commonest policy perceptions of marginal areas land use has been of stock owners obsessed with

quantity rather than quality, seeking for 'cultural' reasons to maximize herd size regardless of the environmental consequences and with no economic motives in their stock keeping. As the national desertification audit shows, the reality of serious land degradation in the marginal areas is undeniable. The prevailing policy attitude has been that this is a tragedy of the commons. The dongas and veld degradation of these areas supposedly prove that group ownership and management of rangeland resources are environmentally untenable. Furthermore, the non-freehold systems under which arable land is held in the MAs, are widely believed to be an insuperable obstacle to sustainable land use. Linked to the policy attitude toward the marginal area land user as being ignorant and irresponsible, has been the standard policy reaction of using authority rather than education or incentives to achieve change.

6.7 Land degradation in Favoured Areas (FA)

Although the South African political dispensation had ensured that land users in the favoured areas were treated more indulgently than those in marginal areas, land degradation has long been recognized as a significant threat to white large scale agriculture, which usually prevails in those areas. Again, the dominant theory guiding land use and degradation policy in these areas is better described as an attitude or a mindset. Perhaps rooted in assumptions of European cultural and intellectual superiority when faced by the challenges of colonization, this dominant attitude has supposed that technical ingenuity can overcome environmental constraints. It has also assumed that original European models of private ownership of defined farm areas are an appropriate spatial framework for agricultural resource use in South Africa. Stimulated by the market incentives of a rapidly growing urban economy during the 20th century (themselves generously distorted by the political motives of government), this dominant mindset has therefore developed a fundamentally flawed strategy. It has used technology to coax more out of the environment than may be sustainable. It has imposed 'wet' agricultural practices and assumptions on a predominantly 'dry' country. It has assumed that fertilizers and irrigation can feed the nation with the foods it prefers from indifferent soils and in a semi-arid and unpredictable climate. It has assumed that the fenced ranching model

is a viable means of meat production in this climate, despite the frequent need to resort to drought relief schemes and subsidies to make up the environmental shortfall.

While guided by these attitudes, policy has recognized that white farmers, too, can be technically ignorant or even irresponsible. The theory in the favoured areas has been that education and extension advice can usually overcome these obstacles. Until very recently, the large scale farming sector received the large majority of the total national extension effort - partly because of the political dispensation of resources, and partly because such effort was believed to be more fruitful in the large scale farming sector than in the marginal one. As in the marginal sector, however, policy for large-scale agriculture has also been guided by the theory that environmental irresponsibility should be punished. Both sectors have been dominated by the theory that farmers' environmental behaviour should be monitored, regulated and, if necessary, controlled by legal sanctions. Although large-scale farmers would usually be exposed to a process of guidance and persuasion when inspection showed them to be degrading the land, they were ultimately punished at law if the guidance and persuasion did not work. It is ironic how two opposing trends in environmental policing have crossed paths. A couple of decades ago, the environmental behaviour of the urban and industrial sectors was only loosely controlled. Air and water pollution was rampant. The environmental behaviour of small-scale and large-scale farmers was more tightly controlled, within a clear legal framework.

6.8 Rural Poverty and Land degradation

The analysis to date has shown that the nation's land allocation history has led to a spatially and racially skewed rural population distribution. The marginal or former homeland areas, comprising a small minority of the national territory, have comparatively high population densities but a lower than normal proportion of men of working age. In the lightly populated favoured areas, land degradation has been recognized and combated with success. Has the land allocation and demographic situation in the marginal areas led to land degradation, as high Black population

densities have often been alleged to do? Or have more people led to less erosion through a process of sustainable agricultural intensification? This analysis went on to show that land use policies, while conducive to conservation in the favoured areas, were inimical to conservation in the marginal areas. The next link in the causative chain identified by this study is livelihoods. From what form the resources and economic activities have rural South Africans constructed their livelihoods? What degree of prosperity or poverty have these livelihoods offered them? To what extent have these livelihoods depended on natural resources use? Understanding the nature and extent of rural people's dependence on natural resources, will help us understand the ways in which they have used these resources and inform our arguments about whether such use has been conducive to land degradation.

Table 6.9: Poverty Risk by Gender

The landless demographic majority in the favoured areas - farm labourers and other farm dwellers - has always lived in poverty. In recent generations, however, the predominantly white owners of land in this sector have enjoyed comparatively prosperous livelihoods. Like much of the apparent prosperity in the South African economy, this comfortable standard of living has been built on credit. Past and present large-scale farmers have often been heavily indebted, their prosperity more precarious than it seems. Sometimes this precariousness has led to land degradation as farmers overstocked or grew the wrong crops in the wrong places for too long. The situation was compounded during the Nationalist Party rule by subsidies that sometimes distorted production incentives in a manner that promoted severe environmentally damaging practices. This analysis argues, however, that conservation policy and programmes were at least partially successful in combating land degradation that emerged in the favoured farming sector. Once again, the main thrust of our inquiry must be towards the livelihood options in the marginal areas.

Most South Africans in the marginal areas live in poverty. May *et al.*, (1995) shows that the distribution of poverty in this country varies according to location, race, age and gender. They estimate that 36,4% of all South African households and 49% can be classified as poor. As *Table 6.9* shows, poverty varies significantly by race.

Given the history of dispossession outlined in this study, the poverty of Blacks is not surprising. The role of migrant labour in history is reflected in the distribution of poverty risk by gender (Table 6.10).

Table 6.9: Poverty by Race

Population Groups	% of People in Poverty	% of Household in Poverty	Poverty Share %
Blacks	60,9	43,6	95,4
Coloureds	28,2	21,7	4,4
Indians	2,0	1,1	0,1
Whites	0,7	0,3	0,2

Source: May et al., 1995.

Table 6.10: Poverty Risk by Gender

Gender	% of Adults in Poverty	% of Black Rural Adults in Poverty
Women	48,2	69,9
Men	43,7	64,3

Source: May et al., 1995

The role of South Africa's land allocation history and its migrant and urban labour system are also evident in the distribution of poverty between rural and urban areas, and in its distribution by province (Table 6.11).

The Eastern Cape and Northern Province show the highest proportions of households in poverty. This accords with the land allocation history of the Eastern Cape and Northern Province, which were the destinations for many forced removals and were among the provinces in which homelands were concentrated.

Table 6.11: Poverty Risk by Province

Province	People in poverty %	Household poverty %	Rural Blacks poverty %	Rural Black household poverty %
Western Cape	18,4	12,0	0	0
Northern Cape	58,6	40,2	50,0	50,0
Eastern Cape	74,7	62,6	86,3	76,1
KwaZulu Natal	51,2	31,8	63,4	44,4
Free State	63,0	47,7	78,5	55,1
Mpumalanga	46,8	30,0	53,0	33,8
Northern Prov.	71,4	55,5	74,9	61,7
North West	52,2	31,5	57,7	35,1
Gauteng	16,6	9,5	21,4	25,0

Source: May et al., 1995

Lipton and Lipton (1993) have argued that the apartheid-inspired land allocation history of South Africa "... far from leading to undue emphasis on agriculture - caused the Bantustans to be overpopulated but underfarmed". If the structure of the national economy and of rural poverty means that marginal area residents do not fully use their natural resource base (and assuming that natural degradation processes are not unusually vigorous), we would not expect to see the severe land degradation that is in fact so evident in most of this country's marginal areas. It is also plainly evident that much previously cultivated land - and not just those fields taken out of production by "betterment" - is no longer used. To understand this situation, we must look more closely at livelihood options in the marginal areas, past and present. A key to understand these livelihood strategies, lies in the land allocation history and land use policies outlined in this study. These meant that, with available technologies, most rural households in the marginal areas could not make an adequate living for arable holdings. Their farming is best described as sub-subsistence. These absolute land shortages helped to ensure that most households sent their able bodied men into migrant labour. The absence of these men altered the nature of farming and other resource use practices in which the remaining household members were able to engage. Migrant wages were low, but sub-subsistence wage employment combined with sub-subsistence and often-exploitative agriculture managed to sustain most marginal area households to enrich the mining and urban

sectors in which rural African men laboured. Under this system, the first three generations of the 20th century saw a heavier dependence on crop and livestock production than what exists today. During this period land degradation, which alarmed visitors to native reserves early in the century, was steadily exacerbated.

More recently, conventional migrant labour opportunities have dwindled. Partly because of more enlightened policies, part of these industries' work force became sedentary, settling near mines and in the towns. Partly it is because of the rapid expansion of homeland populations, meaning that the proportion who may gain access to less rapidly growing migrant opportunities, had shrunk. Meanwhile, a recent study has also shown that only 26,1% of rural Black households have access to arable land (Carter and May, 1997). However, their definition of 'rural', drawn from official statistics, included areas that would better be described as 'peri urban'. Paradoxically, the apparent 'underfarming' of the homelands continues to grow - although this generalization is dangerous. In some marginal areas ploughed fields are rare. In others, industrious agrarian landscapes are the norm. Despite the shrinkage of the migrant labour system, other sources of income and other sectors of economic activity are expanding. For example, old age pensions and other social welfare payments are higher and more widely available than before. The retail sector, and especially informal trading, is booming in the small towns and villages of the former homelands. Dependence on farming and other uses of natural resources remains limited. So far, despite the continuing poverty of marginal area residents, agricultural intensification (with its risk of land degradation) is not the strategy being employed by the majority, but there are some livelihood strategies that continue to depend heavily on natural resource exploitation, as more detailed enquiry shows.

From these data, it can be concluded that livelihoods in the marginal areas do not currently involve levels of agricultural resource exploitation that match the apparent degradation in these areas. The areas of intensive agriculture are mostly those with a more productive resource base and that are less susceptible to degradation. The extensive areas of 'underfarming' are those with less productive, more fragile and

often less significantly degraded resource bases. There has been a significant change in livelihood strategy in the marginal areas since about 1980. The livelihood strategy that dominated the homelands for most of the century - a combination of sub-subsistence, labour scarce farming with sub-subsistence, labour - has been in decline since roughly that date. It was the previously dominant strategy that imposed a significant agricultural dependence on most of the marginal area population without permitting sustainable production systems (adequate labour or appropriate conservation farming practices for example). While levels of dependence on conventional migrant labour have been in decline, the role of agriculture and natural resources in most livelihoods has not significantly increased. Instead, new forms of migrant labour, local and small town informal sectors, and state welfare payments, have filled the gap.

Meanwhile, there is one element of most marginal area livelihoods that has retained a significant dependence on natural resources until very recently. That element is energy. Although electrification is now proceeding apace in these areas, levels of wood fuel collection have remained high to date. It remains to be seen how much the availability of electricity will reduce this removal of biomass that is continuing to degrade land in marginal areas. The use of animal dung for fuel and plastering material remains widespread.

Crop residues are still generally used for animal feed rather than being ploughed back into the soil. Some aspects of natural resource use may be taking place at less destructive levels than earlier this century. But wood fuel collection and failure to return dung or crop residues to the soil remain dominant in many marginal area livelihoods and may still contributing actively to land degradation in these areas.

Table 6.12: Characteristics of different livelihood strategy classes in rural South Africa

Livelihood Strategy Group	% Households	Dominant Tact	(R) Mean Adult Income (median)	% Households with poverty risk	% Access to Land	% Access to Educated Labour
Marginalised	43%	Agriculture 80,6%	190,53(131)	78,7	35,7	27,1
Dependent on welfare	11,5%	Transfers 94,4%	194,63(159)	74,2	35,4	30,7
Dependent Remittances	25,1%	Remittances	196			
Dependent on wages from the primary labour market	19,8%	Wages 95,9%	415,03 (274)	42,3	10,1	15,5
Dependent on wages from the primary labour market	13,6	Wages 97,9%	506,65 (333)	28,7	10,2	53,3
Combining income sources, in which wages are derived from the secondary labour market	15,8	Even spread 20%- 30%	238,34 (177)	61,9	30,8	34,9
Combining income sources, in which incomes in excess of R1000/month are derived from entrepreneurial activity	1,0%	Self employment 69,5%	631,39 (387)	23,6	28,4	59,5
Combining income sources, in which wages are derived the primary labour market	8,1%	Wages 71,5%	375,90 (266)	38,1	29,8	73,6

Source: May et al., 1995

It has been conventional to refer to the people of the marginal areas in southern Africa as 'farmers'. Analysis of their livelihoods, so dominated by migrant labour in the 20th century, shows that this is a misleading description. If anyone deserves the name in these areas, as Tomlison (1953)¹³ pointed out, it is usually the women. Yet they are members of households whose dependence on agriculture has typically been partial. At the same time these partial 'farmers' have had to use the land without adequate labour, thus making the labour intensive practices often associated with sustainable small-scale agriculture impossible. They have needed to produce as much of the basic staple grains needed by their households as they could, so that there has been extensive monoculture across the marginal areas. Their access to farming equipment and technology that might optimize cultivation practice has been severely limited. Part time farming that is also maximum dependant on the land for staple grains is a livelihood combination that can easily lead to land degradation.

6.9 Summary and Conclusions

In this chapter the study has tried to untangle the complex bundle of factors at the human apex of the triangle of causation that explains land degradation, while the causative factors at the biophysical apex of the triangle are those that most directly explain the physical manifestations of land degradation. Human actions and circumstance in turn have a wide range of intricately interrelated, direct and indirect influences on the biophysical factors. In seeking to understand the key dimensions of the role people in land degradation, the study has been able to describe a central chain of causative links.

¹³ The Tomlison Commission for the Socio-Economic Development of the Bantu Areas in 1953.