THE ROLE OF ANTHROPOGENIC DISTURBANCE IN THE CREATION OF A SOCIO-ECOLOGICAL LANDSCAPE

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Abstract

The aim of this thesis is to examine the role of anthropogenic disturbance in the creation of a socio-ecological landscape. Three key questions were answered: what impact has past anthropogenic disturbance had on present vegetative characteristics; what value did this disturbed landscape have to local people; how did the local peoples' worldviews and eco-cosmologies influence how they perceived, valued and managed their landscape?

Research was based in a rural, predominantly amaXhosa village in the Kat River valley, Eastern Cape, South Africa. Four major landscape components characterised the environment, namely dense forests, former grazing lands, abandoned fields and old settlements. A combination of qualitative and quantitative methods were adopted, consisting of a vegetation and soil survey and social science methods including semi-structured interviews, focus groups, transect walks and participant observation.

The key finding was that anthropogenic disturbance is necessary to enhance the potential of the area to support human habitation. However, anthropogenic disturbance can have positive or negative effects for both local people and the environment. An intermediate level of disturbance is a key factor leading to a resilient socio-ecological system.

Various anthropogenic disturbances have had significant affects on vegetation characteristics in terms of species richness, and a change in vegetation composition and species heights. Of the three anthropogenic landscapes examined, former grazing

lands were the least intensively disturbed. They were also more species rich and structurally diverse than areas that were under agricultural production or used as a settlement. Dense forests, although the least desirable landscape to local people were, together with sacred pools, sources of ecosystem renewal and played a critical role during times of disturbance. Anthropogenic disturbance has added value to local people's livelihoods; this disturbance has resulted in a patchy landscape that supplies a wide variety of resources to local people.

Local people are dependent on their environment for their basic needs; this has encouraged sustainable management practices. The local AmaXhosa still retain many elements of their traditional worldview, which has many characteristics of Animism. The environment is an integral component of their belief system and certain sites and species have significant cultural value and are protected.

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Chapter one: Introduction

1.1 Socio-ecological systems

Human society is an integral part of the Earth's ecosystem. Human impacts can either increase or reduce a local ecosystem's resilience. This thesis examines the role of anthropogenic disturbance in the creation of a socio-ecological landscape. The factors which result in a resilient or degraded socio-ecological system are assessed. A socio-ecological landscape is the expression of the close relationship between human society and natural ecosystems. Such landscapes have both natural and cultural attributes. The landscape within which this thesis is played out is Cathcartvale, situated in the Kat River valley, Eastern Cape, South Africa. Southern Africa has experienced limited research of this nature.

The current discourse on the human-environmental relationship, that underpins the thinking of this thesis, views people and nature as part of the same integrated system, where they are closely linked (Fairhead and Leach 1996; Posey 1999a; Berkes and Folke 1998; Berkes and Folke 2001; Stepp *et al.* 2003). This has lead to new concepts such as 'socio-ecological systems' (Berkes and Folke 1998), 'adaptive renewal' (Holling and Gunderson 2002), 'integrated natural resource management' (Campbell and Sayer 2003), and 'community-based natural resource management' (Fabricius and Koch 2004). Budiansky (1995) points out that this integrated approach challenges 'deep ecological' views of untouched wilderness; while Fairhead and Leach (1996) challenge both the notion that humans are an unwanted disturbance that spoils pristine systems and the fundamental belief, held since the Enlightenment, that natural and social phenomena are separate.

The relatively new concept of "a cultural landscape" (Taylor 2002) is gaining legitimacy, as people realise that landscape construction, formation and evolution, as well as biodiversity, are dependent on the complex interrelationship between human management systems and natural forces such as climate, soils and biotic effects (Posey 1999a), leading to the concept of nature and culture being co-created (Ingold 1990). leading to the concept of nature and culture being co-created (Ingold 1990). It is now realized that our natural

world has been fundamentally affected by the cultural patterns of human use (Folke *et al.* 2003; Budiansky 1995; Woodgate and Redclift 1998). As stated by Sanderson *et al.* (2002), 83% of the terrestrial surface experiences direct human influence. This indicates how human practices shape global ecological processes. This includes many seemingly natural ecosystems that are actually the products of human manipulation (Posey 1999b; Feinsinger 2001). An example is the "forest islands" created by the Kayapo of Brazil in a savannah environment. These forests had previously been viewed as natural by both botanists and ecologists, but it is now realized that they are a result of intentional management practices (Posey 1997; Laird 1999).

1.2. Characteristics of this complex socio-ecological system

Up until the 1970s the concept of the "balance of nature" held sway. This was expressed by Marsh (1965:12) as "Nature, left undisturbed, so fashions her territory as to give it almost unchanging permanence of form, outline....". Marsh (1965) devised the theory of the "climax community", regarded as a "super organism", which always moves towards its specific climax state. Scoones (1999) and Sullivan and Homewood (2003) argue that ecological science has consequently been largely built on the idea of equilibrium and linear notions, which assume stasis, homeostatic regulation and static equilibrium points or cycles.

However, socio-ecological systems are increasingly viewed as highly complex and adaptive, as expressed in 'New Ecology' (Scoones 1999). It is realized that these systems are inherently unstable, characterised by multiple and dynamic equilibria and outcomes, non-linear processes, cross-scale interactions, threshold effects, system flips and chaotic fluctuations, while historical events play an important role in influencing ecosystem dynamics (Fairhead and Leach 1996; Woodgate and Redclift 1998; Scoones 1999; Sneddon 2000; Holling 2001; Davidson-Hunt and Berkes 2003).

Holling's (1986) adaptive renewal cycle indicates that ecosystems cycle between exploitation, organization, collapse and renewal, instead of progressing to a fixed climax state (Berkes *et al.* 2003). Exploitation is characterized by the establishment of pioneer species, while organisation is the steady accumulation of nutrients and biomass as the

ecological system moves towards a "climax" state, characterized by high complexity and connectedness. However, stagnation, a lack of flexibility and high biomass, makes the system vulnerable to disturbance, such as fire, insect pest outbreaks or disease (Marten 2001; Berkes *et al.* 2003). A disturbance causes the system to move into the collapse stage, and positive feedbacks generate dramatic change (Marten 2001). The reorganization phase is where the ecosystem begins to recover. It is a creative time where opportunities are open for a new trajectory of growth and species colonization, and change can take on a variety of possible directions (Holling 2001; Marten 2001). This stage is therefore characterized by novelty and innovation (Berkes *et al.* 2003).

Added to this complexity is the social component, which fundamentally affects the way landscapes function and are structured. As will be discussed in chapter six, the worldview and belief system held by a group of people has a major influence on ecosystem functioning. This influences the way we perceive nature and organise our society, which will have either positive or negative ecosystem consequences (Kothari and Das 1999). Peirea and Lewis (1979:12) explain that one's culture is reflected in the landscape; "our human landscape is an unwitting autobiography, reflecting our tastes, our values, our aspirations, and even our fears, in tangible, visible form." Local social and political relations, as well as economic, political and demographic changes also have an influence on ecosystem dynamics and are inscribed onto the landscape (Fairhead and Leach 1996; Kothari and Das 1999). These influence tenure, labour and resource control patterns, which have major impacts on how one utilizes ecosystems (Fairhead and Leach 1996). Woodgate and Redclift (1998) add that intentional and unintentional actions of different social agents can result in significant shifts in ecological dynamics, and that the complexity of this socio-ecological system is reflected in the relationship between people and the environment.

1.3 Biodiversity, anthropogenic disturbance and ecosystem functions

The resilience of an ecological system is an important indicator of sustainability, defined as "the capacity to create, test, and maintain adaptive capability" (Holling *et al.* 2002c: 76). Adger (2000) argues that resilience is in terms of ecosystem functioning rather than maintaining a steady ecological state. For this thesis ecosystem functioning is defined as

the processes and their outcomes that determine the characteristics of the ecosystem. Resilience is measured by the following criteria; firstly, the system's ability to learn, adapt and self organise (Taylor 2002); secondly by the magnitude of disturbance that can be experienced before the system changes its conditions, state and functions (Folke *et al.* 2003; Adger 2000); thirdly by the speed of recovery after a disturbance (Adger 2000) and fourthly by "the capacity to lead a continued existence by incorporating change" (Folke *et al.* 2003: 352).

Biodiversity and variability, which result from landscape heterogeneity (Naveh 2001), is believed to be key to high resilience (Sneddon 2000; Turner *et al.* 2003), ecosystem sustainability (Holling *et al.* 2002b), ecosystem functioning (Adger 2000) and stability, which is defined as a systems ability to "return quickly to equilibrium after a temporary disturbance" (Davidson-Hunt and Berkes 2003: 61). Species rich systems are often characterized by high levels of redundancy, meaning that each ecosystem function is performed by a number of species (Marten 2001). Species richness reduces the vulnerability of these functional groups (Folke *et al.* 2003) and becomes invaluable during times of surprise and disturbance. This is because they play crucial roles during the adaptive cycle stages (Holling 1986) of reorganization and renewal by, firstly, increasing the variety of ways that ecosystems can reorganise themselves and secondly, by helping restore degraded environments (Berkes and Folke 2001; Colding *et al.* 2003; Folke *et al.* 2003). Species that seem redundant are also important in connecting habitats due to their overlapping functions within and across scales (Folke *et al.* 2003).

1.3.1 Positive anthropogenic effects

Disturbance, as part of the natural functioning of ecosystems (Berkes and Folke 2001; Colding *et al.* 2003), plays important roles where it increases heterogeneity, diversity and the number of habitats (Lindenmayer and McCarthy 2002; Colding *et al.* 2003). Studies indicate that suppression of this disturbance can reduce the ability of the ecosystem to renew itself due to a loss of diversity within functional groups (Berkes and Folke 2001). An example is the suppression of fire that occurred in Yellowstone National Park

A classic example of how local people can create forest patches through disturbance is Fairhead and Leach's (1996) study of the Kissidougou in Guinea. The common perception,

held by development professionals, is that the landscape was originally covered with dense, humid forest. Their research revealed that local people had actively created forest patches, which occurred where people settled. When a settlement was abandoned the forest would eventually disappear. Laird (1999) describes a similar situation in Brazil where the Kayapo, through intimate knowledge and careful manipulation of ecological processes, create forest islands. These islands are called *apêtê* and occur in what would naturally be a savannah. The Montane Rain forest of South East Mexico is believed to be one of the most biologically diverse neo-tropical formations. This forest has, however, experienced centuries of intensive anthropogenic disturbance in the form of slash and burn agriculture (Ramírez-Marcial *et al.* 2001). Kandeh and Richards (1996) argue that a history of human settlement is good for biodiversity. They base this statement on a case study of the Gola North forest reserve in eastern Sierra Leone, which examined the relationship between land use history and bird species diversity. Their conclusion is that intensive human occupation of the area has probably concentrated bird species by creating a patchwork of primary forest, successional forest and farm land.

Little (1996: 37) states that savannah ecosystems in East Africa have been fundamentally shaped by human practices. However, they presently "support the richest variety and density of large mammals in the world." This is backed up by Brockington and Homewood (2001) who explain that pastoral activity in Northern Tanzania is a rational choice for semi-arid savannahs and that the level of disturbance by cattle enhances diversity. For example, most of the present population of wildlife is concentrated on pastoral lands. This continues the co-existing relationship between pastoralists and wildlife that has survived for thousands of years (Brockington and Homewood 2001).

Landscape modification through anthropogenic disturbance is a necessary outcome for human habitation of an area (Taylor 2002). Val Grande National Park in Italy, for example, had experienced a reduction of human disturbance and was therefore reverting back to a seemingly wild state (Hocht *et al.* 2005). After assessing the impact on local people they state that an area that experiences a significant re-growth of vegetation, so that it could be termed a natural area, is not hospitable for human occupation.

Toledo *et al.* (2003) document how the indigenous cultures of Mexico manage their tropical humid ecosystem through landscape patch management and multiple use of species and multiple land use strategies. The consequence is a high richness of useful

species, found in different stages of successional forest, mature forest, agricultural fields, and grazing lands. For example, the natural environment utilised by the Totonac village yield 355 useful plant, animal and mushroom species. Toledo *et al.* (2003) describe how ten indigenous Mexican groups utilized 1330 useful plant species, of which 297 were found in mature forests, 595 in secondary forests in different stages of succession, 160 in both mature and secondary forests and 278 in *milpas* and home gardens. *Milpa* is the Mesoamerican version of integral swidden cultivation, practiced in many tropical areas. This system focuses on maize cultivation, but it is more than an agricultural practice, as it also determines social organization and property rights (Alcorn and Toledo 1998). This example indicates that a higher number of useful species are often found in disturbed secondary forests than mature forests. The practices adopted by the indigenous peoples of the Amazon (swidden fallow management, patch clearing and burning) have resulted in the long term supply of a diversity of resources and ecosystem services (Berkes and Folke 2001). The Tapia woodlands of Madagascar have been fundamentally shaped by a variety of human disturbances, including burning and cutting (Kull 2002). These woodlands contain species of high use value to local people including wild silkworms, fruit, fuelwood, mushrooms, edible insects, and herbal medicines, which have increased due to the above types of disturbance (Kull 2002). Netting and Stone (1996) describe how the Kofya of central Nigeria practice high intensification agriculture yet also get high levels of agro-diversity in the form of domesticated plant and animal species. In addition, they manage and utilize areas of natural ecosystems, which supply them with medicines, fuels, construction materials and food supplies.

Anthropogenic disturbance can result in ecosystems similar to those that would normally be classified as natural. For example, home gardens in Mexico, Indonesia and the Amazon are similar in structure to tropical forests (Altieri 1999; Wiersum 2004). In other cases, anthropogenic disturbance results in a change in structure and species composition favouring those most useful to local people (Wiersum 2004). There is often an association with a reduction of primary forest, yet the landscape is enriched with multiple land use systems including natural and economically enriched forests, agro-forestry systems and monocropped fields (Wiersum 2004).

Schmuck-Widmann (1996) document how the Jamuna char dwellers of Bangladesh rely on the yearly floods to irrigate and fertilize their agricultural fields. However, the construction of embankments and dykes by a Flood Action Plan, which aimed to stabilise the system

and remove disturbance, has had negative impacts on these char dwellers. Erosion and sediment patterns, water flows, and fish habitat patterns have all been altered. This has limited the Jamuna char dwellers' adaptive strategies, as disturbance had been incorporated into their livelihood strategies and they consequently depended on it.

A number of deliberate management practices have been adopted by local and indigenous peoples to create landscape patchiness and enhance diversity, especially of useful species as described above. These management practices, based on accumulated ecological knowledge, have co-evolved over centuries of interaction with the local natural environment through trial and error, learning, ecological monitoring, innovation and the long-term experience of environmental variability and disturbance (Berkes and Folke 2001; Colding *et al.* 2003; Stocking *et al.* 2003). A number of authors dispute these types of statements. Stearman (1992) argues that one cannot generalize about the environmental values and management practices held by indigenous peoples. In addition, a number of scientists, such as Hames (1991) and Kalland (1994) are critical of the view that indigenous people's resource management is guided by a conservation ethic. Milton (1996) argues that traditional cultures are often only seemingly in a state of balance with their environment, but that this is not caused by their ideologies and intentional management practices, but rather due to several limiting factors such as geographical isolation, low population density and limited technology. Therefore, although indigenous societies may have an ecologically sound existence, this is not necessarily their objective.

There are, however, many examples of deliberate management practices and include permanent habitat protection of pools, rivers and forests, which is a common practice among local/indigenous people (Bawa and Gadgil 1997; Colding *et al.* 2003). These areas often become integral to religious belief systems, gain sacred status and have strict taboos regulating access and resource use. They often contain much biodiversity, including rare and endangered species, and hold pockets of what would have been natural vegetation across the landscape (Wilson 1993; Kothari and Das 1999; Laird 1999). Colding *et al.* (2003) identify a number of additional services provided by these areas including the enhancement of landscape patchiness; pollination services; and protection of the surrounding area from fire, wind and soil erosion.

Sacred pools, rivers and forests thus protect certain species and habitats, while at the same time play a role in managing disturbance and ecological surprise by creating refugia for

species that can re-colonize heavily disturbed landscapes. Ecological surprise is defined by Gunderson (2003:36) as "A qualitative disagreement between ecosystem behaviour and a priori expectations." Sacred pools therefore play a critical role in the reorganization phase of Holling's (1986) adaptive cycle (Folke *et al.* 1998; Berkes and Folke 2001; Colding *et al.* 2003) by maintaining ecological memory (Folke *et al.* 2003; Berkes and Folke 2001), defined as "The composition and distribution of organisms and their interactions in space and time, and includes the life-history experience with environmental fluctuations" (Berkes *et al.* 2003: 20). Sacred areas are a good example of a cultures' response to feedback where people respond to resource scarcity by completely restricting access to resources in order to allow the ecosystem to recover (Gadgil *et al.* 1998).

Laird (1999) describes how the Mexican Huastec create a mosaic of different stages of succession, which maintains ecological memory as there are always elements available that can regenerate the forest. Related to this, local and indigenous peoples focus on creating small-scale disturbance, including the use of fire, patch clearing, agro-forestry, and pulse grazing by migratory cattle (Berkes and Folke 2001; Folke *et al.* 2003). This puts a brake on the release phase of Holling's (1986) adaptive cycle, (Berkes and Folke 2001) and increases the provision of ecosystem goods and services (Folke *et al.* 1998; Folke *et al.* 2003). This is because local people can make use of a wide range of species occurring in different stages of succession (Colding *et al.* 2003). Colding *et al.* (2003: 164) call this 'backloop management', as the focus is on the release-reorganisation phase where small-scale disturbances prevent biomass from accumulating and thus reduce the chances of large-scale disturbance. This builds resilience (Berkes and Folke 2001), maintains the ability of the ecosystem to absorb perturbations and prevents the system from flipping into a less desirable state (Davidson-Hunt and Berkes 2003).

Case studies indicate that fire, which has been viewed as a significant cause of environmental degradation (Goudie 1986), can be used by local and indigenous peoples to manage a variety of ecosystems and enhance their benefits (Posey 1999b; Kull 2002). An example of this is found in western Fuji. Fires in these mountain areas maintain montane grasslands, (which are a good habitat for wild ungulates) and wet meadows, (which are prime grazing lands). Fire also encourages the growth of the bracken fern rhizome, which is an important source of starch to local people (Coggins 2002). Fire was an important tool of the "First People" populations of North America. It was used to create a patchwork landscape of open woods, large meadows and patches of prairie out of a previously dense

forest (Berkes and Folke 2001). Fire also increased productivity of the land, and provided more food sources, such as berries and root crops (Colding *et al.* 2003; Marten 2001). The Amerindians of Northern Alberta, Canada, used fire to create clearings, corridors and wind fall forests that increased habitat for a number of species including ungulates and waterfowl (Lewis and Ferguson 1988).

There are a number of cultural characteristics that lead to the above management practices. The first critical characteristic is that the managers of these resources have local expertise and knowledge that monitors and is responsive to change in ecological systems (Berkes *et al.* 2000). Berkes and Folke (1998) state that appropriate feedback mechanisms are essential for successful adaptation as ecosystems are dynamic and constantly change. The second important characteristic is that the relevant community experiences continuity to place, which enables them to develop affective values and a strong sense of collective identity associated with their local landscape (Strang 1997). Continuity to place refers to the long-term occupation of an area by a group of people. This is an important characteristic as knowledge, particularly of ecological processes and functions, and the ability to adapt to a particular landscape relies on generations of accumulated experience (Berkes *et al.* 2003). The Australian Aborigines have a deep attachment to their local landscape. Having lived in Australia for, what is generally believed to be, forty thousand years they experience a deep engagement with their local landscape, where every aspect of their life – social, physical, economic, intellectual, emotional and spiritual – is invested in one place. The consequence is that every characteristic of the land is steeped in symbolic meaning and value, and they experience a deep and intensely relational interaction with the landscape (Strang 1997). This differs to people who are new to an area, who often try to manipulate a landscape based on their knowledge of a previous ecosystem, and in the process impose their ideas on how a landscape should look. This is done without an adequate understanding of the ecology. For example, Payne (1999) describes how the early British colonists tried to create a mini-England in the Zuurveld of South Africa. This resulted in a significantly altered environment characterized by, for example, a loss of indigenous vegetation and an increase in exotic plant species.

The third important characteristic relates to the relevant communities' worldview as this is the means by which "cultural values, ethics and the basic norms and rules of a society" are shaped (Berkes *et al.* 2000: 1256). Related to this is a culture's eco-cosmology defined as the way people see the human-nature relationship according to their cosmology and

worldview (Croll and Parkin 1992). An environmentally appropriate worldview found among many cultures, especially from the New World, is the belief that all creatures are part of one community (Pierotti and Wildcat 1999). Turner *et al.* (2000:1279) add that the environment is seen holistically, where all parts are interconnected: "people, animals, material objects and supernatural entities are not separate and distinct". Consequently there is respect for all of life. The third crucial aspect of this worldview is that many indigenous communities typically see the biological and cultural worlds as one (Nabhan 1997; Pierotti and Wildcat 2000). For example, the Tukano, from the South American Basin, do not have a separate term for 'nature'; their environment is as much a part of them as their digestive system, and "an extension of biological man" (Reichel-Dolmatoff 1996: 8). The environment is thus highly valued by these people, because it directly relates to who they are, so in effect damage of the environment leads to damage of oneself. The Raramuri tribe of Mexico manages and lives in the Sierra Madres, which is one of the three most biologically rich areas in the world (Salmon 2000). This group of people is highly connected to the local landscape, which is central to their theory of origin and their cultural identity. Values and meaning placed on the natural environment are thus deep and complex and certain creatures, such as the bear and coyote, for example, are regarded as cousins or siblings. The concept of nature being separate to these people's activities and culture is foreign to them.

A coupled socio-ecological system is very important for the development of the above characteristics (Folke *et al.* 2003). Worldviews and cultural values that do not decouple people from their dependence on local ecosystems are believed to effectively manage ecosystem dynamics (Folke *et al.* 2003). "Ecosystem people", as termed by Dasmann (1991) rely on the biological resources of local ecosystems to fulfil most of their needs. Consequently they often behave as an integral component of the ecosystems they inhabit, which leads to sustainable management practices (Bawa and Gadgil 1997; Kothari and Das 1999). A study undertaken by Jodha (1998) in the mountainous, diverse and inaccessible region of Hindukush-Hindya demonstrates this. Local resource users are isolated from mainstream society and consequently have a direct, crucial dependence on the natural resources, which is coupled with an intricate knowledge of the resource base. This dependence on the local environment has ensured that cultural practices maintain the environment's health and productivity (Jodha 1998).

1.3.2 Negative anthropogenic effects

The history of human existence is littered with examples of the lasting and devastating impacts that anthropogenic disturbance can have on ecosystems and the local people utilizing them. Examples include the Mesopotamians, where it is believed that the intense disturbance caused by these peoples disrupted the natural environment to such an extent that their empire collapsed as a result of it (Jacks and Whyte 1939; Janssen and Scheffer 2004). The Polynesian expansion across the Pacific Islands resulted in the extinction of about 2000 bird species (15% of the world's avian diversity) (Dolman 2000), while vast tracts of land were deforested (Bowie 2000). A similar experience occurred when people arrived in the Americas, Oceania and Madagascar, where over one-hundred genera of large mammals were lost (Dolman 2000). In Malawi the Northern Ngoni Kingdom collapsed because of environmental degradation (McCracken 1987). There are many recent examples of anthropogenic disturbance resulting in soil compaction, forest ecosystem destruction, and loss of biodiversity, (Kozlowski 2000). For example by 1983 it was believed that desertification had occurred on 9 million km^2, which was believed to be caused by over grazing, cultivation and the harvesting of fuel wood (Dolman 2000). In the United States of America half of the rivers are significantly polluted while only 2% are free flowing (Dolman 2000).

Many human activities thus result in a simplification and homogenisation of the world's biota (Feinsinger 2001; Stocking 2003). In these homogenised and intensively managed landscapes ecological memory is significantly reduced. It takes a much longer time for these landscapes to recover from disturbance, they are more prone to invasive species and have a reduced capacity to sustain ecosystem services (Folke *et al.* 2003). In this type of condition, natural environments no longer supply the vast array of benefits normally utilised by local people and can create many problems. The prairies of North America are a good example, where intensive, prolonged anthropogenic disturbance turned once productive lands into a dust bowl (Jacks and Whyte 1939). Hoffman and Ashwell (2001) describe land degradation problems in South Africa resulting from anthropogenic disturbance. These includes soil erosion, where rill, gully and sheet erosion affects 70% of the land's surface. This negatively affects agricultural production, results in dam and river siltation and impedes socio-economic development. In the Transkei of the Eastern Cape there are gullies 20m wide and 6m deep. Another problem is the invasion of alien shrub and tree species, which cover ten million hectares. This reduces water resources (6.7% of

South Africa's total annual runoff is used by these plants) and also threatens South Africa's high biodiversity levels.

A riparian study undertaken by Corbacho *et al.* (2003) indicated that intensive land use schemes had resulted in invasive, non-indigenous species becoming dominant, such as *Typha*, *Eucalyptus, Populus* and *Arundo* formations, which is a common characteristic in landscapes highly affected by agricultural activities. In addition, these human-altered riparian landscapes were characterized by high structural and vegetative homogeneity, overall diversity was low and plants were of the same age class (Corbacho *et al.* 2003).

Lindenmayer and McCarthy (2002) conducted a study on the effects of clear felling on the montane ash forests of the central highlands of Victoria in Australia. They found that this anthropogenic disturbance had very different effects in terms of structure, plant composition, landscape patchiness and species richness when compared to natural disturbances in the form of wild fires. Wild fires result in complex multi-aged forests that are highly variable due to landscape patchiness being enhanced. This compares to clear felling which results in a simple, uniform, even-aged forest structure, and homogenous landscape patterns.

O' Riordan (2000) believes that humanity is threatened by this environmental degradation. He mentions the following indicators: 60% of Europe's commercial forests have been damaged by acid rain; 25% of all fish stocks are presently over fished; for 900 million people environmental degradation means that they no longer have a sufficient means of producing food or getting clean water and fuel wood to keep ones family above the base subsistence level; 500 million people live on marginal lands that are incapable of meeting their subsistence needs; and heavy metal pollution is resulting in bad health. For example, 250 000-500 000 people have renal failure due to cadmium poisoning.

Simplified ecosystems with homogenized spatial patterns increase the chance for multi-stable states, where the system easily moves between stability domains (Folke *et al.* 2003). In addition, anthropogenic disturbance can create a lower productive state not common under natural disturbance patterns and which is difficult to reverse. A classic example is the eutrophication of lakes. In this example an overdose of nutrients resulting from agricultural and industrial wastes leads to an increase in algae and consequently turbid and murky conditions. This results in a decline of certain plants as well as the fish species

feeding off them (Peterson 2002). The consequence is a significant loss of diversity which is very hard to reverse (Knowlten 2004). Another common example is how the over-use of productive savannahs can cause them to flip to a condition characterised by sparse vegetation (Holling 2001; Walker and Meyers 2004). Knowlten (2004) describes how over-fishing can create multi-stable states in ocean systems causing a transition from a coral to an algal dominated seascape.

The collapse of the Northern Cod fisheries, in Newfoundland and Labrador, Canada, provides a classic example of the consequences of intensive, high magnitude anthropogenic disturbance (Finlayson and McCay 1998). In 1992, after a few decades of commercial fishing based on high technologies, such as the use of factory freezer-trawlers, all fishing was banned as the fish stocks were facing commercial extinction; the estimated biomass was only a third of the 1962 figures. In 1994 the numbers continued to decline and northern cod faced the threat of biological extinction (Finlayson and McCay 1998). In 1996 it was believed that the fisheries would be closed for another ten to fifteen years.

There are a number of ideologies and management practices that lead to the impoverished-type landscapes described above. As described by Holling *et al.* (1998), these are typified in conventional resource management, the roots of which can be found in the utilitarian and exploitative world view where humans are regarded as having dominion over nature (Berkes and Folke 1998). This resource management philosophy developed under the reductionist and mechanistic world view that views nature as a store house of raw materials, which are valuable when they have a monetary, economic value (Holling *et al.* 1998). Consequently, nature has been treated as a commodity and conventional resource management is geared to its efficient utilization (Berkes and Folke 1998). The idea of a maximum sustained yield reflects the above characteristics (Scoones 1999). This principle is geared either towards monoculture or a focus on one extractable resource, as well as maintaining the supposed 'stability' of an ecosystem. Conventional resource management has been described as an "equilibrium-centred, linear, cause and effect view" (Berkes and Folke 1998: 12), which treats the environment as a simple system. This is in contrast to the realization of the complex characteristics of ecosystems as described in section 1.2. This is backed up by Scoones (1999) who explains that this type management strategy is founded on the static equilibrium held views that have dominated the ecological and social sciences. Consequently conventional resource management has not been conducive to maintaining biodiversity and ecosystem resilience. Firstly, targeting one species freezes the ecosystem,

leads to unstable, brittle and vulnerable ecosystems and increases the possibility of large scale disturbance as well as flipping the system towards a less resilient state (Berkes and Folke 1998; Holling *et al.* 1998; Adger 2000; Holling *et al.* 2002a). Secondly, the non-flexible nature of these management approaches blocks environmental variability as well as the feedbacks which govern change (Berkes and Folke 1998). The classic example is Yellowstone National Park, where a century of forest fire suppression led to a build up of vegetation biomass. This resulted in almost half of the park burning down in 1988 (Berkes and Folke 1998; Holling *et al.* 1998). Dolman (2000) states that fire suppression in U.S.A National Parks has greatly modified forest structure and regeneration dynamics. Sullivan and Homewood (2003) argues that both equilibrium and non-equilibrium views of social and ecological systems are more based on ideologies than the reality, which have their biases but also justifications. They make the novel statement that these two views should not be seen as contrasting, as they are regularly depicted in the literature, but rather as necessary for each other and in relationship. The dominance of equilibrium-centred views in guiding research, policy and management practices, has affected how we perceive this relationship. It is this which has led to an imbalance in how social-ecological issues are dealt with.

1.5 Aim and Key Objectives

The aim of this thesis is to examine the role of anthropogenic disturbance in the creation of a socio-ecological landscape. The following three key questions were asked.

1. What impact has past anthropogenic disturbance had on present vegetative characteristics?
2. What value does this disturbed landscape have to local people?
3. How do the local peoples' worldview and eco-cosmologies influence how they perceive, value and manage their local landscape?

1.6 Thesis structure

Chapter two describes the study area, examining the history, socio-economic and geographical conditions that characterize my research site. Chapter three describes my methodological and philosophical framework, explaining the interdisciplinary nature of my study and the multiple methods that were used. Each results chapter includes a more detailed explanation of the actual techniques that were employed. Chapter four, the first of three results chapters, answers the following key question: What impact has past anthropogenic disturbance had on present vegetation characteristics? Chapter five follows this up by asking the following key question: what is the value that this disturbed landscape has to the local people. This includes a description of local people's reliance on their landscape and the diversity of resources supplied by it. These two results chapters thus assess whether anthropogenic disturbance has had positive or negative effects on the ecosystem's functioning and local people's livelihoods. The final results chapter, chapter six, addresses the following two key questions: "What are the worldview and eco-cosmologies held by the majority of amaXhosa in four villages in the Kat River valley; namely Cathcartvale, Tidbury, Ntlini, and Fairbairn, focusing on the importance of the ancestors and traditions?", and "What impact has this worldview and these eco-cosmologies had on local people's perceptions, values and management of their local environment?". Chapter seven brings together and discusses my main findings. It examines the factors that lead to anthropogenic disturbance having either a positive effect or negative effect on the resilience of a socio-ecological system.

Chapter 2: Study Area

2.1 Geographical location

2.1.1 The Kat River Valley

The Kat River valley's primary catchment is the Great Fish River. It is part of the Nkonkombe municipality, previously called Stockenstroom, and covers an area of approximately 1700km^2 extending for 80km from South to North. The Kat River valley lies below the Katberg, Elandsberg and Amatola mountains and is situated in the central part of the Eastern Cape Province. The main service centre is Fort Beaufort, situated in the lower part of the valley. See figure 2.1 for the Kat River valley's geographical location.

My study site is made up of four rural villages that occur in the Kat River Valley. The four villages are Cathcartvale (32°30'31"S and 26°45'48"E), Ntlini (32°42'4"S and 26°36'0"E) Tidbury (32°38'6"S and 26°39'5"E) and Fairbairn (32°33'6"S and 26°42'5"E). Cathcartvale, which is situated in the North Eastern reaches, is my main research site, while Ntlini (lower Kat), Tidbury (middle Kat) and Fairbairn (upper Kat) are secondary research sites. Figure 2.2 gives their geographical positions. Relevant information collected during my honours project and two research reports, which were based on these latter three villages, was used for this thesis.

2.1.2 Cathcartvale

Cathcartvale is a village situated five kilometres above Seymour, a small rural service center (Nel and Hill 2000), and fifteen kilometres away from Hogsback, a mountainous tourist resort. It lies along the Elandsberg River, a tributary of the Kat River, and is one of the northern villages in the Kat River Valley. Plate 2.1 is a picture of Cathcartvale village.

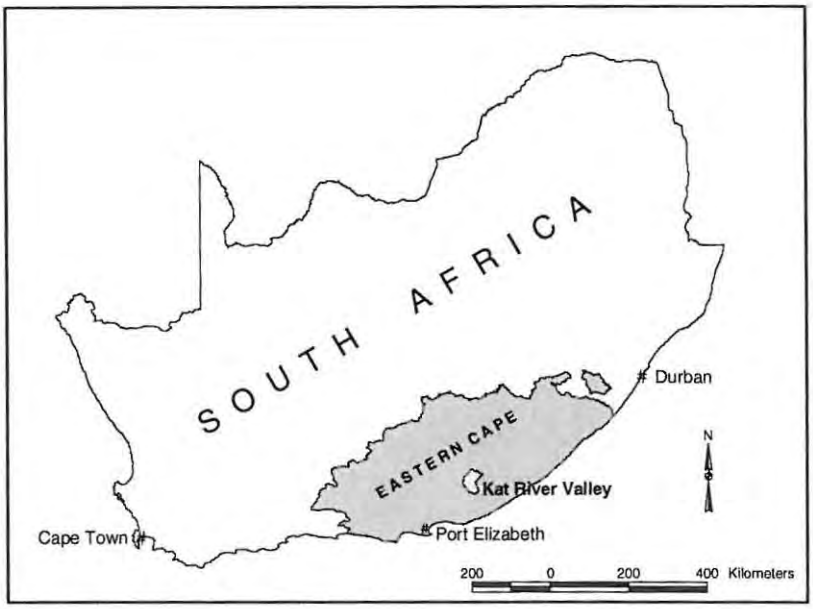

Figure 2.1 The geographical location of the Kat River valley.

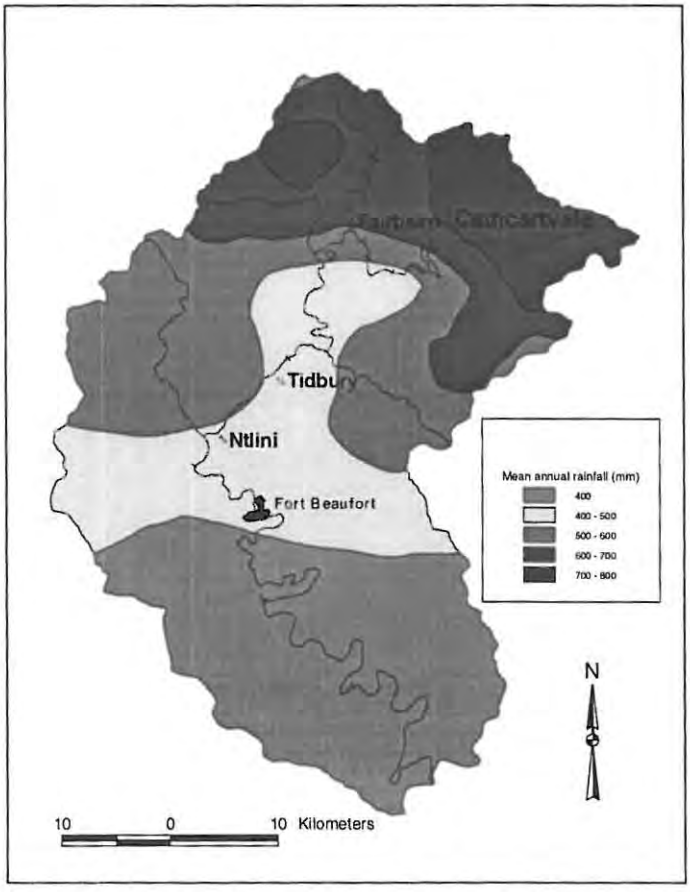

Figure 2.2 The Geographical position of Cathcartvale, Fairbairn, Tidbury, and Ntlini.

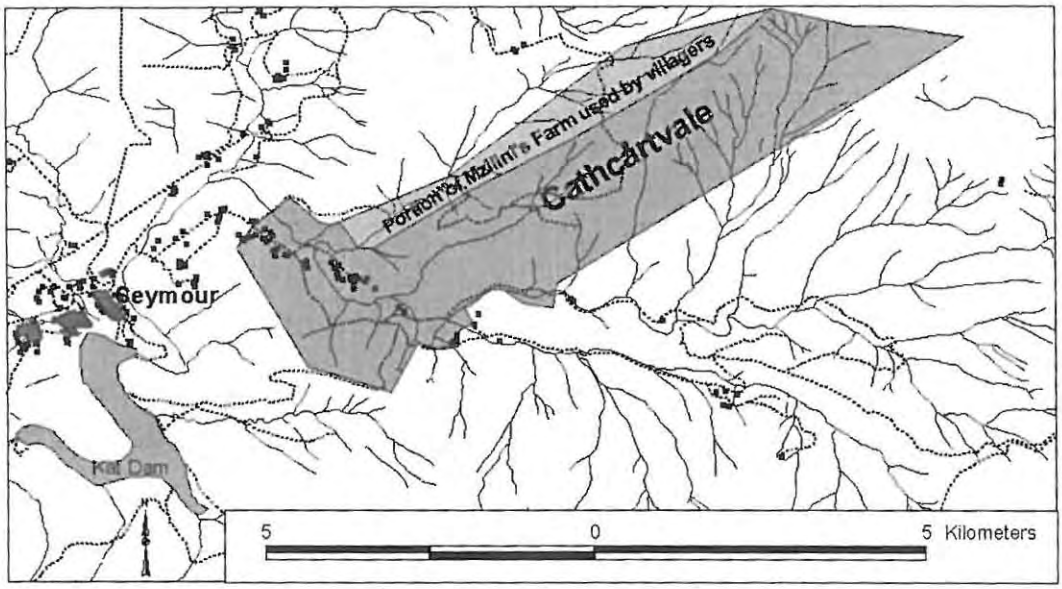

Figure 2.3 The boundaries of Cathcartvale as well as a portion of Mzilini's farm, which was harvested by local people.

Plate 2.1 Cathcartvale village.

This village was chosen as my main study site for a number of reasons. Firstly, the Millennium Assessment funded part of my research. Their research included the Gariep Basin, of which the Great Fish River Basin is a part. The Kat River Valley, which is a tertiary catchment of the Great Fish, was chosen because of my previous research experience in this valley and its proximity to Grahamstown (80km). This would cut down travel expenses. Cathcartvale was specifically chosen because little research has been done in the upper reaches of the Kat valley. I soon realized that Cathcartvale provided a very good case study for my research topic, as it has had a complex history of land ownership and belief patterns influencing resource use and land management. Figure 2.3 is a map showing the boundaries of Cathcartvale as well as a portion of Mzilini's farm, which was harvested by local people.

2.2 Biophysical information

2.2.1 The Kat River Valley

Summer temperatures range between 20 and 35 degrees Celsius, while winter temperatures range from freezing to 20 degrees Celsius (Magni 1999). Rainfall is orographic and averages 500-600mm, but ranges from 400mm at the confluence of the Fish River to 1200mm in the escarpment (Magni 1999). Seventy-five percent of annual rainfall falls between October and March. The valley thus has a summer rainfall pattern.

The Kat River valley is underlain by the Adelaide sub group of the Beaufort series and is predominately shale, mudstone and sandstone (Hill Kaplan Scott 1990). The Amatola Mountains along the northern edge of the valley consist of the hard sandstone of the Katberg formation. Dolerite sills and sheets intrude the central and northern parts of the valley, while stretches of alluvium soils occur along the Kat River (Hill Kaplan Scott 1990). Soils which come from the Beaufort series parent rock tend to be dispersive, with a fine grain size and are therefore susceptible to erosion (Hill Kaplan Scott 1990).

Numerous authors reflect on the environmental richness and biodiversity of the Kat River Valley with its high species endemism, many of which are rare (Hill Kaplan Scott 1990; Logie *et al.* 2000; Nell and Hill 2000). The vegetation is mostly Valley Bushveld and river

thicket, while pockets of afromontane forest and grassland vegetation occur in the higher altitudes (Low and Rebelo 1996).

The upper Kat is characterized by typical Valley Bushveld. In the middle Kat this changes to Eastern Thorn bushveld dominated by *Acacia karroo*. The lower reaches are typified by succulent thicket, characterised by *Acacia karroo, Euphorbia* sp., *Diospyros dichrophylla,* and *Olea europaea* subsp. *africana* (Low and Rebole 1996; Hill Kaplan Scott 1990).

2.2.2 Cathcartvale

The land owned by the villagers of Cathcartvale is diverse both in topography and vegetation. The terrain is mountainous, where the altitude ranges from one-thousand to two-thousand meters (Loxton, Hunting and Associates 1979). Rainfall also varies; villagers testify to the higher rainfall that occurs in the mountainous region of their land. Rainfall averages 685mm per annum (Loxton, Hunting and Associates 1979), but varies between 600mm to 1200mm depending on altitude (Hill Kaplan Scot 1990). Hill Kaplan Scott (1990) state that the geology of the northern Kat Valley consists of the red and grey mudstone of the Elandsberg shale member, as well as the Balfour shale formation. Dolerite has extensively intruded the area. Two soil types dominate the area. They are both of relatively good quality. The first is made up of an association of young alluvial and colluvial soils of low lying areas, while the second consists of black and red euthrophic soils associated with dolerite that occurs in the mountain foothills (Loxton, Hunting and Associates 1979).

The vegetation surrounding Cathcartvale consists of the following vegetation types; spiny scrub forest, characterized by *Cussonia spicata, Euclea undulata, Plumbago auriculata, Portulacaria afra,* and E*uphorbia triangularis*; woodlands, characterised by *Euphorbia triangularis, Cussonia spicata, Ptaeroxlyon obliquum, Olea europaea* subsp. *africana* and P*appea capensis*; bush clumped grassveld, characterized by P*appea capensis, Grewia* sp. and E*uclea undulata* (Hill Kaplan Scott 1990); and a short deciduous, dry valley shrubland to open shrubland that is dominated by *Acacia karroo*. Other species include *Ehretia rigida, Rhus undulata, Xeromphis rudis, Asparagus* sp., and *Aloe ferox*. Common grass species are listed as *Digitaria eriantha, Setaria neglecta, Sporobolus fimbriatus, Panicum*

stapfianum, *Themeda triandra*, *Heteropogon contortus*, *Aristida congesta* and *Eragrostis obtusa* (Loxton Hunting and Associates 1979). In addition, the following two vegetation types occur; dry valley thicket and short shrubland, which is characterised by a mosaic of short to very short evergreen vegetation type dominated by *Olea europaea* subsp. *Africana*, *Grewia robusta*, *Maytenus polyacanthus* and *Rhus* sp.; and plateau and valley dwarf shrubland, which is described as an advanced degradation of mixed sweet grassland and thicket shrubland caused by overgrazing. It is dominated by an almost pure stand of *Chrysocoma tenuifolia* (Loxton Hunting and Associates 1979).

2.3 History

2.3.1 The Kat River Valley

The Kat River catchment is fertile and well drained. It has thus been an area of contestation between the Xhosa, British and coloured/Khoikhoi people, for two centuries (Logie *et al.* 2000). Its history has been shaped by violence, dispossession, resettlement, insecure land tenure and multiple land owners. According to Logie *et al.* (2000), these factors have fundamentally influenced the condition and characteristics of the present landscape.

In the early 1800s the Kat River Valley was occupied by a group of Xhosa people under the leadership of chief Maqoma. In 1829, however, their land was declared a buffer zone and Chief Maqoma and his followers were expelled from the area (Preston 1983; Logie 1998). This was a consequence of the rising tensions between the British (who had territory west of the Fish River), and the Xhosa (who had been forced into the eastern half of the country) (Logie *et al.* 2000). The British allotted this area to freed slaves and people of Khoikhoi and coloured ancestry, with the intention that they would act as a military barrier against the Xhosa (Ross 1997). Ross (1997) clarifies that these coloured people were either "bastards" who had some European blood, or else were descendents of white Afrikaners, who married Khoi women. The Kat River Settlement came into existence where 1000km of land was divided into five areas and managed by people of coloured and Khoi descent. They lived in village-like settlements, with each household owning a river frontage plot of three to five acres. These were planted with wheat, sorghum, barley,

potatoes and also fruit trees. The rest of the land was set aside for communal grazing. The main farming activities were the cultivation of tobacco and citrus (which continues to the present day) and sheep farming (Logie *et al.* 2000).

This occupancy by coloureds continued until the 1850s whereafter large portions of the land was handed over to "land-hungry white settlers" who were attracted to the area due to the growing wool industry (Logie 1998: 37). It was also a consequence of the Eighth Frontier War of 1851 between the Xhosa and British, where about a quarter of the coloured inhabitants rebelled against the British (Logie *et al.* 2000). This rebellion and war was the beginning of the end of the coloured settlement. The door was opened to whites who could buy land that was confiscated from "rebellious" Coloureds; in total about half of the coloured settlers lost their land (Logie *et al.* 2000).

The passing of the Boedal Erven Act in 1905 brought further changes to land ownership. It resulted in the large commonages being sub-divided into farms, which were bought by white farmers. This act dispossessed most of the coloured people, leaving a remnant population who mostly congregated together in Hertzog village (Logie *et al.* 2000).

Logie *et al.* (2000) describe how, with time, the Kat River Valley began to act as a place of refuge where there was a steady influx of Xhosa people seeking pastures and a place to settle, as well as coloured vagrants. By the 1940s 5000 people, occupying 640 plots, lived in the area. This compares to the estimated figures of 350 people settled on 25 farms, if white farmers had occupied the same land (Logie *et al.* 2000). The area was thus described as over-populated. Many had illegal status. Eight-hundred and seventy-one of these people were illegal immigrants, while 4000 people were vagrants. The vagrants included both black (Mfengu, Tswana and Xhosa) and coloured inhabitants. Many of these coloured and Xhosa people worked as labourers on the white owned farms (Logie 1998).

The next major shift in land ownership occurred in 1975, when plans were put in place to incorporate portions of the Kat River valley into the independent Ciskei homeland. The idea was that the Ciskei would be independent from a white South Africa, run by a Xhosa government for Xhosa people. This was a policy adopted by the Apartheid government to give Bantusans their own homeland. The Apartheid was a strategy used by the National Party to separate people based on racial identity. Over 150 white farms were bought out and either resold to black farmers, or left to lie fallow and unproductive (Logie *et al.*

2000). Citrus and tobacco was cultivated. By 1979 the Kat River population was largely Xhosa (10 891 people), followed by Coloureds (2589 people) and then whites (865 people) (Logie *et al.* 2000). In 1994 the Ciskei state was reincorporated back into South Africa. The area now experiences a predominantly Xhosa occupation with many of the ex-labourers settling on previous farm land, "to which they have no legal title, yet are tied to it for reasons of birth, their labour, dwellings and for historical reasons" (Logie 1998: 55).

2.3.2 Cathcartvale

Up until 1981 the history of Cathcratvale paralleled that in the rest of the Kat River valley. The land of Cathcartvale had been divided up into five farms, which were owned by both whites and coloureds. The coloured population lived in two village-like settlements. In 1981 the white and coloured farms were bought out and Cathcartvale was incorporated into Ciskei. The present Xhosa village of Cathcartvale is situated on one of these old villages. The Xhosa were previously scattered over the area and worked as farm labourers and herders for both the white and coloured land owners. They lived in small settlements, a few of which were in the mountains, three kilometres from the present village. In total there were 20 small-scale settlements of various kinds, including: a few dwellings for herders, village settlements for coloureds, plots for individual white farmers, and small Xhosa settlements. One can still see their marks on the landscape.

Informants described how the area was intensively managed under white and coloured land ownership: livestock numbers were higher than at present, cultivation (of millet, maize, sorghum, tobacco, lucerne, wheat, barley and fruit trees) was widespread and large quantities of indigenous species were harvested as building materials. The coloured landowners also harvested large quantities of fuel wood to sell.

Informants explained that the white land owners had cattle, sheep and goats (including angora goats). The land was burnt and cleared to make it productive for livestock. This was especially the case for farmers owning angora goats, where thorny species such as *Scutia myrtina* and *Acacia karroo* were actively removed. The white land owners also planted *Acacia mearnsii* and established an extensive road network.

In 1978, as a consequence of the land becoming incorporated into Ciskei, previous Xhosa farm labourers and herders moved down from the mountains and settled in their present day settlement. Many of the coloured population left, mostly to East London, while about five families stayed. The remaining families now make up a small percentage of the present population. An informant explained that a few Xhosa people farmed the land after the white population left. However, there was an interval of about five years between this transfer of land ownership. The land was consequently not grazed or utilized and trees, especially *Acacia karroo,* began to grow. In these five years the density of plant species increased significantly, as testified by informants.

2.4 Socio-economic demography

2.4.1 The Kat River Valley

The following results are based on the 1996 and 2001 census data (Statistics South Africa 2004). The current population consists of 45 000 blacks, who make up more than 90% of the population, 2000 Coloureds and less than 1000 whites. The upper and middle reaches of the Kat are predominately black and coloured as this area used to be the old Ciskei, while the lower Kat has a comparatively larger proportion of white farmers (Magni 1999). Twenty-five percent of the rural population engages in agriculture and forestry activities as their primary activity, while another 25% see community, social and personal activities as their primary activity (Statistics South Africa 2004). The unemployment rate is as high as 83.3%, and the average income per household per month is R328, while 31.1% of households say they have no secure source of income (Statistics South Africa 2004). The main sources of income are through pensions and working as laborers on the citrus farms. A small percentage is employed to work for the Eastern Cape Department of Water Affairs and Forestry. In terms of education, 16% of the population has never been schooled, 34% have done some level of primary education, 45% have been to secondary school, of which only 15% have received their senior certificate, while 5% have been involved in higher education (Statistics South Africa 2004).

These statistics indicate that the Kat River Valley has a large black population, the majority of which live in material poverty, with few opportunities to be employed. There is

consequently a heavy reliance on the natural resources to secure a livelihood. Due to cultural and economic reasons the area is heavily stocked with cattle and goats. After the area was incorporated into the Ciskei in the 1980s, there was an 82% increase in cattle, 44% increase in sheep, 75% increase in goats and 56% increase in equines (Hill Kaplan Scott1990). Hill Kaplan Scott (1990) believes that in 1990, assuming good veld condition, the grazing lands were overstocked by 55% and the browsing lands were overstocked by 63%. They state that these are generalizations, where the reality will vary considerably from place to place.

2.4.2 Cathcartvale

The data for this section is based on a resource-household survey I conducted with forty-seven households in the village. This is about 95% of the total number of households in the village.

Cathcartvale is made up of approximately fifty households with a total population of about 272 people. Sixty-six percent of these villagers are local to the area, and are either former farm labourers and herders or their descendents, with 84% being from the Kat River Valley. Therefore, only 16% come from outside of the catchment. The population is made up of twenty-five different clans, of which the Mpinga (7 households) and Mamgcina (6 households) are the most common. Five households see themselves as coloured. In terms of religion, 44 (91.7%) households practice traditional beliefs while 41 (89.1%) call themselves Christian. This reflects the synchronization of traditional and Christian beliefs. The average income per household is R823 per month. Table 1 summarizes the main sources of income for each household.

The average number of livestock owned by each household is 6.8 chickens, 4.7 goats, 2.8 cows and 0.5 donkeys. A few households also own pigs, sheep and ducks. There is a total of 222 goats and 129 cows owned by the villagers. The village has no electricity or tap water. Therefore, villagers make use of fuel wood and collect water either from the river, or a pipe which brings underground water from the mountain. There is a local 'spaza' shop that supplies a variety of goods. However, Seymour, which is only five kilometers away, has a number of well functioning shops and two schools that are attended by the local children.

Table 2.1: Main source of income per household.

Source of income	Monetary value	No. of households	%
A single pension	R700	17	35.4
A pension and remittances	R850	6	12.5
Local businesses	R760	5	10.4
Harvest and sell resources (aloe, fuel wood)	R270	4	8.3
Two pensions	R1400	4	8.3
Work in the forestry sector	R1300	3	6.3
Remittances	R383.3	3	6.3
A single pension supplemented by a small additional income	R986.7	3	6.3
Child grants (two households have small additional income sources)	R160	3	6.3
Farm labourer	R350	2	4.2

2.4.2.1 Community Committee

When the ANC came to power in 1994 they developed a policy where each individual is entitled to R15 000 in order to build a house. In some instances communities have been encouraged to pool their money and buy some land as a community project. In 1997 the community of Cathcartvale decided to pool their money and buy the land, consisting of the previously owned coloured land, as well as three white farms. They established the Masakhana Communal Property Association to legally represent the community in purchasing the land as a community project. Members of this association, representing their respective households, include anyone who has bought a share in the land. A member must also have the following characteristics as stated in the Draft Communal Property Association Constitution: they must be over the age of 18 with one or more dependents; they must have applied in writing, submitting all personal details and indicating that they are a first time beneficiary to the subsidy; they must qualify for grants from the Department of Land Affairs and Forestry; and they must not have a habitual criminal record. The rights of every member include; access to communal land, and other communal amenities and facilities; and an individual demarcated site for a house.

A community committee, democratically elected on a yearly basis, was set up to manage this association. Its consists of eight local people who hold the positions of chairperson and his/her vice; a secretary and his/her vice, a treasurer and three additional members.

This association has been influential in organizing an agricultural scheme where each household is allocated a field to cultivate. The excess produce from crops is sold in Fort Beaufort. The Association owns a tractor, which can be rented out by individuals. An agricultural school has been set up by the Masakhana Communal Property Association to train the villagers in cultivation. It is run by a couple of experts who come from surrounding universities. The Association also has plans to develop the area as a tourist destination.

Chapter Three: Methodological Framework

3.1 Introduction

An understanding of the complexity of reality requires a combination of different kinds of knowledge and points of view. This understanding can be achieved through academic disciplines working together (Van Dijkum 2001). This is particularly so when examining a complex socio-ecological system (Berkes and Folke 1998), which is the topic of my research. My research methodology, therefore, includes a range of research approaches and methods that cross the social and natural science divide, and covers a variety of disciplines including anthropology, human geography, physical geography and botany. This is an increasingly common endeavour, especially in 'New Ecology' ("sensu", Zimmerer 1994), which requires one to cross disciplinary boundaries in its examination of how nature and society are part of one complex system (Scoones 1999).

To understand the concept of a socio-ecological landscape requires an understanding of the situation from both a sociological and ecological perspective, which uses different methodological frameworks. I have thus had to adopt both a positivist framework that uses quantitative data, and an interpretive framework that uses qualitative data. The importance of combining these approaches is not to give me more information about ecological aspects, which many researchers have already obtained, or information about only the social aspects. What adds value is that I am able to see the situation from an integrated systems perspective and can make connections and see relationships between the components of the system (Gunderson and Holling 2002). My research, therefore, does not rely solely on the collection of extensive, concrete, undisputable data, but rather on determining relationships and feedbacks.

Redclift (1998) emphasizes the challenge of combining the natural and social sciences. They have different epistemological foundations and assumptions about reality, which can result in conflicts when they are combined. The starting point of the natural sciences is the physical, and the focus is on accumulating reliable, rigorous and objective data about this world. Redclift (1998) argues that natural science is timeless and placeless. It focuses on

accumulating knowledge that is waiting to be discovered. The social sciences, in contrast, are influenced by post-modern thinking, examine knowledge in a particular place and time and view it as subjective - being influenced by ones values, ideologies and specific historical conditions. These deeply rooted epistemological differences are most stark between the interpretive social sciences and positivist natural sciences. These contrasts, identified by Redclift (1998), are important considerations for my research methodology.

3.2 Methodological frameworks

Neuman (2003) provides a valuable critique of methodologies and their underlying philosophical frameworks. Much of the following discussion is based on his work. He identifies the following three main methodological frameworks; the positivist, interpretive, and critical realist research approaches. These approaches have different epistemological and ontological underpinnings and use different methodologies when undertaking research. The positivist and interpretive approaches were used in my research.

Positivism, founded by Comte (1798-1857) in Kitchin and Tate (2000), is the approach commonly used by the natural sciences. Precise, measurable, reliable, quantitative data is collected via surveys, statistics and experiments. This is done in order to objectively understand an actual reality that exists apart from the researcher, and to reveal natural and social laws (Henwood and Pidgeon 1993; Kitchin and Tate 2000; Neuman 2003). A critique of this approach is that valuable information relating to context is often discarded when the quantitative information is summarised and reduced to fit into statistics (Madsen and Adriansen 2004).

The positivist approach was the framework I used when collecting data about the ecological system and the human impact on it. This includes the use of botanical surveys and the household survey of resource use, where rigorous, quantitative data was collected. Chapters four and five, respectively, contain information on these two methods.

The interpretive approach, strongly influenced by Evans-Pritchard's work (Barnard 2000), has been defined by Neuman (2003: 76) as the "systematic analysis of socially meaningful action through the direct detailed observation of people in natural settings in order to arrive

at understandings and interpretations of how people create and maintain their social worlds." Henwood and Pidgeon (1993) explain that this approach focuses on what is relevant to the people under study, and searches for understanding and the meanings they create. The focus is on description rather than explanation, and reality is represented through the eyes of participants. When compared to positivism it is different in that it assumes that the social world is not waiting to be discovered, but is rather what people perceive it to be. It is therefore possible to have many interpretations of human experience and reality (Redclift 1998; Neuman 2003).

In relation to this, reality is viewed as complex and is not necessarily understood by reducing data to numbers and looking for generalizations and representivity typical of the positivist philosophy (Henwood and Pidgeon 1993; Neuman 2003; Madsen and Adriansen 2004). Understanding the context, making connections and seeing relationships are important (Neuman 2003; Madsen and Adriansen 2004). Different methods, mostly qualitative, are therefore used to collect information, with the aim of being able to contextualize it (Madsen and Adriansen 2004). This approach underpinned my methods that examined the social world and how it relates to the ecological system. The use of interviews, transect walks and focus groups (Berg 1998; Ervin 2000) are placed within this framework. These were the methods I used to understand the context of local people's relationship to their natural environment, where one's worldview, ideologies and values as well as the history of land use all play a role in this relationship. Chapters five and six contain more detail about how these methods were used.

3.3 Goal-setting in research

The three most common purposes of research are exploration, description and explanation (Babbie 1992; Kitchin and Tate 2000; Neuman 2003). The goal of explorative research is to understand a complex, broad, fairly new topic, so that more precise questions can be asked later on. This compares to descriptive research, which describes the situation and asks "How?" and "Who?" questions. Techniques used include surveys, field research, content analysis and historical comparative research (Neuman 2003). My research, especially that which focussed on local people's relationship with and the use of their environment, as well as their worldview and eco-cosmologies, was descriptive and made extensive use of my informant's quotes. The goal of explanatory research is to identify

causes of a situation appearing the way it does. My research also had an explanatory purpose, where I examined why the landscape structure looked the way it did and why local people valued and related to the landscape in particular ways.

3.4 Reality orientation

Assmo (1999) argues that one can only be objective with regards to the honesty with which one states one's assumptions. This he terms 'intellectual honesty'. This is because an individual views reality from a subjective stand point. An important assumption, that must be stated clearly, is how a researcher perceives reality.

Neuman (2003) identifies two different orientations towards reality, namely social constructionism, of which the interpretive, critical and post-modern theories are a part (O'Meara 2001), and essentialism. The essentialist stand point is influenced by the positivist philosophy, and believes that there is an actual reality in which people live in that stems from the natural order of the world (Neuman 2003). This differs from the social constructionist view point, which rejects the possibility of objective knowledge and believes that one's reality is constructed by the beliefs and interactions of people. In the social constructionist approach there is thus no external factor that creates the reality, as it is a product of social processes (O'Meara 2001; Neuman 2003). The middle ground, which is where my research outlook fits in, believes that one's worldview and social setting has a large influence on how one perceives reality, but that this does not negate the view that an actual physical reality does exist, independent of people's beliefs and actions. The purpose of my research is not to prove or disprove the objective reality of my informants' beliefs but to observe the effect that these beliefs have on their behaviour and ways of interacting with the environment.

3.5 Research Methods

Research methods are either qualitative or quantitative and are associated with the interpretive and positivist philosophy respectively (Henwood and Pidgeon 1993). Although these two approaches are very different, as will be discussed shortly, many authors

recommend combining them (Strauss and Corbin 1990; Assmo 1999; Ervin 2000; Neuman 2003; Sullivan and Brockington 2004) as they are complementary and each has its own strengths (Assmo 1999; Neuman 2003). My research thus combined both quantitative and qualitative approaches. My ontology was situated within the interpretive framework, but my epistemology uses both interpretive and positivist methodologies.

3.5.1 Qualitative approach

The qualitative approach has an explorative aspect (Assmo 1999). Detailed descriptions of situations, people and places (Patton 1980; Ervin 2000; Neuman 2003), and the meanings people attach to their world (Sullivan and Brockington 2004) are obtained by collecting data in the form of words, pictures, objects and direct quotations. When using this approach the researcher is fully engaged with the people under study. This is due to qualitative research encouraging one to listen, observe, discuss and learn from the people being researched (Assmo 1999; Neuman 2003). The researcher can thus be described as a well-informed outsider in a position to gain a fuller understanding of the social reality people live in, and the cultural meanings they create (Berg 1998; Assmo 1999; Neuman 2003). In addition, the focus of qualitative research is on interactive processes and events, where a few cases are examined in detail. The research process is more cyclical than linear, and the means of data analysis is rarely known at the beginning of the research process (Neuman 2003).

The qualitative research path was used to examine the cultural reality, and the importance of the natural environment to the people of Cathcartvale (the village of my research).

The following key questions were asked:

1. How important is the natural environment (ecosystems and their services) to local people? (c.f. chapter five);
2. What role does the local landscape and its associated plant cover play in local people's livelihoods? (c.f. chapter five);
3. What is the role of anthropogenic disturbance in providing ecosystem goods? (c.f. chapter five);

4. What are the worldview and eco-cosmologies held by the majority of amaXhosa in four villages in the Kat River valley; namely Cathcartvale, Tidbury, Ntlini, and Fairbairn, focusing on the importance of the ancestors and traditions? (c.f. chapter six);
5. What impact have these worldview and eco-cosmologies had on the amaXhosa's perceptions, values and management of their local environment? (c.f. chapter six).

The qualitative approach was chosen because of, firstly, the complexity of a socio-ecological landscape. I followed the inductive approach, where theory is built up from data (Babbie 1992; Henwood and Pidgeon 1993; Kitchen and Tate 2000; and Sullivan and Brockington 2004). This approach is adopted for qualitative, rather than quantitative research (Henwood and Pidgeon 1993; and Neuman 2003). I therefore initially went into the research process with a number of broad research questions. My main aim was to understand the situation from the local people's perspective, examine the social reality through interviews and participant observation, and from this draw a theory, abstract generalizations and ideas about the relationship between people and their local environment. Secondly, because my research path was not simple and well worn, with few sign posts along the way, I followed a non-linear research path, which was experimental and involved back-tracking. This is more appropriate when following a qualitative route (Neuman 2003).

3.5.1.1 Ethics/How the community was approached

The nature of qualitative research means that considerable time and information is taken from the people under study. It is therefore important to be ethically sensitive and approach the community in a manner that is respectful and involves them in the design of the project from the beginning (Motteux 2002). Some key ethical considerations outlined by numerous ethical associations (see for example American Anthropological Association 1998) include the issue of prior informed consent, where it is important to clearly inform the community of one's research intentions and gain their permission to conduct research (Alexiades and Laird 2002). After obtaining permission from the community committee to work and live in the village my first research trip was undertaken, with the main aim of introducing and explaining my intensions to the local villagers and gaining their trust and

co-operation. From the outset, at a community meeting organised during this first field outing, discussion centred on the goals of my research and how I could contribute to the community. It was decided that I would teach English to the children and play soccer with them every evening. From previous research projects I found that this was a valuable activity that enabled me to gain acceptance and trust from the adults. I also gave a small gift of appreciation; usually an item of food to each informant interviewed and a daily wage of R50 each to my two key informants, when they accompanied me in the field. This is in line with ethical associations who state that fair return should be given to informants for their services (Laird and Posey 2002). Shanley and Laird (2002) stress the importance of sharing one's research findings with the people under study, which must be done in a manner that they can understand. This exercise has not yet been done, but the members of the Community Committee are aware of my intention to share my findings. I plan to do this through a workshop and giving three copies of my thesis to the Community Committee. It would be most beneficial to shorten my thesis and translate it, but this is not feasible due to time and financial constraints. The Community Committee does, however, own a number of English documents and some members have a good grasp of written and spoken English.

3.5.1.2 Participant observation

Participant observation was an important qualitative aspect of my research that complemented my use of interviews - described below. To participate effectively in the village it was important to find a rural household who would host me. This would help my integration into the community, gain their trust at a deeper level, and open the door for participant observation. The Community Committee organised a household where I could live for the period of my research. This relatively wealthy household consisted of an elderly man and his two grandchildren and had high social status within the village. This contact allowed me to observe a lot more about village and household life, and to experience many other aspects related to Xhosa culture. For example, because of this contact I was able to attend two important ceremonies, namely a ritual and funeral, which gave insight into community dynamics.

Three main types of participant observation exist. Complete participation where the researcher's role as observer is hidden; participant-as-observer, where the researcher's role as observer is known; and complete observer, where the researcher observes the situation without any contact with the researched (Eyles 1988; Burkey 1993; Nelson and Wright 1995). My means of participant observation was participant-as-observer. The villagers knew my intensions as a researcher and were willing to accommodate me on their walks to harvest resources, and to attend ceremonies with the knowledge that I was collecting data. (See chapter 5 for more detail about transect walks with resource harvesters).

For participant observation to have been truly effective it would have been beneficial to have lived in the village for a considerable length of time; at least a year (Ervin 2000) and to have been able to communicate without an interpreter. This would have increased my understanding of community dynamics and subtle cultural meanings and also gained their deep trust. Due to time and financial constraints, and the multifaceted nature of my research, it was unfortunately not possible to devote enough time to living in the village. A total of two months was spent in Cathcartvale, broken up into eight week-long field visits from April 2003 to April 2004. There was also a language barrier as I do not speak or understand Xhosa. My interpreter helped overcome this by translating my questions into Xhosa and also translating informant's answers into English. My interpreter accompanied me during interviews, transect walks, focus groups and when I was daily interacting with the local people. He was therefore always available to explain people's actions, translate conversations villagers were having and ask follow up questions.

3.5.1.3 Interviews

Interviews were my main qualitative research tool. Berg (1998) identifies three major interview categories; namely the standardised (formal or structured), the un-standardised (informal or non-directive) and the semi-standardised (guided semi-structured interview). The semi-standardised approach was the method I adopted. These interviews were open-ended, long and semi structured. Themes were prepared but each informant was not necessarily asked the same set of questions. Questions were adapted to suit each respondent and the way the interview was progressing. Chapters five and six provide more detail of this method.

It was decided that a translator should not be chosen from within the village as this could result in biased information and tension between villagers. This is because of possible tensions between individuals, and issues of fairness where villagers may question why I chose one individual over another, especially as employment opportunities were limited. The translator was thus someone from outside of the village, who had no previous contact with the local people and was chosen based on a recommendation from a colleague. An untrained translator may reduce the validity of the data. As Assmo (1999) indicates, the interpreter may interpret the response in a way that the researcher will understand, but in the process will lose some of its meaning. My translator proved himself to be experienced and thorough, which minimised this problem. Another problem is interviewer bias, where respondents give answers that they think are what the interviewer wants to hear (Neuman 2003). In addition, respondents don't always understand the question properly (Neuman 2003). To a degree this problem was overcome by ensuring that my translator understood the questions properly, as well as the research objectives and approach. He then carefully explained the relevant question to the informant. The informant's answers often reflected whether they had understood the question or not. When a question seemed to be misunderstood it was repeated or asked in a different way. Questions were also asked in different ways to different informants. The question that produced the most in-depth answers was favoured thereafter. In addition, triangulation was used, where key themes were addressed by asking different kinds of questions, pertaining to the same theme, to the relevant respondent.

3.5.2 Quantitative Approach

The quantitative approach is frequently based on formulating a hypothesis and then collecting data to prove or falsify it (Assmo 1999; Sullivan and Brockington 2004). It is, therefore, often a deductive technique (Babbie 1992; Kitchen and Tate 2000), which begins with a theory or concept and then collects data to prove or disprove the data (Neuman 2003; Sullivan and Brockington 2004). It is also geared towards collecting data expressed as numbers or frequencies, which can then be simplified through statistics (Neuman 2003). In addition, the focus is on measuring objective facts in a rigorous manner; many cases are used; analysis is achieved through statistics and the researcher is, in most cases, detached

from what is being researched (Neuman 2003). The findings of research should also be replicable and generalizable (Henwood and Pidgeon 1993).

The quantitative approach was used to understand the relationship between past land uses and present landscape structure, and to examine the benefits that this structure has for local people.

The following key questions were asked:

1. What impact has past anthropogenic disturbance had on present vegetation composition? (c.f. chapter four);
2. What impact has past anthropogenic disturbance had on the species richness and structure of the vegetation? (c.f. chapter four);
3. Do soil properties have a significant influence on these vegetation characteristics? (c.f. chapter four);
4. What role does the local landscape and its associated plant cover play in local people's livelihoods? (c.f. chapter five);
5. What is the role of anthropogenic disturbance in providing ecosystem goods? (c.f. chapter five).

3.5.2.1 Quantitative methods employed

A household survey of resource use was conducted (see chapter five for a detailed description of this method) to gain detailed, reliable household information such as the number of people per household, clans in the area, and source of income, as well as to determine the extent of resource use and which species were used for which purposes. These interviews were structured to ask a predetermined set of questions to each household. The answers were mostly in the form of names or numbers, i.e. data that could be quantified. These interviews can therefore be classified as standardized (Berg 1998).

The design of focus groups was also geared towards collecting quantitative data. This data was provided through various ranking exercises, asking informants about their favourite

species and determining the benefits of different plant species to local people. Chapter five provides more detail about how these methods were used.

A botanical and soil survey of past land uses was undertaken. Techniques were based on standard natural science techniques geared towards collecting quantitative, objective, reliable data that could withstand statistical analysis. See chapter four for more detail of these two methods and how data were analyzed.

In conclusion this combined approach has enabled me to get an overview of this complex reality. It could be beneficial if further research focused on in-depth data collection in order to substantiate the feedbacks and relationships that I have identified.

Chapter Four: The effect of past anthropogenic disturbance on vegetation characteristics

4.1 Introduction

Disturbance, biotic and abiotic, human and natural, is a necessary part of the natural functioning of ecosystems (Budiansky 1995; Colding *et al.* 2003). Krohne (2001) and Picket and White (1985) identify three main qualities of disturbance. Firstly, disturbance disrupts population, community and ecosystem structure; secondly, it alters resource availability; and thirdly, disturbances are often frequent events where many vegetation communities are in various stages of succession following a disturbance.

As identified by Picket and White (1985), a disturbance affects the species richness, dominance and structure, as well as the functional attributes of ecosystems, such as nutrient cycling and energetics. Because no two disturbances are alike (Picket and White 1985) their effect will vary considerably depending on the severity, frequency and spatial extent of the disturbance (Krohne 2001; Picket and White 1985) as well as landscape characteristics (Picket and White 1985). This has significant consequences for the structure and function of a landscape because as Budianksy (1995) states, ecosystems are never duplicated at different times and places.

The relationship between succession and disturbance plays a significant role in the diversity of ecosystems. Succession, as defined by Krohne (2001: 325), is the "sequential change in the relative abundances of the dominant species in a community following a disturbance". The term sequential is important as it indicates that the successional pathway may not be the same after each disturbance (Krohne 2001). This is because disturbance resets the ecosystem, redistributes resources (Picket and White 1985) and consequently opens up opportunities for new species to replace or take over the role of previously dominant ones (Marten 2001). Ecosystems do not necessarily repeat the same successional and regeneration stages after each disturbance (Frelich and Reich 1998). The biological community is thus partly a matter of chance (Marten 2001), and multi-stable states are common in ecosystems (Holling 2001; Holling and Gunderson 2002). This is

conceptualized in Holling's (1986) adaptive cycle, as explained in the introductory chapter, which demonstrates the importance of disturbance in releasing accumulated nutrients for a new trajectory or growth. In addition, each stage of succession is accompanied by greater complexity and species diversity. Different species also dominate in each stage (Marten 2001). Consequently, sites with similar physical conditions have similar processes of ecological succession, but may have very different species assemblages. Sites at different stages of succession therefore support different ecological attributes. This creates a patchwork of different resource types and increases habitat diversity and the richness of ecological actors (Feinsinger 2001; Marten 2001). The original ideas of succession, influenced by Clements (1916), were different to that explained above, where it was believed to be a much more linear process of change.

This fragmentation of the landscape has both positive and negative impacts on species richness and resilience. One of the consequences of fragmentation is that it increases the ratio of the edge relative to the interior of an ecosystem. Wilcove *et al.* (1986) explain that the edge-effect influences vegetation composition 10-30m inside the forest, while its affect on predation can extend 300-600m inside the forest. They believe that this can have a strong negative impact on woodland fauna and flora. This compares to Turner *et al.* (2003) who state that ecosystem edges are often associated with high biodiversity and productivity, and have unique species assemblages. Forman and Godron (1986) incorporate both points of view and state that certain ecological processes are aided by a high interior to edge ratio, while other important processes are enhanced by a low ratio. They explain that the abundance of rare interior species decrease due to landscape heterogeneity, while species adapted to the edge of habitats, as well as animals requiring two or more ecosystems, increase and total species co-existence is enhanced.

The effect of disturbance depends on its scale, frequency and intensity (Krohne 2001). A landscape infrequently disturbed will become increasingly homogenous as a few species gain a competitive advantage and out-compete other species (Krohne 2001; Forman and Godron 1986). A study based on Val Grande National Park in Italy found that species richness is decreasing in later successional stages due to uncontrolled nature development, where human disturbance has been minimized (Hochtl *et al.* 2003).

This compares to an area experiencing either a chronic or repeated disturbance, which leads to a homogenised and species impoverished landscape. This is because few species

can survive repeated disturbance (Krohne 2001; Forman and Godron 1986). The system can also experience long lasting change in terms of species composition and interaction, when a disturbance pushes the system beyond its resilience threshold (Denslow 1985). The resilience threshold is the highest level of disturbance a system can absorb before flipping from one equilibrium state to another (Berkes and Folke 1998).

Disturbance leads to species diversity and landscape heterogeneity when its frequency and intensity is intermediate, as stated by the intermediate disturbance hypothesis (Connel 1978; Denslow 1985; Picket and White 1985). This is because space and resources are opened up for less competitive species, thus preventing a few species from becoming dominant (Picket and White 1985; Krohne 2001). When human induced disturbance is small-scale and involves multiple land uses, it can have a positive impact on species richness and ecosystem functioning. See the introductory chapter for more detail on positive and negative consequences of anthropogenic disturbance.

The relationship between species diversity, ecosystem functioning and resilience is complex and many theories attempt to explain it. Because species perform a diverse range of ecological functions, such as nutrient transporters and water-flow modifiers (Folke *et al.* 2003), many ecologists assume that an increase in species diversity will increase functional diversity and therefore ecological stability (Peterson *et al.* 1998).

Tilman (1997) argues that there is a positive relationship between biodiversity and ecosystem productivity because there will be more species to fill the available niches, which allows them to utilize their limiting resources more effectively. In addition, biodiversity increases ecosystem stability; a study in the Serengeti showed that grasslands with higher plant diversity recovered more rapidly from grazing by African buffalo as compared to those with a low plant diversity (McNaughton 1993). However, high species richness can cause the population dynamics of individual species to have high fluctuation patterns (Tilman 1997), and in some cases diversity has little affect on productivity and ecosystem stability (Dolman 2000).

The rivet hypothesis, developed by Ehrlich and Ehrlich (1981), states that a system can lose a relative number of species before ecological function is impaired. This suggests that ecological functions overlap (Peterson *et al.* 1998). However, at a certain point when too many species are lost the system will change its ecological state to one less productive

(Krohne 2001). Walker (1992, 1995) developed the "drivers and passengers" hypothesis, which argues that some species are the drivers and have a significant influence on the structure of an ecosystem, for example the beaver, while others are passenger species and have a minor ecological impact (Peterson, *et al.* 1998). It is therefore the presence of drivers which determines the ecosystem's stability, as most of the ecological functions are performed by them. There is thus a degree of species redundancy (Peterson *et al.* 1998).

However, redundancy gives a system a high level of flexibility and resilience (Marten 2001). For example, it plays an important role during times of disturbance (Peterson *et al.* 1998) where seemingly redundant species become critical for the regeneration and reorganization of the system (Folke *et al.* 1998; Colding *et al.* 2003). Species that seem redundant may also play critical roles such as connecting habitats because of their overlapping functions within and across scales (Folke, *et al.* 1998). Diversity thus enhances the ability to persist in the face of change and is a means of spreading risks and creating buffers (Folke *et al.* 1998). Redundancy is also important for ecological memory, which becomes dramatically reduced in homogenised and intensively managed landscapes. These consequently require a much longer time for reorganisation (Folke *et al.* 1998).

The complex history of land ownership in Cathcartvale has had a considerable influence on the local landscape. The goal of this chapter is to examine the impact that past anthropogenic disturbance has had on present vegetation characteristics.

This was determined by asking the following three key questions.

1. What impact has past anthropogenic disturbance had on present vegetation composition?
2. What impact has past anthropogenic disturbance had on the species richness and structure of the vegetation?
3. Do soil properties have a significant influence on these vegetation characteristics?

4.2 Methods

4.2.1 Mapping of past land uses

Abandoned agricultural fields, old settlements, grazing lands and dense forests were initially mapped using a Geographical Positioning System (GPS). Although dense forests were identified as such by local people, they had experienced harvesting pressure in the past and therefore were not pristine. These past land uses will be referred to as anthropogenic landscapes for the rest of this thesis. The area included the land presently owned by the villagers of Cathcartvale as well as portions of Mzilini's neighbouring farm, which are currently used by the local people to meet their basic needs. See figure 4.1 which demonstrates the area that was mapped out.

A local 56 year old man by the name of Jan van Vogel, who grew up in the area and was employed as a livestock herder by a former farmer, was hired to identify the boundaries of anthropogenic landscapes. He was appointed by the community committee due to his deep knowledge of the area and detailed memory of past anthropogenic landscapes, including their previous owners, uses and exact boundaries. This information was verified by other informants; both on transect walks and when sampling medicinal plants in the different sites.

A GPS was used to obtain latitude and longitude readings for the corners of boundaries of anthropogenic landscapes and dense forests. Sketch diagrams representing the different sites were drawn. Jan van Vogel provided information about the previous owner; when the land use was abandoned; and how the vegetation structure, plant density and composition has changed since the white farmers left the area in the 1980s.

The GPS readings and details of previous land uses were entered into an Excel database. This data was then incorporated into a GIS database and used to create a map of anthropogenic landscape boundaries. Electronic maps from the survey and mapping database, based on the 1:50 000 series (Chief Directorate; Surveys and Mapping) were used as a backdrop.

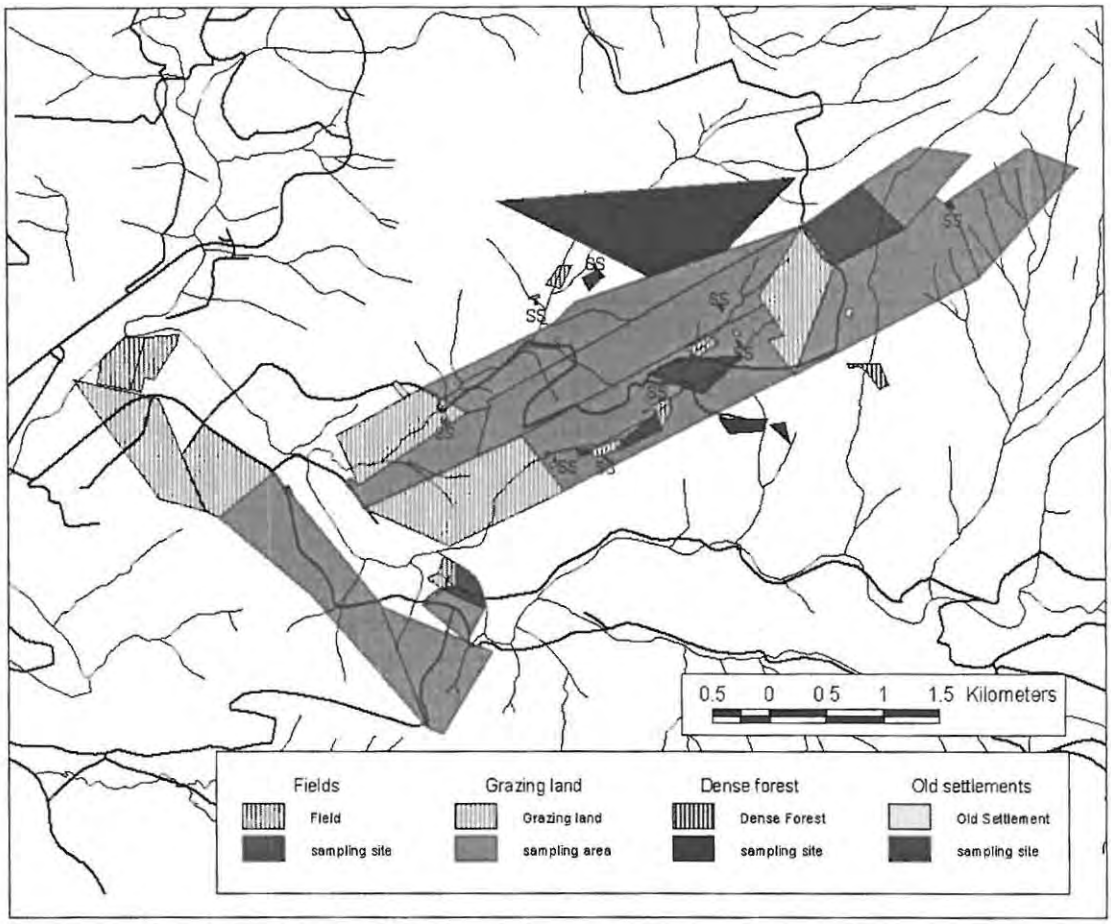

Figure 4.1 Past Anthropogenic landscapes mapped and sampled.

Plate 4.1 Searching for medicinal plants in a quadrant.

4.2.2 Vegetation and soil surveys

Due to time and financial constraints vegetation surveys were carried out on a sample of 29 sites, i.e. 58% of anthropogenic landscapes. GPS readings for each site were recorded. These were selected to cover the spatial extent of the study area as well as the full range of time since abandonment. Agricultural fields and old settlements were abandoned at different times: the earliest being in the 1960s, the latest being in 2002. Where a number of abandoned fields and old settlements were abandoned at the same time and were in similar spatial positions a representative sample was taken. Seven agricultural fields (53.9%) and nine old settlements (45%) were sampled. A higher percentage of the grazing lands (78.6%) were sampled because they were more diverse in terms of spatial location and vegetation characteristics. Two of the three dense forests (66%) were sampled. Figure 4.1 indicates the geographical position of each anthropogenic landscape that was sampled.

Vegetation characteristics were surveyed using quadrants. Between one and seven quadrants were sampled in each of these sites. The number of quadrants depended on the size of the site and the variability of vegetation types within that site. For example, only one quadrant was needed for the old settlements due to their small area, while agricultural fields often had very similar vegetation growing throughout their extent and about three quadrants were needed to capture the variability of vegetation in an agricultural field. This compared to grazing lands, which often occurred over a large geographical area that varied in altitude. Consequently, a greater number of quadrants were needed to capture the diversity and variability of the vegetation that occurred. The sampling was stratified according to vegetation types within each anthropogenic landscape. These were then sub-sampled on a random basis, following a random number chart (Lindley and Miller 1953). Quadrants were five meters by twenty meters, a rectangular shape that reduced the chance of missing a species during sampling. This quadrant shape is recommended by Mueller-Dombois and Ellenberg (1974) and Forman and Godron (1986) because variation between samples is reduced and sampling intensity is increased, i.e. more species diversity is captured.

In each quadrant the species richness, abundance of plants, heights and percentages of woody and grass cover were documented. The height categories for woody species were: small (<1 m), medium (1-5 m), large (5-20 m) and very large (>20 m). The percentage

cover was an informed, subjective estimate and followed Shackleton *et al.'s* (2003) method, a revised version of Walker's (1976) scale that is based on choosing one of eight classes of percentage cover. A voucher specimen for each new species observed was collected. Specimens were labelled with information regarding their geographical location, a description of any significant vegetative features, and a Xhosa name if applicable. They were identified by Mr Tony Dold, who is the assistant curator at the Selmar Schonland Herbarium. Vegetation surveys were carried out in late March to early April, which is the beginning of autumn. This is not the best time to collect specimens as many of them are no longer flowering or fruiting. This increased the difficulty of identifying the species.

The initial goal was to sample both herbaceous and woody species. However, it was soon realized that this was an extremely laborious process and was limiting the amount of sites that could be surveyed. Because the herbaceous species growing on a site often fluctuate and thus do not give a true indication of species richness it was decided that only woody species and succulents higher than ten centimetres would be sampled, which follows Fabricius *et al.*'s (2003) approach. To record herbaceous medicinal plants a local man who was knowledgeable about medicinal plants was hired to identify them. Plate 4.1 shows him looking for medicinal plants in a quadrant. An estimate of their percentage cover was recorded on a data sheet.

From earlier transect walks it was noted that a number of valuable species grew on the edges of old settlements. A one to two meter boundary along the edge of the old settlements was also sampled. All species were recorded. The density of plants beyond this boundary significantly increased, which makes them difficult to access and therefore harvest. The quadrant shape and size for dense forests and sacred pools differed to the above. Due to the impenetrable nature of dense forests, it was decided that sampling would occur for 100m along an animal track leading into the forest. The species closest to the edge of the path were sampled. A five by twenty meter quadrant was too small to capture the "boundary" of a sacred pool, i.e. that which is considered to be a sacred pool. The size was thus increased to a 10 by 20m quadrant, which started at the waters edge and went up the river bank for ten meters and across for 20m. The river section, ten meters below each sacred pool had the same quadrant size as sacred pools. In total, six sacred pools (35%) with their accompanying river sections were sampled.

4.2.3 Soil sampling and analysis

In total, 44 soil samples were collected using a soil auger that went to a depth of 20cm. At least one sample was selected for each past anthropogenic landscape in a particular quadrant. Sites which had a greater area and were more variable in soil types had between two and four quadrants sampled. Soil samples were dried, sieved to two millimetres and then tested for texture, pH and gravel content. It was deemed appropriate for the level of analysis to determine texture using the subjective technique called 'field estimation of texture' (Hartmann *et al.* 1989). About 50g of soil is moistened and this is then rolled to make a worm shape. The shape that this takes determines its texture, which is classified either as sand, sandy loam, sandy clay loam, clay loam, sandy clay and clay. The results are therefore categorical estimates. The percentage gravel content was determined by weighing the total soil sample. This was divided by the weight of the particles greater than two millimetres that were collected after the soil was sieved. The pH was tested using a pH meter, following the procedure outlined by The Non-Affiliated Soil Analysis Work Committee (1990). In this test 10g of dried soil are mixed with $25cm^3$ of de-ionized water. This was stirred rapidly for five seconds and then left to stand for fifty minutes, after which it was stirred again. After waiting for another ten minutes, the pH was read using a pH meter.

4.2.4 Statistical analysis

4.2.4.1 Kruskal-Wallis and Mann-Whitney U Test

The non-parametric Kruskal-Wallis test was undertaken to examine whether there is any significant difference in species richness, species abundance, percentage cover and heights (small, medium, and large) between past anthropogenic landscapes. The non-parametric multiple comparisons post hoc test determined which sites were significantly different from each other. A Mann-Whitney U test examined whether there is a significant difference in species richness, species abundance, percentage cover and heights (small, medium, large and very large) between sacred pools and the river section.

4.2.4.2 Chi squared test

A chi squared test was used to determine the association between soil properties and past anthropogenic landscapes. The following null hypotheses were tested.

1. There is no association between past anthropogenic landscapes and texture.
2. There is no association between past anthropogenic landscapes and pH.
3. There is no association between past anthropogenic landscapes and gravel content.

Data from soil surveys was used. These hypotheses were accepted or rejected depending on whether the p value was more or less than 0.05. These values are based on the probability table (Hammond and McCullagh 1978). See appendix 1 for the observed and expected frequencies.

To make the chi squared test viable, texture, pH and gravel content each had to be grouped into three classes. Texture was grouped into loams (sand, sandy loam), clay loams (clay loam, sandy clay loam) and clays (clay, sandy clay). This grouping is based on Foth, *et al.'s* (1980) modified textural triangle. The three groups for pH were based on the distribution of values, which were divided in three. These categories were: group one (4.9-5.6), group two (5.7-6.1) and group three (6.2-7). The three groups for gravel content were also based on their distribution, which were divided into low (1-13%), medium (13-23%) and high (>23%) percentage gravel content.

The association between species richness and anthropogenic landscapes, texture, pH, and gravel content was compared using a chi squared test. The groups for texture, pH and gravel content are as above, while species richness was divided into three categories: low (0-3 species), medium (4-10 species), and high (11-22 species). These groups were based on the distribution of species richness and were divided into three groups of roughly equal number.

4.3. Results

4.3.1 The association between anthropogenic landscapes and soil properties

Soil texture, pH and gravel content are not associated with past anthropogenic landscapes. There is no difference in texture between past anthropogenic landscapes ($X^2 = 7.524$, $_{df4}$, $p>0.10$), in pH between past anthropogenic landscapes ($X^2 = 8.365$, $_{df4}$, $p>0.05$) and in gravel content between past anthropogenic landscapes ($X^2 = 2.426$, $_{df4}$, $p>0.10$).

4.3.2 The relationship between past anthropogenic landscapes and vegetation characteristics

4.3.2.1 A comparison of species richness, plant abundances and percentage cover between anthropogenic landscapes

Table 4.1 compares the statistics of former grazing lands, abandoned agricultural fields, old settlements and dense forests in terms of species richness, the abundance of plants (i.e. the total number of plants that occurred), and percentage cover. The percentage cover for dense forests was not calculated. The table also indicates whether there was a significant difference in these vegetative characteristics between anthropogenic landscapes (Kruskal-Wallis test). The multiple comparisons post hoc test indicates which anthropogenic landscapes were different to one another.

Dense forests had a far higher species richness and plant abundance than anthropogenic landscapes, being 3.2 times more species rich, and having 3 times the abundance of plants than grazing lands. Of the three past anthropogenic landscapes, grazing lands were more diverse and had a higher vegetation cover, indicated by the greater plant abundance and percentage cover, than agricultural fields and old settlements. These results are significantly different from each other. Grazing lands were 2.3 and 2.1 times more species rich and had 2 and 3.8 times the plant abundance than abandoned fields and old settlements respectively. Plate 4.2 shows an abandoned field and a grazing land separated by a fence.

Table 4.1 Species richness, abundance and percentage cover of former land uses (Kruskal Wallis, values are probabilities).

	Statistics			Grazing lands	Abandoned fields	Old settlements	Dense forests
Species richness (p=0.005)	**Mean**			8.5	3.7	4.00	27.5
	Standard error			5.8	1.24	1.03	2.1
	Median			10.3	2	4	28
	Multiple comparisons		**GL**				
		AF	0.0007				
		OS	0.006				
Plant abundance (p=0.002)	**Mean**			59.3	29.0	15.56	180.25
	Standard error			9.3	9.35	9.59	26.8
	Median			69.9	20	8	161
	Multiple comparisons		**GL**				
		AF	0.001				
Cover (%) (p=0.0228)	**Mean**			33.96	19.7	9.22	
	Standard error			6.04	7.70	5.34	
	Median			35.83	13.75	1	
	Multiple comparisons		**GL**				
		OS	0.04				

This plate is a typical example of the wide difference in species richness, plant abundance and percentage cover between these two anthropogenic landscapes. Plate 4.3 is another example of an abandoned field and plate 4.4 provides a clearer picture of the vegetation characteristics of former grazing lands.

4.3.2.2 The affect of past anthropogenic landscapes, texture, pH and gravel content on species richness

There is a positive association between past anthropogenic landscapes and species richness ($X^2 = 23.546$, $_{df8}$, $p<0.01$). In comparison, there is no association between texture and species richness ($X^2 = 10.898$, $_{df8}$, $p>0.1$), pH and species richness ($X^2 = 5.388$, $_{df8}$, $p>0.1$) and gravel content and species richness ($X^2 = 10.254$, $_{df8}$, $p>0.1$).

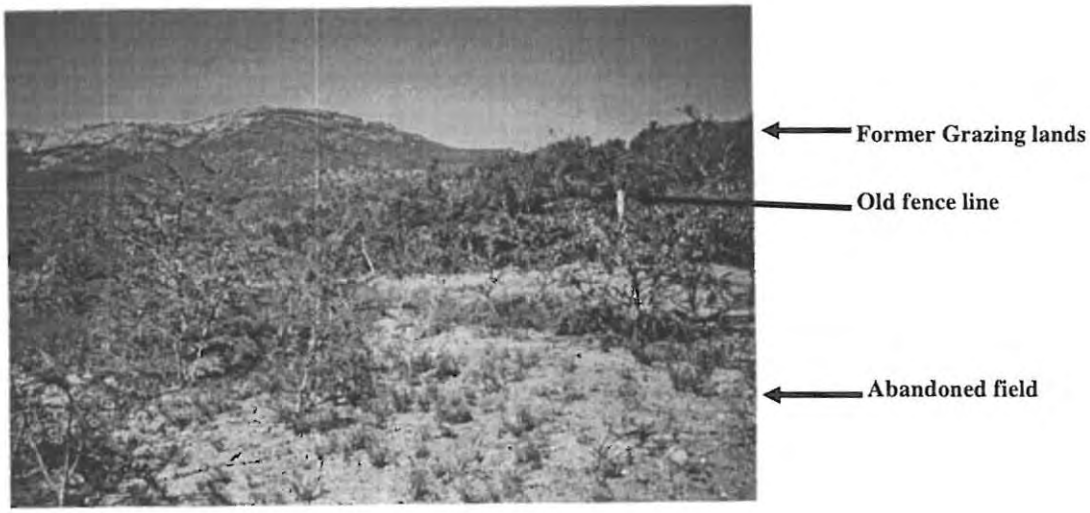

Plate 4.2 Comparison in species density between a former grazing land and an abandoned field.

Plate 4.3 An abandoned field.

Plate 4.4 Vegetation characteristics of former grazing lands.

4.3.2.3 A comparison of plant heights between past anthropogenic landscapes

Table 4.2 compares the statistics of the different heights that occurred in the abandoned agricultural fields, old settlements, former grazing lands and dense forests. It also indicates whether there was a significant difference in these height categories between anthropogenic landscapes (Kruskal-Wallis test). The multiple comparisons post hoc test indicates which past anthropogenic landscapes were different from one another.

Table 4.2 Species heights of past land uses (Kruskal Wallis, values are probabilities).

	Statistics			**Grazing lands**	**Abandoned fields**	**Old settlements**	**Dense forests**
Small (p=0.007)	***Mean***			32.3	16.3	10.7	28.5
	Standard error			3.9	3.6	9.2	5.3
	Percentage			58.62	57.80	71.81	15.8
	Median			29	13	3	25
	Multiple comparisons		**GL**				
		AF	0.015				
		OS	0.004				
Medium (p=0.026)	***Mean***			22.5	11.6	4.1	142
	Standard error			3.2	2.8	1.3	28.2
	Percentage			40.84	41.14	27.52	78.9
	Median			23.5	4.5	5	117.5
Large (p=0.9234)	***Mean***			0.3	0.3	0.1	9.5
	Standard error			0.2	0.2	0	1.3
	Percentage			0.55	1.06	0.67	5.3
	Median			2	0	1	9

Dense forests had a far greater proportion of medium and large species than past anthropogenic landscapes. They had 6.1 times the number of medium species and 31.7 times the number of large species as compared with grazing lands. Although grazing lands had a higher number of small and medium species than abandoned fields and old settlements, which was a significant result, the percentage of these species is similar to abandoned fields. Old settlements had a higher percentage of smaller species, and a lower percentage of medium species than the other past anthropogenic landscapes.

4.3.3 The relationship between sacred pools and the river section in terms of vegetation characteristics

4.3.3.1 A comparison of species richness, plant abundances and percentage cover between sacred pools and the river section

Table 4.3 compares the statistics for species richness, plant abundance and percentage cover of sacred pools with those of the river section and states whether they are significantly different or not (Mann-Whitney U test).

Table 4.3 Species richness, plant abundance and percentage cover of sacred pools and the river section (Mann-Whitney U test, values are probabilities).

	Statistics	Sacred pools (N=6)	River section (N=6)
Species richness (p=0.936)	*Mean*	17.7	17.3
	Standard error	3.5	1.8
	Median	17.5	16.5
Plant abundance (p=0.749)	*Mean*	91.2	101.8
	Standard error	24.0	15.9
	Median	78	91
Cover (%) (p=0.873)	*Mean*	44.7	44.7
	Standard error	9.7	9.9
	Median	42	43

Sacred pools and the river section were almost identical in terms of species richness, abundance of plants and percentage cover. The Mann Whitney U test indicates that any differences in vegetation characteristics were not statistically signicant. The standard error was, however, higher in sacred pools than in the river section, indicating their greater variation. This was evident during the vegetation sampling where most of the sacred pools had a relatively higher species richness and plant abundance than the river section. There was, however, one sacred pool in particular that had few species growing around it.

4.3.3.2 A comparison of plant heights between sacred pools and the river section

Table 4.4 presents the statistics of the different heights that occurred in scared pools and the river section and whether or not they were significantly different, using the Mann-

Whiney U test. The river section had a marginally higher number of small, medium and large species, while sacred pools had a slightly higher number of very large species.

Table 4.4 Species heights for sacred pools and the river section (Mann-Whitney U test, values are probabilities).

Height categories	Statistics	Sacred pools	River section
Small (p=0.936)	***Mean***	61.5	69.5
	Standard error	16.6	11.6
	Median	58.5	65
Medium (p=0.469)	***Mean***	24.7	26.0
	Standard error	8.3	6.3
	Median	15.5	23.5
Large (p=0.866)	***Mean***	3.2	2.8
	Standard error	0.5	0.3
	Median	3	3
Very Large (p=0.652)	***Mean***	0.67	0.5
	Standard error	0.3	0.4
	Median	0.5	0

4.3.4. Vegetation composition

4.3.4.1 The relationship between land use sites and vegetation composition

Figure 4.3 provides a comparison of the species abundance between anthropogenic landscapes, including dense forest. It graphically demonstrates how similar past anthropogenic landscapes, including dense forests, were in terms of vegetation composition. Appendix 2 provides a full list of all the scientific species names according to the numbers given on the X axis in figure 4.2. Figure 4.3 indicates the concentration curves of these different landscapes. The landscape as a whole and the dense forests had the lowest concentration curves, while abandoned fields, old settlements, and the edge of old settlements had the highest concentration of species. Of the three disturbed landscapes, grazing lands had the lowest concentration curve. Figure 4.4 indicates the percentage abundance of the five dominant species in each landscape, relative to the abundance of the remaining species.

Abandoned fields and old settlements had the highest percentage of *Acacia karroo,* and their six dominant species constituted 75% and 74% respectively of the total plant abundance. This differs to grazing lands, dense forests and the landscape as whole, where their five dominant species constituted 50%, 45% and 40% of their total plant abundances respectively. Plate 4.5 shows an abandoned field and indicates the dominance of *Acacia*

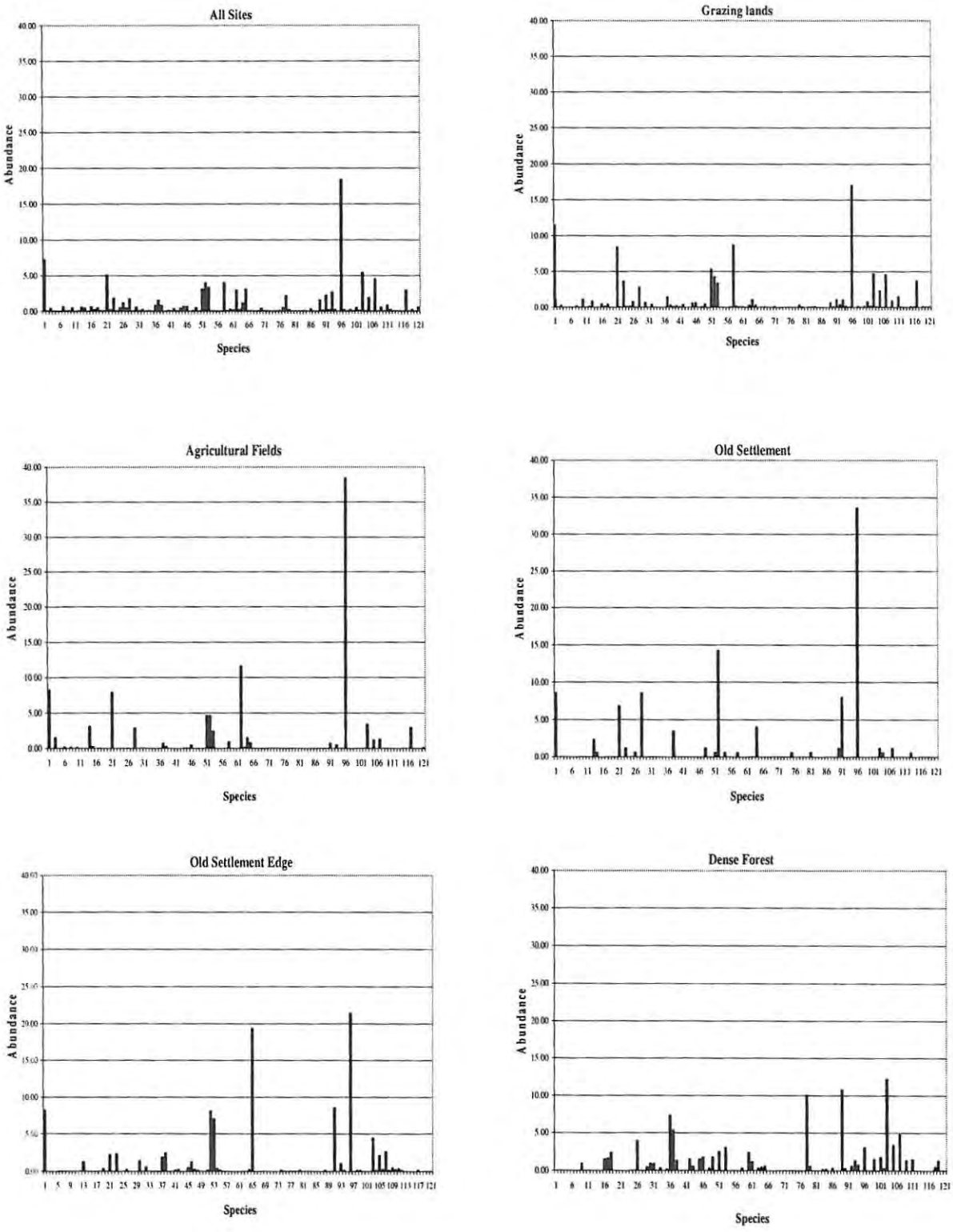

Figure 4.2 Comparison of the abundance of different species between anthropogenic landscapes, including dense forest.

karroo in this past anthropogenic landscape, while plate 4.6 shows how grazing lands had a greater mix of species. Dense forests were high in diversity (71 species, where only four

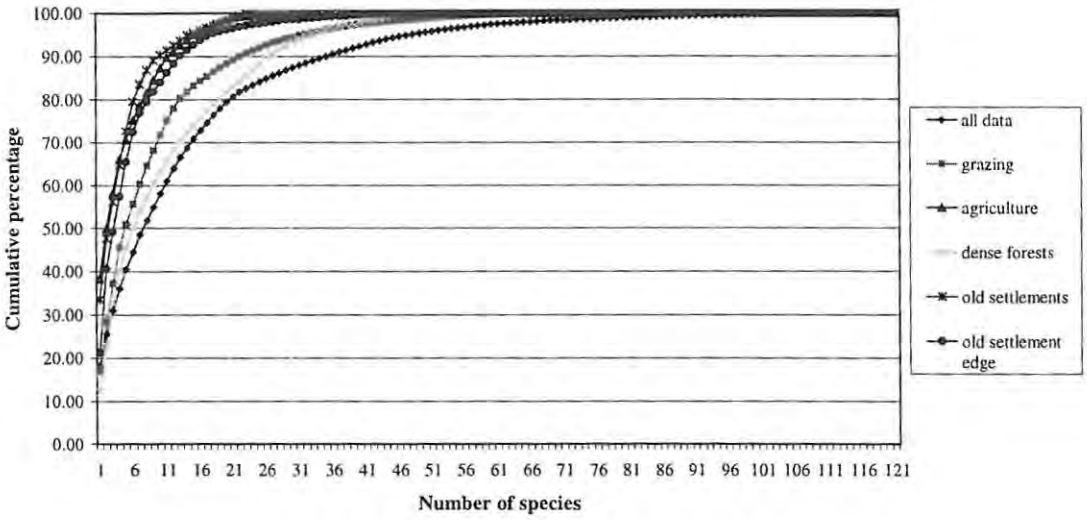

Figure 4.3 Curve comparing the concentration of species of past anthropogenic landscapes, including dense forests.

quadrants were sampled) and had a different mix of species to the past anthropogenic landscapes. *Acacia karroo* (3.01%) was no longer abundant, but was replaced by *Grewia occidentalis* (12.18%) as the most abundant species. A number of species that were rare in the area as a whole became abundant in dense forests. See table 4.5 for examples. In addition, a few species dominant in the area as a whole were not present in dense forests. This included *Aloe ferox* (7.22%), *Coddia rudis* (5.04%), *Sida* sp. (2.95%) and *Acacia mearnsii* (2.92%).

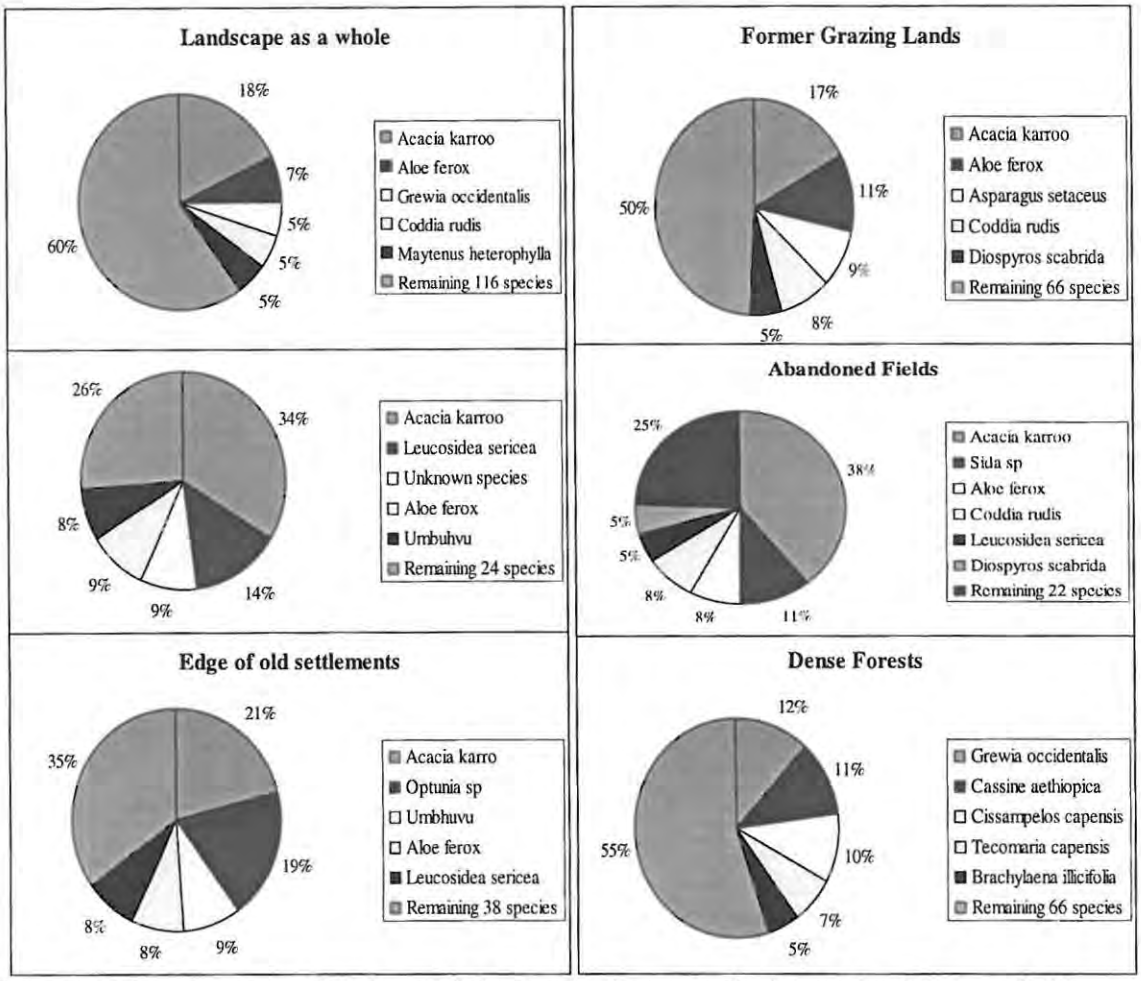

Figure 4.4 The percentage abundance of the five dominant species in each landscape, relative to the abundance of the remaining species. The unknown species in old settlements could not be identified because of the poor voucher specimen.

Table 4.5 A comparison between species abundant in dense forests and the landscape as a whole.

Species	Total Area (percentage abundance)	Dense forest (percentage abundance)	Difference
Hippobromus pauciflorus	1.55	10.74	9.19
Cissampelos capensis	2.18	10.03	7.85
Grewia occidentalis	5.39	12.18	6.79
Tecomaria capensis	0.8	7.31	6.51
Brachylaena illicifolia	1.52	5.30	3.78

Plate 4.5 The dominance of *Acacia karroo* in an abandoned field.

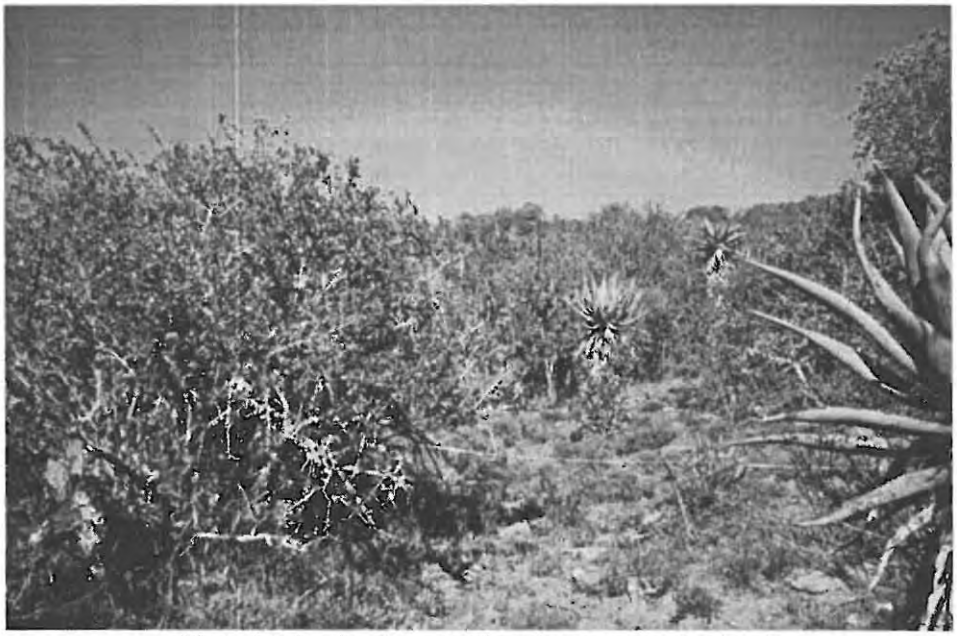

Plate 4.6 A mix of species in a former grazing land.

4.3.4.2. The relationship between sacred pools and the river section in terms of vegetation composition

Figure 4.5 shows the abundance of species for sacred pools and the river section and thus compares their vegetation composition. See appendix 2 for a list of these species with their scientific names according to the numbers given on the X axis in figure 4.5. There were a number of species that occurred in sacred pools, which were rare or absent in sacred pools, and *visa versa*. Examples include *Bambusa* sp. (number 7), *Celtis africana (*number 25), *Ehretia rigida* (number 26) and *Solanum psuedocapsicum* (number 70). In addition, some species that were abundant in either of these sites were less so in the other site, for example *Acacia karroo* (number 96) and *Diospyros lycoides* (number 93). These sites did, however, share some common species with similar abundances, for example *Cissampelos capensis* (number 78) and *Maytenus heterophylla* (number 107).

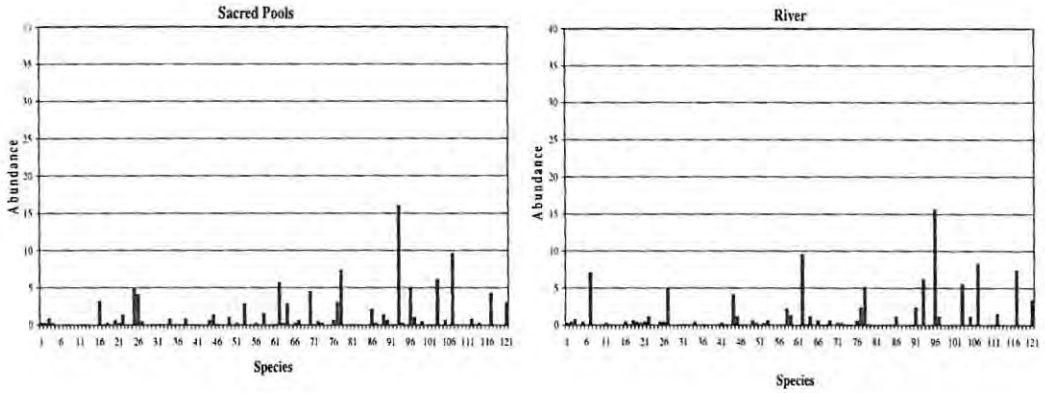

Figure 4.5 Comparison of the abundance of different species between sacred pools and the river section.

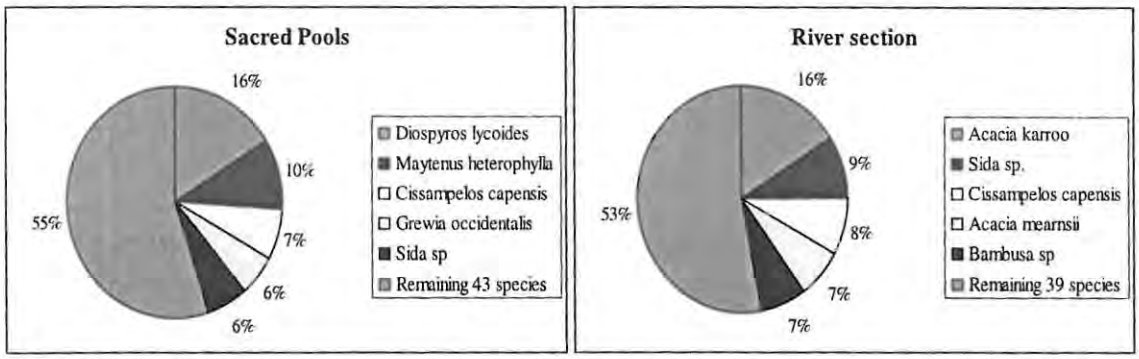

Figure 4.6 The percentage abundance of the five dominant species in sacred pools and the river section, relative to the abundance of the remaining species.

Of the five dominant species in sacred pools and the river section, two species were shared, namely *Cissampelos capensis* and *Sida* sp. The river section was similar to past agricultural landscapes in that *Acacia karroo* was the most dominant.

4.4 Discussion

The significant differences in species richness, abundance, percentage cover, plant heights and vegetation composition between past anthropogenic landscapes and dense forests indicate the impact that these disturbances have had on vegetation characteristics. This finding supports Picket and White's (1985) assertion that disturbance affects species richness, dominance and structure. There were also significant differences between past anthropogenic landscapes with grazing lands having the highest species richness, plant abundance and percentage cover. Picket and White (1985) explain that a relationship exists between the physical intensity of the disturbance and the biological effect, where intensity equals the amount of biomass destroyed and the degree of substrate disruption. The high biomass removal of both agricultural fields and old settlements could explain their current condition of being species poor and dominated by a few, invasive species. This differs to land set aside for grazing, where the intensity of disturbance was less, and consequently former grazing lands were more species rich with a wider distribution of species abundances, i.e. they had a lower concentration curve of species. This supports the notion that intensive disturbances can result in a species impoverished landscape as stated by the intermediate disturbance hypothesis (Connel 1978; Denslow 1985; Picket and White 1985). This hypothesis states that plant communities experiencing an intermediate level of disturbance will have the highest species richness (Picket and White 1985). It has been difficult to relate my findings to this hypothesis, as this intermediate level is relative and varies among ecosystems (Denslow 1985). If grazing lands are assumed to be of an intermediate disturbance, my findings contradict this hypothesis, as dense forests had the greatest species richness.

The role of anthropogenic disturbance in determining vegetation characteristics is confirmed by the two chi squared tests. The first test indicated that there is no association between anthropogenic landscapes and soil properties (texture, pH and gravel content) and soil thus need not be treated as an external factor influencing the results related to past anthropogenic landscapes. The second chi squared test, examining the association between

species richness and past anthropogenic landscapes, texture, pH and gravel content, shows that it is the past anthropogenic landscapes, rather than the above soil properties, which had the most significant affect on species richness.

Former grazing lands and abandoned fields had similar proportions of small, medium and large species. This could be due to the fast growing *Acacia karroo* that dominated abandoned fields. It had, however, taken a much greater time for species to establish themselves in old settlements where their proportion of small to medium species was significantly greater than former grazing lands and abandoned fields. Greater soil compaction could have occurred under old settlements, which would have increased the difficulty of species colonising these landscapes.

The anthropogenic landscapes share a number of the most common species including *Acacia karroo, Aloe ferox, Coddia rudis* and *Leucosidea sericea.* In all disturbed areas, *Acacia karroo* is the most common. This is different from dense forest where *Acacia karroo* constituted a small percentage of the total abundance. *Aloe ferox* (7.22%), *Coddia rudis* (5.04%), *Sida* sp. (2.95%) and *Acacia mearnsii* (2.92%), which were all common in the landscape as a whole, did not occur in dense forests, while some species that were rare in the landscape as a whole were more common in dense forests. This indicates that dense forests act as reservoirs of rare species, which could become locally extinct should they be heavily disturbed. Past anthropogenic disturbances have therefore resulted in different kinds of species dominating the landscape.

Numerous researchers have found similar results when examining the impact of anthropogenic disturbance on the environment. Grau *et al.* (2003), basing their work in Puerto Rico, found that 40 years after field abandonment the vegetation composition was very different from intact forests. In addition, anthropogenic disturbances had resulted in a homogenization of species composition, and the now dominant exotic species were having lasting ecological impacts. They believe that past intensive disturbance will continue to impact ecosystem dynamics for several centuries. Ramírez-Marcial *et al.* (2001) examined the influence of anthropogenic disturbance on forest structure and composition in the Montane rainforests of Mexico. They found that anthropogenic disturbance had increased the dominance of *Pinus* while drastically decreasing floristic richness and the number of tree species. A study conducted by Zou *et al.* (1995) on the Luquillo Experimental Forest

of Puerto Rico found that deforestation and crop cultivation have had a long term influence (>50 years) on tree species composition.

There are a number of implications of a change in vegetation composition and a reduced species richness. Firstly, Reed and Cloike (2000) state that, by affecting species composition and soil properties, anthropogenic disturbance can have long-term impacts on ecosystem processes and structure. In addition, species perform a diverse number of ecological functions and their loss will therefore affect ecosystem functioning and stability, as argued by many ecologists (Denslow 1985). This view is, however, contested, as indicated by the variety of theories that attempt to explain the relationship between species diversity and stability, such as the Rivet (Ehrlich and Ehrlich 1981) and 'drivers and passengers' (Walker 1992) hypotheses. Secondly, Folke *et al.* (2004) argue that a loss of diversity can increase the chance that an ecosystem will experience a regime shift, and thus have a reduced capacity to generate ecosystem services.

In an undamaged state, Valley Bushveld, which is characteristic of my study site, is a very dense, semi-succulent shrub about two metres high (Dold and Cocks 2000). When overgrazed, it is opened up, becomes invaded by *Optunia ficus-indica* and experiences a loss of endemic species and a decrease in plant cover. This description characterises my study site, but it is not within the scope of this thesis to make a judgment on the condition of the environment and the ecological consequences of its present species richness. In addition, sampling may have missed transient species and since not all species could be identified, total diversity could not be captured, nor could rare or endemic species be highlighted. Species richness is therefore likely to be an underestimate.

The comparison between sacred pools and the river section indicates a surprising result, where there are no significant differences in species richness, abundance, percentage cover and species heights between these two sites. Thus setting aside an area as sacred, with its associated harvesting taboos did not have a significant impact on these vegetative characteristics. This contradicts a lot of literature that states that sacred pools have high species richness relative to the rest of the landscape (Wilson 1993). However, species dominating sacred pools were different species to those in the river section. The species dominating the river section were similar to those from disturbed sites in the rest of the landscape. Examples include *Acacia karroo, Sida,* sp. and *Acacia mearnsii*, which are all

invasive species. This differs from sacred pools, where their vegetation composition reflected that of dense forests. This supports both Laird (1999) and Kothari and Das (1999), who explain that sacred areas hold pockets of vegetation that were previously predominant in an area before intensive disturbance.

Two main conclusions can be made. Firstly, different human induced disturbances have resulted in a patchy landscape that varies in species composition, species richness, abundance and percentage cover. Secondly, human induced disturbance has encouraged more invasive species and weeds, such as *Acacia karroo* and *Sida* sp, to dominate. As will be seen in the next chapter, these species are often beneficial to local people. Consequently the present landscape structure is very different from what it would be like without these disturbances. An examination of the more natural landscape types, namely dense forests and sacred pools, shows that they have very different species compared to the more disturbed landscapes. This suggests that different species would dominate the area if the landscape was less disturbed.

Chapter Five: The importance of anthropogenic disturbance to local people's livelihoods

5.1 Introduction

Many rural people, especially in developing countries, are dependent and place high value on their local natural resource base and use a wide variety of species to survive (Wollenberg and Ingles 1998; Dolman 2000; Campbell and Luckert 2002). There are many examples in the literature on this. For example, Altieri (1999) states that tropical agro-ecosystems typically contain over 100 plant species per field and provide many ecosystem goods such as construction materials, tools, firewood, medicines, livestock feed and human food. The woody vegetation supplied the Mbeere of Kenya with many basic needs such as fruits, fodder, fuel wood, medicine, fibres and material for housing (Little and Brokensha 1987). The Housa farmers of central Nigeria make use of 29 cultivated and 235 semi-wild plants for medicine, while 61 of these are used for food (Netting and Stone 1996). Shackleton and Shackleton (2000), Dovie (2001) and Magasela *et al.* (2001) describe how important natural resources are to the rural people of South Africa. This is backed up by Shackleton and Shackleton (2002). Their research showed that almost all rural households make use of natural resources to varying degrees. Cocks and Dold's (2003) research in the Peddie District of the Eastern Cape found that local people regularly use more than 100 plant species for utilitarian and cultural purposes from the Valley Thicket vegetation type alone.

Ichikawa (1996) describes the Mbuti people's reliance on their natural environment. These people are hunter gatherers who have inhabited the old forests of north eastern Zaire for many centuries. The Mbuti culture is dependent on a wide variety of forest resources. They utilize all 57 large and medium wild mammals that occur in the area for food. One hundred plant species are used for food, 124 as medicine, 260 as construction materials and binding, 74 for arrow and fish poisons, 10 for narcotics, and 114 for ritual and non-material purposes. This heavy reliance on the natural environment results in small-scale disturbance, but as Ichikawa (1996) argues, this has improved the resource base rather than led to degradation. For example, the density of food species is significantly higher in secondary forest than in primary forest, while plants eaten by edible caterpillars and grubs

occur in secondary forest. It has also increased the availability of some food plants, which do not grow well in the shade of primary forest. The introductory chapter provides many more examples of how anthropogenic disturbance patterns, particularly those caused by small-scale farmers and indigenous peoples, can enhance the local resource base, significantly increasing the variety and number of useful species. It was also shown that people actively manage their natural environment to enhance species richness and ecosystem resilience. Examples include permanent habitat protection, mixing land uses, and manipulating successional processes. There are also examples of how anthropogenic disturbance can reduce species diversity and the productivity of the natural environment, as described in the introductory chapter.

Scheffer *et al.* (2001) and Frelich and Reich (1998) identify three ways that ecosystems respond to anthropogenic disturbance. Some ecosystems respond in a smooth, continuous way to increasing stress. A more common occurrence is that ecosystems experience little change until stress reaches a critical level; when this point is reached the ecosystem changes into another state. Another possibility is when ecosystems have two or more alternative states and switch between them depending on the environmental conditions affected by anthropogenic disturbance. Sheffer *et al.* (2001) describe how shallow lakes can switch between a state of clear water and many birds and fish species, to a state that experiences murky water and a significantly reduced fish and bird population. They explain that this eutrophication occurs due to an overdose of nutrients. These different conditions must therefore be factored in when considering the effect that local people's disturbance has on their natural environment.

Cathcartvale has experienced anthropogenic disturbance of different intensities with different land owners. This has created the landscape structure described in chapter four. The aim of this chapter is to examine the value that this disturbed landscape has to the local people.

This was determined by asking the following three key questions.

1. How important is the natural environment (ecosystems and their services) to local people?
2. What role does the local landscape and its associated plant cover play in local people's livelihoods?

3. What is the role of anthropogenic disturbance in providing ecosystem goods?

5.2. Methods

The following methods were used to obtain the data necessary for this chapter.

- Household survey of resource use.
- Eleven focus group discussions.
- Ten transect walks.
- Twenty-nine semi-structured interviews.

5.2.1 Household survey of resource use

The household survey of resource use was conducted with 47 individuals (about 17% of the community), each representing a different household. All households were targeted, although a few were not interviewed as the occupants of the household were not present at the time of the survey. Seventy-seven percent (36) of the interviewees were women while 23% (11) were men. This skewed representation was unintentional, and was a consequence of there being more women available for the survey. The men were often busy herding cattle, attending the agricultural school or participating in construction work for the Masakhana project. A positive aspect of this is that many researchers regard women as the dominant resource harvesters (Dankelman and Davidson 1988). Table 5.1 summarizes the gender and age groups of the people interviewed.

Table 5.1 Summary of gender and age groups of household and resource use interviewees.

Age category	Females	Males	Total
Less than 20	4	2	6
20-40	10	2	12
40-60	11	3	12
60+	12	4	16
Total	36	11	47

I had a formal interview schedule, where a set of key questions were always asked. However, a number of additional questions were asked depending on how the interview

was progressing, available time and knowledge and interest shown by the respective informant. This explains why the total number of respondents was forty-seven but the range of answers for specific questions was from forty-seven to nine.

The questions covered the following two main areas (see appendix 3): household data (gender, clan, age, place of birth, length of stay in village, number of livestock, religious beliefs, occupation) and the use of the following resources: fuel wood, medicinal plants, building materials, and cultural plants. Informants were questioned about which species they harvested; which species they favoured; which species were most common; how much of the resource they used; where they collected it; how often they harvested it; and how the resource was changing.

5.2.2 Focus groups

Ten focus group discussions were conducted. These were split into five all male and five all female groups, which crossed age categories. This follows Neuman's (2003) advice that focus groups should consist of a homogenous group of people. The following activities were undertaken in the various focus groups. Firstly, the different resource types, written on pieces of card, were ranked by each group who gave an explanation for their various ranks. The position of a resource type, determined by each focus group, was given a value; for example if ranked most important it was valued as 1, if ranked fifth most important it was valued as 5. These values were tallied, averaged and the relevant rank was determined when compared to the value of other resource types. The resource types were: fuel wood, building materials, cultural species, wild fruits, *imifino* (wild vegetables), honey, medicinal plants, livestock, river water and mountain water. These were chosen in advance, based on my previous research and interviews that indicated that these were the resource types of importance (Fox 2002a). The informants were then asked to state their five most valuable species, obtained in either of the above resource types, their five most important fuel wood species, and those species they did not use as fuel wood due to cultural and practical reasons.

Photographs taken during previous field trips were made into flash cards, reflecting different resource patches/vegetation types, namely the mountain; forests and grasslands in various stages of succession, sacred pools, *Acacia* shrub land, and open thicket. These

cards were used to stimulate discussion relating to each resource patch. This method was adapted from Fox (2002b) and was successful as it provided visual stimulation, thus increasing the interest of the informants as well as the depth of answers provided. These cards were shown to all focus groups, who were asked to state the benefits obtained in each resource patch. Ranking (Bernard 1989; Chambers 1992) was then used to identify the top five resource patches, as well as the three that were least important. The resource patches discussed in this focus group acted as a pilot study, which helped inform the later decision to base landscape classification on past anthropogenic landscapes.

A two-day focus group discussion was held to determine the benefits of different species found in the environment. It was conducted with six informants who were chosen based on their knowledge about plant species. Each informant had specialised knowledge in either cultural species, medicinal plants, fuel wood and forage species and included four males and two females. These informants were asked to identify, if possible, each voucher specimen collected during vegetation sampling, as explained in chapter four (The effect of past anthropogenic disturbance on the present landscape structure). They then gave the specimen a rating, 0-3 (where 0 = never use, 1 = use every now and again, 2 = use once a month and 3 = use weekly) in terms of its use as an edible plant, fuel wood, cultural species, building material, medicinal plant, and forage species. For forage species the rating scores meant the following: 0 = never eaten by livestock; 1 = eaten every now and again; 2 = eaten whenever it is available; and 3 = animals actively go and look for the relevant species. Informants also decided on the plant's overall importance, i.e. very high, high, medium, low, and not important, and were asked whether they managed the species to ensure its continued survival.

5.2.3 Transect walks

Ten transect walks (Chambers 1992) were arranged with different fuel wood and medicinal plant collectors. The aim of these walks was to observe how local people utilized their environment and where they went to harvest particular resources. It also provided many opportunities to question the harvesters on species of value; resource patches of importance; their benefits and problems; and change in the landscape. Informants often pointed out species of value and explained their various uses. Any notable features in the

environment were photographed and described using a tape recorder. Informant's answers to my questions were also translated and recorded.

Two walks were arranged with two knowledgeable medicinal harvesters. On each seven hour walk we went to the main harvesting site, a mountain higher than 1100m above the village. These two walks were beneficial as a vast area of my research site was covered, crossing many anthropogenic landscapes. It also gave me an opportunity to question my informants regarding these anthropogenic landscapes, obtaining detail about their past uses, what benefits they presently provide, and how they have changed. This information confirmed general views on the change in vegetation density and how this has affected local people's livelihoods.

A lady who had accompanied me on the two transect walks to collect medicinal plants had proven to be highly knowledgeable about the landscape, especially the history of land use. She agreed to take me to Nyumen, an often mentioned dense forest. During this three hour walk information was gained regarding the history of land use, and how the vegetation has changed, as well as which resource types and species are beneficial to local people.

Three two-hour walks and two one-hour walks were arranged with fuel wood harvesters. On each walk a different part of the landscape was covered. These walks provided the opportunity to question informants about landscape change and what benefits they obtained from different areas. I was able to observe how local people collected fuel wood, which species they harvested and how far they travelled. I was invited to accompany a harvester who travelled to a neighbouring farm by donkey. The purpose was to collect a large amount of fuel wood for a traditional ceremony. I used this opportunity to view a larger part of the local area, and to ask questions relating to dense forests and resource use.

I also went on two, one hour, transect walks with aloe harvesters. These walks occurred during the initial stages of my field research. They provided an opportunity to build a relationship with the informants. Accompanying these harvesters also gave me an understanding of the importance of different resources to local people. A number of important species were pointed out to me, and their benefits were explained. I questioned informants about their culture, including the importance of the ancestors and how their culture has changed.

In sum these transect walks added value to my research in a number of ways. Firstly I was able to observe local people's use of the environment over a large percentage (±70%) of the local landscape. Secondly it provided an opportunity to question informants about their resource use and relationship with their landscape, and to validate previous results in an informal, relaxed setting. Thirdly it built up good rapport with a number of key informants.

5.2.4 Semi-structured interviews

Thirty-six interviews were conducted with the villagers. These were semi-structured as I focused on particular themes, yet the questions varied between informants depending on how the interview was progressing, the informant's knowledge, their interest and how much time was available. Sampling of informants was purposive, and included those selected at a community meeting for their depth of knowledge. Sampling also took place opportunistically. For example, some interviews were conducted with people relaxing outside their homes. In addition, informants were selected on a random basis where I went from household to household. When somebody was available and willing, they were interviewed. Key informants, identified from this process, were interviewed more intensively. Informants included male and females of different age groups (young adults, middle aged and old people). See table 5.2 for a summary of the age groups and gender of people interviewed.

Table 5.2 Summary of gender and age groups of interviewees.

Age category	Female	Male	Total
20-40	7	3	10
40-60	4	4	8
60 +	13	5	18
Total	24	12	36

The interview themes included the following:

- How the local people relate to, value and feel about their natural environment.
- A healthy environment described and its causes and benefits.
- A degraded environment described and its causes and consequences.
- The present condition of the natural environment.
- A perfect Cathcartvale environment described (what changes would be made to the present environment).

- The history of Cathcartvale, including characteristics of previous land owners, past management practices and significant historical events.
- White and coloured land owners' use and management of their natural environment.
- The condition and characteristics of the natural environment when white and coloured people managed the area.
- Future predictions of Cathcartvale and its natural environment.
- Significant environmental events.
- Local people's impact on their natural environment (positive and negative impacts).
- The occurrence of dense forests/dignified bush, associated harvesting practices and people's feelings towards them.
- Change in vegetation, reasons for this change, people's feelings about this increase and the consequences.
- Environmental rules and management practices (the rules and reasons for them, people's attitude and level of adherence, and environmental change resulting from these rules).

5.2.5 Data analysis

5.2.5.1 Descriptive analysis

The questions for the interviews, household survey of resource use and focus groups were open ended, i.e. informants did not choose between a set of pre-determined answers. This gave informants freedom in how they answered the questions and increased the honesty and quality of their answers. This approach does, however, increase the challenge of analyzing the data.

Informant's responses were recorded on a tape recorder and then translated and transcribed. Although this was more time consuming than writing people's answers immediately, it did ensure reliability and gave me freedom to be flexible in the questions I asked as I was not concentrating on writing down informants' answers.

To analyze the data I read the interview responses more than ten times to get a good grasp of the main themes. I then began to group informants' answers into broad themes. Similar

answers relating to specific questions were grouped. In addition, answers given during interviews, transect walks, focus groups and the household survey of resource use were grouped together into similar themes. The technique of triangulation was thus adopted, as a specific theme was verified by different data collecting techniques.

5.2.5.2 Statistical analysis

5.2.5.2.1 Chi squared test

A one way chi squared test was used to see if there were significant groupings based on the data in table 5.4 "The importance of the natural environment to local people", Table 5.5 "Reasons for the environment's importance as stated by informants", Table 5.7 "When the environment was at its most healthy", Table 5.8 "Environmental change since white and coloured land management", Table 5.16 "Reasons for the environmental rules", Table 5.17 "Peoples attitudes towards the environmental rules and their reasons" and Table 5.18 "Adherence to environmental rules".

5.2.5.2.2 Kruskal-Wallis by Ranks test

The non parametric Kruskal-Wallis by Ranks test was undertaken to examine whether there was any significant difference in the species richness and abundance of important resources between past anthropogenic landscapes, namely former grazing lands, abandoned agricultural fields, old settlements, the edge of old settlements and dense forests. The delineation of anthropogenic landscapes and the methods used to determine species richness and abundance are explained in chapter four. The resources that were compared were fuel wood, building materials, woody and herbaceous medicinal plants, cultural species, edible fruits, and forage species. Past anthropogenic landscapes were also compared in terms of the abundance of useful species as well as the number of harvestable species. Harvestable species included those that fell in the medium and large height categories. Chapter four explains how the height categories are defined.

The data for these tests were based on the focus group that examined the benefits of the different voucher specimens, as described in chapter four. Every species occurring in each site was categorized according to its benefits, namely fuel wood, building materials,

cultural plants, edible plants, forage, and medicinal plants. These were then totalled to determine the species richness and species abundance of each resource. To determine the value of each anthropogenic landscape every species occurring in each site was given a score depending on its importance to local people; low = 1, medium = 2, high = 4 and very high = 8. This scoring system was chosen to reflect the far greater value of a species of high importance compared to one of low importance. The value of each site was determined by adding these scores. The abundance of plants of each species, and not just the presence the species, was used to determine this value.

Sites of the same past anthropogenic landscape were then grouped together and the Kruskal-Wallis by Ranks test was run to compare the differences between past anthropogenic landscapes for each resource type, as well as value, abundance of useful species and number of harvestable species.

5.3. Results

5.3.1 Basic needs and the natural environment

Nine out of the eleven informants described positive feelings when discussing their relationship with the natural environment. Examples include their love, appreciation and care of the environment. See table 5.3 for the relevant quotes. These feelings are primarily a consequence of the local people's high dependence on their natural environment to meet their basic needs.

Related to this is the importance of the natural environment to local people. Table 5.4 indicates the environment's importance. The majority of informants said that the environment is important. This is a significant result (X^2 34.57, $_{df3}$, $p=<0.0001$). Table 5.5 states the reasons for the environment's importance. The main reason for its importance is that it meets their basic needs, which is also a significant result (X^2 63.11, $_{df6}$, $p<0.001$). (These results are taken on actual and not percentage data as is the case for all chi squared tests in this thesis).

Table 5.3 Local people's feelings about their environment (N=11).

Question
What are your feelings towards the environment?
Positive responses
• Feeling good concerning the environment. • Feeling nice when talking about the environment. • Good feelings. • I like the environment very much. • Looking at the environment you feel happy. • I love the environment very much. • Loves the environment but since staying in East London no longer takes it that seriously. • Feeling okay towards the environment because when grew up most of the people were using the forest maybe to collect wild fruits and other things there. • We like the environment very much, more especially people from the past because know how important is the environment so love it very much.
Negative or indifferent responses
• Now when comparing this time to the past I think that it is not good for her. Because in the past it was not like this, not feeling happy with the present environment. Even if God could destroy everything that will be good because everything is not right. • Feels alright.

Table 5.4 The importance of the natural environment to local people.

How important is the natural environment?	No. of responses	%
Very Important.	13	31
Important.	25	60
The environment goes together with a person.	1	2
Don't know.	3	7

Table 5.5 Reasons for the environment's importance as stated by informants.

Reasons for the environment's importance	No. of responses	%
The environment meets local people's basic needs.	20	54
Local people have livestock.	6	16
Don't know.	4	11
It gives local people a high standard of living.	2	5
Placing importance on the environment follows their father's footsteps.	2	5
The environment works together with people.	1	3
Local people can't live without the environment.	1	3
Local people care for the environment and do not want to exploit it.	1	3

To indicate how important the natural environment is, informants were asked what would happen if the natural environment became extremely degraded. The answers were variable but always negative. Table 5.6 summarizes the problems caused by a degraded environment. Informants believe that the main problem caused by a degraded environment is that it would have a negative affect on their livestock and ability to meet their basic needs. When asked to define a healthy environment 4 out of 18 (22%) informants referred to its ability to meet basic needs, while 2 out of 18 (11%) said it is one that has many trees, especially indigenous building materials. When asked, "What are the benefits of a healthy environment?" 3 out of 5 (60%) informants stated that it met their basic needs. In comparison 4 out of 12 (33%) informants defined a degraded environment as one that did not meet their basic needs, while the effect of a degraded environment, as expressed by 9 out of 15 (60%) informants is poverty due to a lack of resources.

Table 5.6 The resulting problems of a degraded environment (N=16).

Problem	No. of responses	Representative quote
Affects local people's livelihoods: their ability to meet their basic needs and their livestock.	12	*"It would be too bad because for people to live there must be those natural resources there."* *"The livestock will suffer because* [they] *won't have grass to eat, and some will die and people will also struggle because* [they] *won't get things they need from there."*
A lack of water	2	*"People get sick because sometimes drink water which is not flowing, which stays in one place which means that the water gets polluted easily. It won't be easy for the people to drink. Even the livestock drinks the same water."*
Affects local people's ability to perform traditions (rituals).	1	*"Would be difficult for us as Xhosa people especially those people still performing traditional ceremonies. Unless this transformation of people where they no longer believe in the ancestors. So it will be okay for them if the environment was to become degraded. But for us people who are still practising those traditions that will be too difficult."*

Table 5.7 summarises the informant's views of when the environment was most healthy and reasons for this. The majority of informants believe that it was most healthy under white and coloured land management, which is a significant result (X^2 15.7, $_{df2}$, $p<0.001$).

Table 5.7 When the environment was at its healthiest.

Most healthy/best condition	No. of responses	%	Reasons
At present	2	11.1	White farmers cut poles and fuel wood.
Under white and coloured land management	15	72.2	There was more grass and water as the vegetation was less dense. There was control under white land management. People did not harvest a lot. Managed by white farmers. Removed trees which were sucking water in rivers and in dams.
No difference	3	16.7	

Table 5.8 summarises informants' statements about how the natural environment has changed. The majority of informants stated that the vegetation has become thicker, which is a significant result ($X^2=104.931$, $_{df8}$, $p<0.001$). Forty-one of the informants' statements indicated that there has been an increase in either vegetation cover or species richness. Fourteen of the informants' statements implied that there has been no change, while three informants suggested that species richness and vegetation cover has decreased.

Table 5.8 Environmental change since white and coloured land management.

Environmental change	No. of responses	%
The vegetation has become thicker.	30	51.7
There has been no change.	9	15.5
The number of species has increased.	5	8.6
There is no change in the number of species.	5	8.6
Wild animals have increased.	3	5.2
It was more dense under white ownership.	2	3.5
The roads have grown over with vegetation.	2	3.5
Acacia mearnsii has increased.	1	1.7
Resources are further away.	1	1.7

The general feeling to this increase in vegetation cover is negative (100% of informants asked). Respondents gave the following four main reasons: a dense forest is dangerous; we are unable to harvest resources in a dense forest (especially fuel wood and building materials); we are afraid of dense forests; and it increases livestock death. The following quote indicates the difficulty of accessing resources in an area of thick vegetation:

> *"People used to come and collect fuel wood here but they are no longer coming because the vegetation has become thicker. They were collecting it using their head loads, so now it is difficult to move here because we have to bend in places because it is too thick and the road is too bad to move here having a load on our head".*

However, when asked about the present condition of the environment eight informants (100%) said that it is in good condition. This could reflect the fact that many basic needs are met by the present environment as shown below.

5.3.1.1 Benefits obtained from the local landscape

Resources supplied by the natural environment include the following: water, fuel wood, medicinal plants, woody and herbaceous building materials, grazing lands and browsing forage, cultural species, edible fruits, honey, game meat, wild herbs and species of economic value (*Aloe* sp. and *Optunia ficus-indica*).

Table 5.9 summarises the results of an exercise to rank these resource types. Mountain water, cultural species and fuel wood were ranked as the top three, while *imifino*, honey and wild fruits were ranked the lowest.

Table 5.9 Ranking of resource types (N=10).

Rank	Resource	Value	Reason
1	Mountain water	13	Water is crucial to one's survival, and this water is healthy, unlike the river water.
2	Cultural species	31	Traditions are essential to the life of a Xhosa person and these species are needed when performing them.
3	Fuel wood	36	Used for many purposes, such as cooking and traditions.
4	Livestock	40	Acts as a safety net; important for traditions; and supplies meat and milk.
5	Medicinal plants	51	Medicinal plants are used to treat many illnesses and play a role when performing traditions.
6	Building materials	55	No responses.
7	River water	58	Acts as a safety net for when the mountain water dries up. Also useful for irrigation; washing in and provides drinking water for livestock.
8	Agricultural crops	61	Used as food; they are fresh and good for health; and will provide a constant supply of food.
9	*Imifino*	67	Are healthy (full of vitamins); act as an alternative to meat; and are important when in poverty.
10	Honey	79	Treats asthma; useful when hungry in the bush; and has many vitamins.
11	Wild fruits	86	They act as a food supplement; have lots of vitamins; and are important in times of poverty.

Table 5.10 indicates the six favourite species of the people of Cathcartvale. These species were identified in the ten focus groups. *Olea europaea* subsp. *africana is* the favourite species of the local people, followed by *Ptaeroxylon obliquum* and *Acacia karroo.*

Tables 5.11 - 5.14 provide relevant detail regarding the four main resources: fuel wood, medicinal plants, cultural species and building materials, that was obtained from the household survey of resource use. These results are similar to those collected in the focus groups and interviews and are confirmed by information gathered in transect walks. These additional data sources indicate that the number of species is an underestimate, where there are >40 medicinal plants, more than nine building materials and seven cultural species.

Table 5.10 The six most favourite species of the local people.

Rank	Species (Latin)	Species (Xhosa)	No. of responses listing species as one of five most valuable	%	Reasons
1	*Olea europaea* subsp. *africana*	Umnquma	8	80	Frequently utilized. Important for traditions. Livestock eat it. Provides forage during drought conditions.
2	*Ptaeroxylon obliquum*	Umthathi	4	40	A cultural plant. Acts as a good building pole.
2	*Acacia karroo*	Umnga	4	40	Frequently utilized.
3	*Grewia occidentalis*	Umnqabaza	3	30	Frequently utilized. An edible fruit.
3	*Scutia myrtina*	Isiphingo	3	30	An edible fruit.
3	*Acacia mearnsii*	Umthole [1]	3	30	Used for building houses.

[1] In Cathcartvale *Acacia mearnsii* is called umthole, whereas in other Eastern Cape villages umthole is the Xhosa name for *Acacia caffra* (Dold and Cocks 1999)

Local people are heavily dependent on their local landscape to supply them with fuel wood. One-hundred percent of the households used fuel wood, and it is collected on average every 3.2 days. As many as 13 out of 47 households collect it every day. Most households collect one or more head loads of fuel wood. *Acacia karroo* is the favourite fuel wood species and is also the most common in the area. However, a variety of species are used as these have different benefits. For example, *Acacia karroo* makes very good embers while *Olea europaea* subsp. *africana* is good for starting a fire.

A high number of households also use medicinal plants, which are collected by households either on a weekly or monthly basis. *Alepidea amatymbica* is the favourite species and is also one of the most common. The mountain is the favourite harvesting site and the majority of informants believe that medicinal plants are increasing.

The majority of households use cultural species, but on a much less frequent basis compared to fuel wood and medicinal plants. Most households had used these species within the last year, when a ritual was performed. *Olea europaea* subsp. *africana* is the most important species. Cultural species are believed to be increasing, as stated by the majority of informants.

Building materials were used by all households interviewed, but again on a much less frequent basis. The majority of informants had used this resource either within the last year, or within the last ten years. *Acacia mearnsii* is the most important building material, while a high number of informants stated that they don't use *Olea europaea* subsp. *africana* and *Ptaeroxylon obliquum* as these are important cultural species. This compares to when white farmers lived in the area. Informants stated that these farmers heavily utilized *Ptaeroxylon obliquum* as a building material. The majority of informants believe that building materials are increasing.

In sum, the local environment supplies, as an underestimate, 21 species of fuel wood; 40 medicinal plants; 7 cultural species; 9 building materials; resources with an economic value such as prickly pear and aloe; game meat; honey; clean water; and forage of different densities, which obtain value at different times in the year and under different drought conditions.

Table 5.11 Fuel wood species (results from household resource use survey).

Question	Species (Latin)	Species (Xhosa)	No. of responses	%	Reasons
Households who use the resource			47	100	
Number of species	21				
Top five used species?	*Acacia karroo*	Umnga	46	100	Makes very good embers which last a long time.
	Olea europaea subsp. *africana*	Umnquma	29	63	Kindling; works when wet; and good for starting a fire.
	Coddia rudis	Intsinde	29	63	Burns easily and makes a fire when wet.
	Scutia myrtina	Isiphingo	20	43.5	Fire lasts a long time and burns easily.
	Schotia afra	Umqaqoba	17	37	Good embers and makes the best heat.
	Grewia occidentalis	Umnqabaza	14	30.4	Can light when still wet.
Three favourite species?	*Acacia karroo*	Umnga	40	95.2	
	Scutia myrtina	Isiphingo	16	38.1	
	Olea europaea subsp. *africana*	Umnquma	15	35.7	
Most common species?	*Acacia karroo*	Umnga	29	93.6	
	Scutia myrtina	Isiphingo	13	41.9	
	Olea europaea subsp. *africana*	Umnquma	9	29	
How often do you collect the species?	1-2 times a day		12	24.1	
	3-5 times a week		6	13	
	2-3 times a week		12	26	
	1 a week		17	37	
	Average		***3.2 days a week***		
How much do you collect?	A single head load		18	64.3	
	A single donkey cart		9	32.1	
	A wheel barrow		1	3.6	
Change over the years?	Easier to collect		6	33.3	An increased amount of wood is dry; villagers were previously restricted by white farmers; and there is a lot of *Acacia karroo*.
	Increasing		9	37.5	
	Harder to collect		11	61.1	
	Decreasing		14	58.3	Increased population and harvesting pressure; and wood is scarce.
	No change		2	4.9	

Table 5.12 Medicinal plants (results from household resource use survey).

Question	Species (Latin)	Species (Xhosa)	No. of responses	%	Reasons
Households who use the resource			35	74.5	
Number of species	37				
Top four used species	*Alepidea ametyiblica* *Haemanthus* sp. *Dioscorea sylvatisa* *Schistostaphium* sp.	Iqwili Amathunga Skolpad Umhlonyane	26 16 9 7	83.9 51.6 29 22.6	
Three favourite species?	*Alepidea ametyiblica* *Haemanthus* sp. *Olea europaea* subsp. *africana*	Iqwili Amathunga Umnquma	5 4 3	55.6 44.4 33.3	
Most common medicinal plants?	*Alepidea ametyiblica* *Haemonthus* sp. *Gunnera perpensa* *Pachycarpus concolor*	Iqwili Amathunga Iphuzi Itshongwe	5 3 2 2	71.4 42.9 22.2 22.2	
How often do you collect medicinal plants?	Monthly Weekly		6 4	60 40	
Where do you collect medicinal plants?	Mountain Forest Other		20 12 5	54.1 32.4 13.5	
Change over the years?	Increasing Decreasing		11 2	84.6 15.4	Lots of rain. Lots of people are collecting, and some people sell what they have collected.

Table 5.13 Cultural species (results from household resource use survey).

Question	Species (Latin)	Species (Xhosa)	No. of responses	%	Reasons
Households who use the resource			43	91.5	
Number of species	4				
Most important species (top four)?	*Olea europaea* subsp. *africana*	Umqnuma	42	97.7	
	Ptaeroxylon obliquum	Umthathi	25	58.1	
		Ubulawyo	18	41.9	
	Suite of species	Umgcunube	1	2.3	
	Salix capensis				
Where do you collect cultural species?	River		7	35	
	Mountain		6	30	
	Forest		3	15	
	Anywhere		3	15	
	Other		2	10	
Last time collected cultural species?	Within the last few weeks		4	11.4	
	Within the last month		5	14.3	
	Within the last year		11	31.4	
	Within the last 10 years		5	14.3	
	More than 10 years ago		10	28.6	
Change over the years?	Increasing		21	87.5	Not often used, and no longer used as poles by the white farmers.
	Decreasing		1	4.2	People are using them a lot.
	Not sure		2	8.7	

Table 5.14 Building materials (results from household resource use survey).

Question	Species (Latin)	Species (Xhosa)	No. of responses	%	Reasons
Households who use the resource			47	100	
Number of species	8				
Most important species (top four)?	*Acacia mearnsii* *Bambusa* sp. *Pinus* sp. *Olea europaea* subsp. *africana* *Ptaeroxylon obliquum*	Umthole Ingcongolo Uthulwana Umqnuma Umthathi	39 21 13 11 6	84.8 45.7 28.3 23.9 13	
Last time collected building materials?	Within the last few weeks Within the last month Within the last year Within the last 10 years More than 10 years ago		3 4 9 6 7	10.4 13.8 31 20.7 24.1	
Change over the years?	Increasing positive negative Decreasing No change		15 12 3 1 1	88.2 80 20 5.9 5.9	Easier to find. Because it is a good building material and at present it is too far away. Decreases the grass and will make a forest with no road.
Don't use cultural species for practical purposes?	Don't use *Olea europaea* subsp. *africana* Don't use *Ptaeroxylon obliquum*	Umnquma Umthathi	16 17		Doesn't have straight poles, use it for traditions and quickly becomes dry Only used for traditions.

5.3.2 Management of the environment

The people of Cathcartvale have set up a management system that regulates the use of the natural environment. This management system coincides with the establishment of the community committee, as described in the study area chapter. There are a number of rules that guide resource use, which are controlled and enforced by the community committee.

The environmental rules were agreed upon in a village meeting and are partly based on management principles adhered to by the former white land owners. An example is the rule that one must not harvest green branches. They are also based on traditional management systems, where *Olea europaea* subsp. *africana* and *Ptaeroxylon obliquum,* (which both have high cultural value) have stronger harvesting restrictions. Chapter six provides more detail on the cultural value of these two species, as well as traditional management practices relating to sacred pools. If someone is caught breaking any of these rules they are taken to a community meeting and fined a sum of money.

See table 5.15 for the various rules in place, and the number of informants who mentioned each particular rule.

Table 5.15 Environmental Rules and informants' understanding of the reasons for each particular rule (N=41).

Environmental rule	No. of responses	%
Must harvest dry, rather than green, branches.	24	58.5
Must not chop down species useful for traditions.	7	17.1
Cannot hunt wild animals.	6	14.6
Before trees are harvested, for example building materials, permission must be obtained from the community committee.	5	12.2
Can harvest trees on the banks of rivers and dams.	3	7.3
Must not burn grazing lands.	2	4.9
Trees must not be cut close to the village.	2	4.9
When harvesting woody building materials, only *Acacia mearnsii* can be used.	2	4 .9
Must not chop down indigenous trees.	1	2.4
Green branches must not be left lying around the forest.	1	2.4
Must not pollute river water.	1	2.4

These rules have influenced people's use of the environment where six (66.7%) out of nine informants described the destructive impact of previous uses of the environment; trees were indiscriminately chopped, wild animals were killed and the environment was used for commercial purposes. Table 5.16 summarizes the reasons informants gave for why these

environmental rules are in place. The main reason is that these rules ensure that there is forage and grazing land for livestock, which is a significant result (X^2=25.88, $_{df7}$, p<0.0001).

Table 5.16 Reasons for the environmental rules (N=25).

Reason	No. of responses	%
To ensure that there is forage and grazing land for livestock.	11	44
Do not know.	4	16
To provide shelter for livestock in harsh weather conditions.	3	12
To provide and ensure that there is food for wild animals and birds.	3	12
So that the land remains in good condition.	1	4
So that the environment is there for future generations.	1	4
To stop people being destructive.	1	4
The government said so.	1	4

Table 5.17 summarizes people's attitude towards the environmental rules, and the reasons why they feel a particular way. The majority of informants (85%) have a positive attitude towards these rules.

Table 5.17 People's attitudes towards the environmental rules and their reasons (N=40).

Attitude	No. of responses	%	Reasons
Agree with, and feel positive towards the environmental rules.	34	85	It means that there will be shelter for livestock. It ensures that there is enough forage for livestock to browse. There is a penalty if you disobey.
Disagree with, and feel negative towards the environmental rules.	6	15	The consequent increase in forest thickness increases the danger of cattle getting lost. It affects people harvesting fuel wood.

Table 5.18 indicates how many people obey the rules, reasons why they do and don't and the possible consequences of this. The majority (57.9%) of informants adhere to these rules, which is a significant result (X^2= 11.73684, $_{df2}$, p<0.01).

Table 5.18 Adherence to environmental rules (N=36).

Do people adhere to the rules?	No. of responses	%	Reasons	Consequences
Yes	22	57.9	They are the rules and there is punishment for disobedience. Local people did not cut green trees before these rules were put in place.	Provides food for livestock and wild animals. The environment's condition improves. Increases our value of the environment. Would keep goats closer to the homesteads. The increase in trees has resulted in an increase in livestock deaths as they get lost in the dense forest.
No	11	29	People don't listen. There is no co-operation. People are lazy. People don't realize their importance. People grew up like that.	Negative for the environment because livestock will not get food. Will result in poverty because local people will have to sell their livestock.
Some people	5	13.2		

When asked how the environment has changed as a result of these rules, informants gave the following responses, as summarized in table 5.19. These responses indicate that the majority of informants believe that the diversity and density of species has increased.

Table 5.19 Environmental change.

Environmental change	No. of responses	%
Trees have increased.	7	36.8
No change.	3	15.8
The environment's condition will continue to improve.	3	15.8
The environment will become too dense and it will therefore be difficult for people to meet their needs.	2	10.5
There has been an increase in wild animals.	1	5.3
There are now beautiful trees.	1	5.3
Roads no longer exist.	1	5.3
Water has decreased because trees suck it up.	1	5.3

5.3.3 The role of anthropogenic disturbance in local people's livelihoods

5.3.3.1. The effect of disturbance from a people's perspective

When asked what the environment would look like without people, five (100%) informants explained that there would be many more trees and the area would be dense. Six informants were asked what impacts had the most effect on the natural environment. Five informants believed that harvesting green trees for building materials and fuel wood had the most impact, while one believed animals grazing caused the biggest impact. The harvesting of medicinal plants is believed to have a limited impact because they regenerate.

Twelve informants were asked what positive effects they can have on their natural environment. Table 5.20 summarizes informant's answers. As high as six (50%) informants stated that their activities have no positive impact on the environment.

Table 5.20 Land uses and activities having a positive effect on their local environment (N=12).

Positive effects	**No. of responses**	**%**	**Reasons**
No positive impacts	6	50	Harvesting trees destroys the environment. Still inexperienced in managing the land. Compared to the past, people harvest all the trees they see, rather than only a few trees.
Harvesting resources	3	25	The plants coppice and regenerate.
Cattle grazing	2	16.7	After grazing, the plants grow again. Makes the forest beautiful.
Rotational grazing	1	8.3	
Cultivating fields	1	8.3	
Fix dongas	1	8.3	

The following two disturbances were also identified as having a positive impact on local people's livelihoods. Firstly, the road network established by the previous white land managers had positive repercussions on people's livelihoods as people were able to access previously inaccessible forest, as indicated by the following quote:

> "*When Peter Chin* [a previous white farmer] *was here the road was good and the people were going there* [a dense forest] *and there are a lot of resources. Almost every resource you could get there.*"

However, in recent years the roads have become overgrown with vegetation and are no longer used to penetrate resource hotspots. Secondly, the introduction of *Acacia mearnsii* to the area has provided a large supply of building materials to local people and it is used to construct houses.

Eighteen informants were asked what negative effects they can have on their natural environment. Table 5.21 summarizes informants' answers.

Table 5.21 Land uses and activities having a negative effect on the natural environment (N=18).

Negative effects	No. of responses	%	Reasons
Harvesting trees	6	33.3	Trees act as wind breakers. Trees hold rain and the grass under the trees is wet because of the dew. The environment's condition is negatively affected.
No negative impact	4	22.2	When trees are cut they coppice again. Medicinal plants regenerate. When grazed, grass grows again.
Burning the natural vegetation	3	16.7	
Poor harvesting (cutting green and small trees)	3	16.7	
Cutting wire fences	2	11.1	Cattle from other villages will come to their forest and destroy it.
Cattle grazing	1	5.6	
Hunting	1	5.6	
Playing in the water	1	5.6	
Over utilization/harvesting	1	5.6	

A number of former disturbances, including the establishment of roads and introduction of *Acacia mearnsii* have also had negative impacts on local people, based largely on their own views. Firstly, the former road network is now a significant source of erosion, because of the formation of deep gullies. These gullies limit people's use of these roads, as donkey carts can no longer travel on them and it is difficult to carry a head load of fuel wood. Secondly, a number of abandoned fields are also a source of erosion where the land is now hard, bare of vegetation and is scarred by gullies. Plate 5.1 shows an abandoned field that has these characteristics, and plate 5.2 provides two examples of the formation of gullies on former roads. Thirdly, *Moraea polystachya* (Ukronxina), a plant poisonous to cattle, grows in the former sheep grazing lands. Fourthly, areas infested by *Acacia mearnsii* experience grey, hard, bare soils and have limited value for livestock. In addition, these areas are increasing.

5.3.3.2 The relationship between anthropogenic disturbance and resources

5.3.3.2.1 Pilot study of resource patches and their benefits

Local Xhosa people place high utilitarian value on key resource patches such as mountains, and forests and grasslands in various stages of succession. The different types of resource patches provide different kinds of resources, thus satisfying the villagers' basic needs.

Table 5.22 ranks the main resource patches and presents their benefits in order of importance, depending on how often it was mentioned by an informant. This explains why some benefits are of the same importance. Information was obtained from the ten focus groups. The different intensities of past and present grazing pressure are the predominant disturbance affecting these resource patches.

The mountain grasslands are the most important resource patch, as they are the main source of medicinal plants and good quality water; they provide very good grazing land for cattle and the grasses are also used for making brooms, ropes and thatching roofs. Open grasslands closer to the village are also important, especially during summer where they provide nutritious forage.

Various types of secondary forest are valuable because they are easy to access and provide a diverse set of resources including building materials; cultural species, some medicinal plants; wild fruits; certain kinds of fuel wood; and they also become important for livestock during times of drought, providing browsing forage.

Acacia thicket is the preferred place for fuel wood and is also a source of *Aloe* sp. and *Opuntia ficus-indica*, which provide the villagers with an income. They are also important grazing lands as the trees provide shelter during harsh weather conditions, as well as browsing forage, which is very important during winter when the grass has dried out.

Dense thicket, dense forests and heavily grazed highland grassland with aloe were the lowest ranked resource patches. Dense forests and thickets do, however, have a number of important benefits where they are a source of rare medicinal plants, honey, game meat, and have wild fruits on their edges. They are also an important source of forage and shelter during times of drought.

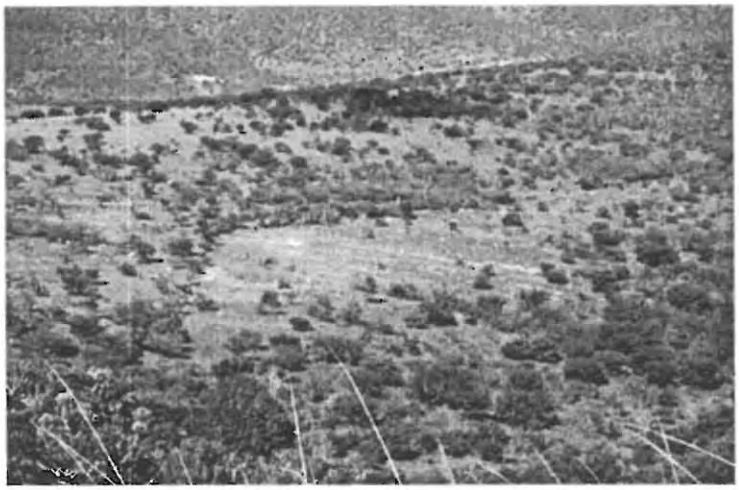

Plate 5.1 Erosion occurring on an abandoned field.

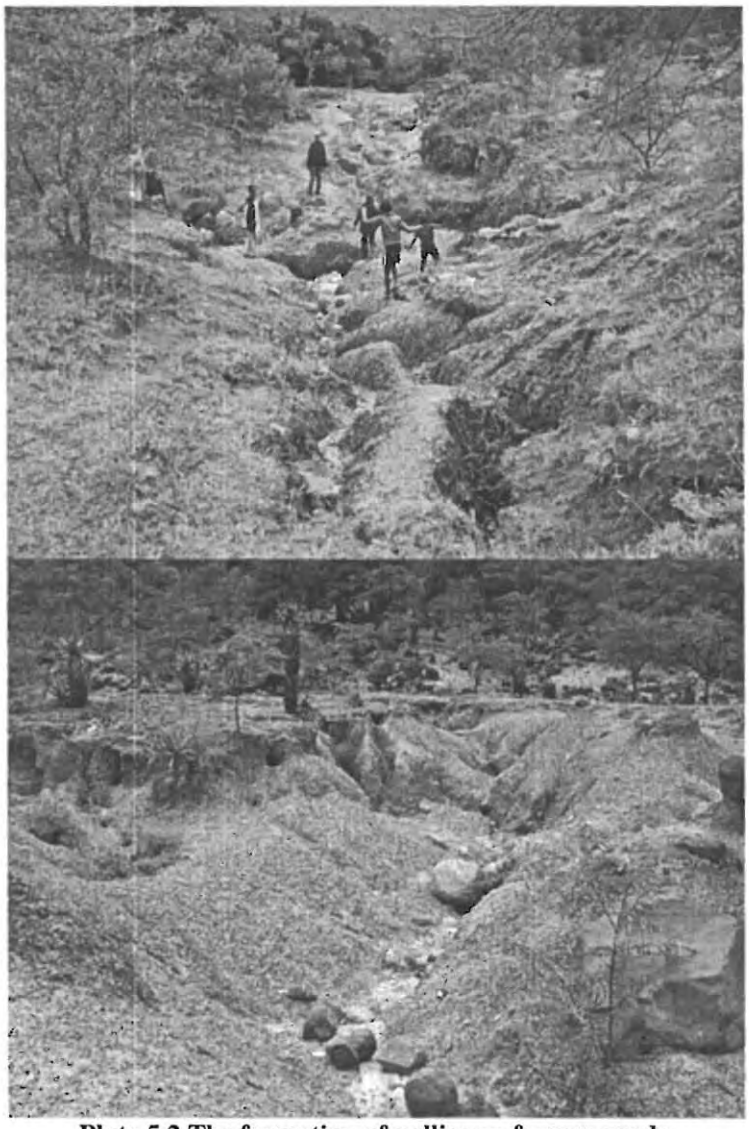

Plate 5.2 The formation of gullies on former roads.

When asked how important it is to have all of the resource types in the environment, five (62.5%) focus groups said that all the resource patches must be there "*because even if the one is missing means that life won't be complete.*" However, three (37.5%) focus groups said that it would be alright if dense forest was not there: *"If there is a forest it must not be too dense so people can have access. If no dense forest there nothing can happen to them,"* and *"even if thick forest not there people can live without it."*

5.3.3.2.2 Past anthropogenic landscapes and their resource benefits

Former grazing lands, abandoned fields, old settlements, the edge of old settlements and dense forests were compared in terms of species richness and abundance of fuel wood, building materials, medicinal plants, cultural species, edible plants and livestock forage, as well as the number of harvestable species, abundance of useful species and the total value of each former disturbance. This data was based on the benefits of each species, as determined in the focus group that examined each voucher specimen and stated its benefit as a fuel wood, medicinal plant, building material, cultural species, forage species, edible plant and its total value. See appendix 4 for a list of each species and its benefits. Table 5.24 compares the species richness and abundance of different resource types between past anthropogenic landscapes, including dense forests. Table 5.25 summarises the results from the multiple comparisons test, indicating which anthropogenic landscapes are significantly different from one another in terms of the species richness and abundance of resource types.

The results indicate that dense forests are the most species rich and abundant in many useful resources, including fuel wood and medicinal woody plants. They had the highest species richness for all resources, contained the most useful and harvestable species and scored the highest value. This is a notable result when one considers that during focus groups, when interviewed and on transect walks, the majority of informants viewed dense forests as having limited or negative value. Ten (90.1%) informants indicated that they don't want the vegetation to become thicker, while only one said that it would be preferable if the environment was denser. Related to this, twelve (85.7%) informants described a healthy environment as being open. For example, an informant described a healthy environment as one without "*bad things*". When questioned further, these "*bad things*" are "*trees which have closed canopies so that when you go into the forest you have*

Table 5.22 The main resource patches: their benefits and problems.

Resource Patches	Benefits	Problems
Mountain grasslands (past grazing land on upper slopes).	1. The main source of medicinal plants. 2. Supplies clean water. 3. Grass for brooms, ropes and thatching. 4. Grazing land which produces healthy cattle.	
Wattle/pine plantation (past grazing lands and abandoned fields on upper slopes).	1. Building materials. 2. Livestock shelter. 2. Fuel wood.	Decreases water.
Mixed acacia thicket (past grazing lands on lower slopes).	1. Important source of fuel wood. 2. Grazing land and provides browsing forage. 3. Harvest many resources because fairly open. 4. Can get aloe. 5. Provides shelter for livestock. 6. Medicinal plants.	
Open grazing lands/sourveld (past grazing land on lower slopes).	1. Good grazing land (lots of grass and trees to browse). 2. Open – can see livestock. 2. Thatching grass. 2. Fuel wood. 2. Trees provide shelter for livestock.	
Secondary forest (past grazing land of low intensity on lower slopes).	1. Many different resources/species. 1. Aloes which have an economic value. 2. Fuel wood. 2. Grazing and forage for livestock. 2. Honey. 3. Cultural species. 3. Medicinal plants. 4. Habitat for wild animals. 4. Shelter for livestock.	Too dense and thorny so not good for livestock. Zombies live here.
Heavily grazed palatable grassveld with few *Acacia* (past intensive grazing on lower slopes).	1. Grazing land for small stock. 2. A future building site. 3. Fuel wood.	Not a lot of grass for livestock.
Heavily grazed highland grassland with *Aloe* sp.	1. Good source of *Aloe*. 2. Grazing land for livestock as move up to mountain. 3. Honey made from aloe nectar. 4. Some fuel wood (*Acacia karroo*). 4. A source of *Izithu* – a plant used at initiation school.	Too many stones. A small amount of grass Species are thorny.
Dense thicket/forest	1. Honey. 2. Rare medicinal plants. 3. Has a large number of resources. 3. Hunting. 3. Important for livestock during drought. 3. Collect berries on edge.	Too dense so can't access the forest. Dangerous. Livestock can't graze. Livestock get lost.

to go under the trees. It must be spacious". Table 5.23 summarizes the reasons why dense forests are viewed negatively.

Table 5.23 Negative aspects of dense forests.

Reasons	**No. of responses (individuals)**	**%**
Can't see danger (wild animals and criminals) because forests are too dense.	5	29.4
Can't access resources. "*A thick forest is not too important to the people because even if the resources are there in the environment it is difficult to find them because it is too dense.*"	5	29.4
Livestock get lost and die.	3	17.7
Livestock can't go through dense forests.	2	11.8
Scary.	1	5.9
Can't walk in dense forests.	1	5.9

All eight focus groups (100%) said that dense forests must consist of small pockets. When they form small pockets their value greatly increases because many of their negative effects, as summarised in table 5.25, are mitigated.

Eight (80%) informants don't harvest in dense forests because it is 'dignified', i.e. they are highly respected and they are thus scared of harvesting in these places. This is indicated in the following two quotes:

> "*There are some places which we are afraid to go to because they are so dignified, big trees and when you look inside you can't see under the trees, so we don't go there and harvest any resources.*"

> "*There are places which we don't go to harvest. Although there is a rule that you can't harvest green trees, there are places where we can collect dry wood or medicinal species, but we don't go there because we see that the place is dignified and too dark so we are afraid to go to it.*"

Table 5.24 A comparison of species richness and abundance of different resource types, between past anthropogenic landscapes, including dense forests (Kruskal-Wallis test, significant values are highlighted). DF = dense forests (N=4), OS edge = the edge of old settlements (N=8), GL = grazing lands (N=46), AF = agricultural fields (N=27), OS = old settlement (N=9).

	Kruskal Wallis			Species Richness			Abundance		
Resource type	*Species Richness*	*Abundance*	*Land use*	*Median*	*Mean*	*SE*	*Median*	*Mean*	*SE*
Fuel wood	**p=0.004**	**p=0.000**	DF	11.5	11.5	0.7	85.5	83.3	6.3
			OS edge	7	6.9	1.1	46.5	61.5	17.1
			GL	4	4.9	0.48	41	41.4	4.5
			AF	2	2.4	0.5	11.5	21.3	5.9
			OS	2	1.9	0.4	3	8.1	7.0
Cultural species	**(p=0.006)**	(p=0.095)	DF	2.5	2.5	0.5	11.5	13.5	4.1
			Os edge	2	1.4	0.2	23	27.4	10.4
			GL	1	1	0.1	14	11.6	1.6
			AF	1	0.7	0.1	10	13	3.1
			OS	1	0.4	0	2	6.6	8.7
Building materials	**(p=0.044)**	(p=0.172)	DF	3	2.8	0.8	16	17.5	3.8
			OS edge	3	2.4	0.4	28	29.4	10.7
			GL	2	1.6	0.1	16	16.8	2.6
			AF	1	1.2	0.2	17.5	16.1	3.8
			OS	1	0.9	0.2	2	7.6	7.2
Medicinal (Woody)	**(p=0.000)**	**(p=0.000)**	DF	4	4	0.4	19	26.0	4.0
			Os edge	2	2.5	0.5	20	19.8	7.2
			GL	2	1.9	0.2	15	19.2	3.6
			AF	1	0.7	0.1	8	5.7	2.5
			OS	2	1	0.3	3	4.1	3.1
Medicinal (Herbaceous)	(p=0.102)	(p=0.428)	GL	4	4.2	0.3	2.5	6.6	2.5
			AF	3	3	0.4	2	4.4	1.2
			OS	3	2.75	0.6	3.75	3.4	0.9

Forage	**(p=0.0001)**	**(p=0.0001)**	DF	10	10	1.2	67.5	68.3	5.8
			Os edge	9	8.4	0.4	75	104.5	28.0
			GL	6	5.7	0.5	67	73.2	8.8
			AF	3	2.9	0.5	33	27.6	5.8
			OS	3	2.1	0.7	6	13.6	9.9
Edible fruits	**(p=0.0000)**	**(p=0.0000)**	DF	5.5	5.3	0.9	42.5	43.5	5.2
			Os edge	6	5.3	0.7	47	63.9	22.5
			GL	3	3.0	0.3	14	15.6	2.2
			AF	2	1.4	0.4	6.5	6.2	2.3
			OS	2	1.4	0.4	4.5	4.2	2.2
Harvestable species		**(p=0.0000)**	DF	86	92.3	13.2			
			Os edge	51.5	61.9	20.6			
			GL	23.5	22.2	2.9			
			AF	9	11.8	2.9			
			OS	7	4.6	1.8			
Useful Species	(p=0.253)		DF	22	22	1.6			
			Os edge	12	10.9	1.4			
			GL	7.5	7.5	0.7			
			AF	3	3.4	0.7			
			OS	4	3.4	0.8			
Value	**(p=0.0000)**		DF	556.5	578	70.7			
			Os edge	211.5	372	162.9			
			GL	102.5	109.3	12.3			
			AF	57	52.9	12.7			
			OS	14	26.2	19.7			
			Os edge	2	1.4	0.2	23	27.4	10.4
			GL	1	1	0.1	14	11.6	1.6
			AF	1	0.7	0.1	10	13	3.1
			OS	1	0.4	0	2	6.6	8.7

Table 5.25: A summary depicting which past anthropogenic landscapes sites are significantly different to each other in terms of the species richness and abundance of resources (Multiple comparisons test, values are probabilities). Only significant differences are indicated.

	Species Richness			Abundance		
	Grazing land	Abandoned Field	Old settlements	Grazing Land	Abandoned Field	Old settlement
Fuel Wood						
Abandoned Field	0.017			0.032		
Old Settlement				0.008		
Edge of Old settlement		0.017	0.031			0.011
Dense Forest		0.0006	0.001		0.006	0.0009
Cultural Species						
Dense Forest			0.043			
Edible Fruits						
Abandoned Field	0.023			0.020		
Old Settlement						
Edge of Old settlement		0.0007	0.015		0.0002	0.004
Dense Forest		0.023			0.003	0.014
Woody Medicinal plants						
Abandoned Field	0.001			0.001		
Old Settlement						
Edge of Old settlement		0.014			0.007	0.040
Dense Forest		0.0007				
Livestock Forage						
Abandoned Field	0.030			0.006		
Old Settlement				0.014		
Edge of Old settlement		0.007	0.043		0.040	0.021
Dense Forest		0.014	0.040			
Harvestable species						
Abandoned Field						
Old Settlement		0.011				
Edge of Old settlement			0.004			
Dense Forest	0.033	0.003	0.0009			
Perceived value						
Abandoned Field	0.047					
Old Settlement	0.036					
Edge of Old settlement		0.001	0.0007			
Dense Forest		0.0007	0.0003			

The consequence of not harvesting in these type of areas is that they become more dense, as expressed by three (100%) informants. In addition, an area which people used to harvest has recently become thicker and consequently people are now afraid to go there.

Of the three disturbed sites, grazing lands, although containing far fewer resources than dense forests, often had two to three times the species richness and abundance of resources compared to abandoned fields and old settlements. The edge of old settlements is not included, as the area sampled was larger. This partly explains why they had a relatively high species richness and plant abundance. Resources included fuel wood species where grazing lands are 2.2 and 2.6 times more species rich and had 1.9 and 5.1 times the abundance of fuel wood species than abandoned fields and old settlements respectively. In terms of woody medicinal plants grazing lands are 2.7 and 1.9 times more species rich and they have 3.4 and 4.7 times the abundance of these plants than abandoned fields and old settlements respectively. The only time grazing lands did not score the highest value out of the disturbed landscapes was regarding the abundance of cultural species, where abandoned fields had a marginally higher number. Grazing lands had 2.1 and 4.2 times the value, and 1.9 and 4.8 times the number of harvestable species than abandoned fields and old settlements respectively. Grazing lands also had 3.9 times the number of useful species compared to both these sites. Table 5.23 indicates that many of these results are significantly different.

These results do, however, hide the role that abandoned fields and old settlements play for local people. Abandoned fields provide an abundant source of *Acacia karroo*, the favourite fuel wood species, while old settlements provided an ideal resting spot for cattle due to their openness and lush grass. Old settlements were also important to local people because of the abundance of the valuable *Opuntia ficus-indica* and *Scutia myrtina* growing on their edges. These are two of the villagers' favourite edible fruits. During transect walks we often stopped to harvest *Scutia myrtina* for a snack. Plate 5.3 is of an abandoned fields and indicates the abundance of *Acacia karroo* in this past anthropogenic landscape. Plate 5.4 is of two separate old settlements and show how they are favoured by cattle.

Plate 5.3 The abundance of Acacia karroo in an abandoned field

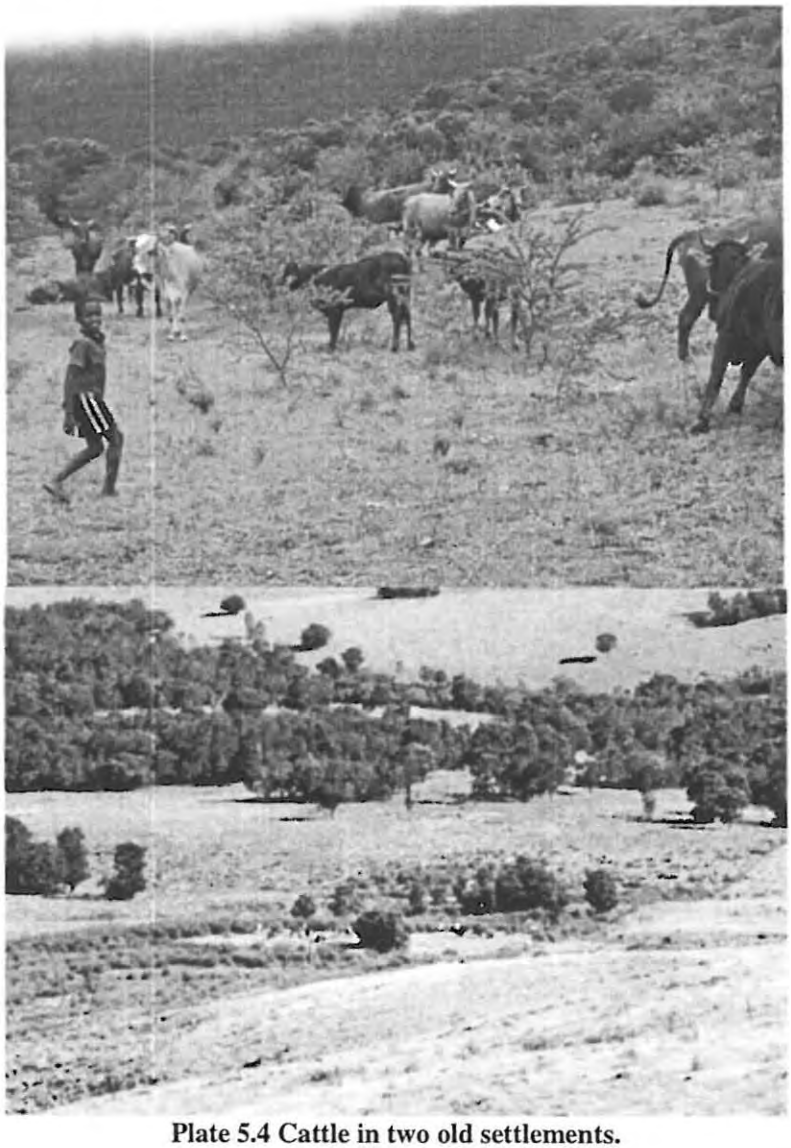

Plate 5.4 Cattle in two old settlements.

5.4 Discussion

The villagers of Cathcartvale are heavily dependent on their local environment to meet their basic needs. A wide variety of plant species are utilized for fuel wood (21), medicinal plants (40), building materials (9), cultural species (7), edible plants (>6), grazing and forage (>47) and species of an economic value (2). Firstly, this increases the redundancy of resources and therefore spreads harvesting pressure, secondly it indicates the extensive use of the environment as a whole where species are harvested in, for example, mountainous grasslands, low lying acacia thicket and secondary forests, and thirdly, it reflects the different practical benefits of species within one resource type. For example, some fuel wood species provide a lot of heat, other species are good for starting the fire, while some last a long time (see table 5.11).

The local landscape, therefore, supplies a wide variety of resources to local people. This parallels many groups in South Africa (Cocks and Dold 2003, Shackleton and Shackleton 2002), as well as internationally, for example the Mbeere of Kenya (Little 1987), the Mbuti of north eastern Zaire (Ichikawa 1996) and Housa groups of central Nigeria (Nettle and Stone 1996). Ichikawa (1996) believes that the Mbuti's reliance on a diverse array of resources for both material and cultural wellbeing has been a key reason for the Mbuti's long-term occupation of their environment. Adger (2000) argues that dependency on a few resources can lead to instability and an increased risk of the various resources collapsing. Barrow (1998) argues that in dry land ecosystems the socio-ecological system can survive if a diversity of resources (he emphasizes animal types) are utilized.

The local environment is important to the villagers of Cathcartvale. Informants express a close relationship with it, and positive feelings towards it, while certain aspects of the environment are an integral part of their culture and belief system, as explained in chapter six. This is largely a consequence of the environment's ability to meet a wide variety of basic needs. For example, the majority of informants explained that the main reason for the environment's importance is that it meets their basic needs. In addition, a number of informants defined a healthy environment as one that meets their basic needs, while the main problem of a degraded environment is that it affects their ability to meet their basic needs. Fox and Shackletons' (2003) research in the Kat River valley indicated that when the environment becomes degraded, and therefore no longer suplies an adeqaute number of

resources, people's attitude and feelings towards the environemnt become negative. An integral aspect of the way local people relate to and value their local environment is therefore based on their dependence on it for survival. Jodha (1998) explains that when the survival of local resource users depends on the environment they have a huge incentive to manage their resource base sustainably. The environmental rules in place, as well as the expressed desire for the environment to be in a good condition for future generations, indicates the desire for villgers to manage their resource base sustainably. The secure land tenure experienced by villagers of Cathcartvale, who now own their land, is another important factor driving both this conservation ethic and the establishment of an institution that regulates resource use. Literature points to the importance of local resource users having secure land title and access to their natural resources if resources are to be sustainably managed (Alcon and Toledo 1998).

There are numerous case studies of local communities actively managing their landscape to enhance its usefulness, see for example Wiersum (1997; 2003). The amaXhosa place high value on cattle and they are an integral component of their religious, social, and economic lives (Shaw 1974; Hammond-Tooke 1975; Hunter 1979; Kuper 1982; Poland *et al.* 2003). Evidence indicates that local resource users in Cathcartvale actively manage their environment to make it suitable for cattle and to protect ecosystem goods. For example, the environmental rules are in place to ensure the continued provision of useful resources and also to create an environment of maximum benefit to livestock. Fifty-six percent of the informants stated that the benefit of the environmental rules is that they ensure that there is forage and shelter for the livestock. This is also one of the reasons why informants obey the environmental rules. In addition, local people's preference for the environment's appearance is linked to that which is most beneficial to cattle, i.e. an environment that is open, has lots of grazing and forage available, and a limited number of dense forests.

The next few paragraphs examine the role that disturbance has played in creating an environment that supplies so many useful resources to local people.

The importance of disturbance is indicated by the limited value attached to dense forests, even though they contain the highest number of useful species. Informants indicated that without human disturbance, the area would naturally be covered by dense vegetation. This would have little value to people, as it would not be suitable for rearing livestock, resources would be difficult to access and many dangerous animals would occur in the

area. People thus associate dense forests with danger, fear and impenetrability. This parallels many fairytales where fear, foreboding and evil are associated with dark, undisturbed landscapes such as thick forests. This contrasts to the benign feelings associated with open woodlands and park-like landscapes. The Kayapo of Brazil, who manage a variety of resource patches to provide the maximum amount of useful species, actively disturb mature forests when they become too dark and unproductive (Posey 1999b).

Other factors indicating the importance of disturbance include the following: firstly, a number of the species most useful to local people, namely *Acacia karroo*, *Opuntia ficus-indica*, and *Acacia mearnsii,* are associated with disturbed landscapes (Hoffman and Ashwell 2001). Dold and Cocks' (2000b) research in the Grahamstown and Peddie districts of the Eastern Cape found that weeds, problem and alien plants, and thus species associated with disturbed landscapes, have high medicinal value. Of the 33 plants used for their medicinal properties, 28 are classified as problem plants, 9 are plant invaders, and 5 are declared weeds. Secondly, the former road network is presently used as the main route to access resources. Thirdly, the majority of informants reminisced about the past, under white and coloured land management. During this time the land was intensely managed in comparison to the present. It was consequently more open as there were less trees and more grass. It was thus easier to access resources, and livestock were easily seen. One-hundred percent of the informants interviewed saw the present increase in vegetation as negative.

There are however, a number of negative effects of disturbance. Firstly, disturbance has resulted in thorny, invasive type species, such as *Acacia karroo*, dominating many parts of the landscape. Local people complained about these thorny species and how they prevented them from moving easily in the landscape. *Opuntia aurantiaca* which was common in abandoned fields, see figure 4.3 in chapter 4, is a particularly bad invasive species and causes severe harm to livestock. *Acacia mearnsii* also has negative repercussions as it sucks up a lot of water (Hoffman and Ashwell 2001), and makes the soil grey, hard and acid. This limits the growth of other species, particularly grass. Secondly, erosion and poor soil quality, resulting in minimal grass cover, are characteristic of many former grazing lands and abandoned agricultural fields. One can, therefore, question whether the natural environment would be more beneficial to local people had it not been disturbed at the intensity that it was. Thirdly, the former road network is now a significant

source of erosion, which is sedimenting the river and causing gullies to scar the landscape, preventing people from using them. Fourthly, fuel wood, which is harvested by all the households on a weekly, and even sometimes a daily basis, is believed to be decreasing, as stated by the majority of informants. This compares to cultural species, building materials and medicinal plants, which are harvested monthly, or yearly. Over 80% of informants believed that these resources were increasing. From an environmental perspective, intact thicket is extremely valuable, as it has high biodiversity value and produces a number of environmental services. It is also very hard to regenerate as it resprouts and does not generate well from seed (Pierce 2003). There are, therefore, substantial ecosystem costs when it is cleared, as had presently occurred in Cathcartvale.

An important aspect of disturbance is its seemingly contradictory effect, where there is often a tension in the informants' responses; the local people seem unsure of the effects of disturbance on their livelihoods. For example, local people throughout the research process commented on the negative effect of a dense forest, and how a landscape is beneficial when open, accessible and livestock can easily be seen. However, when asked about the positive impacts people can have on the natural environment a high number believed that villagers have no positive effect. In addition, a greater proportion of informants believe that harvesting fuel wood and building materials has a negative rather than a positive impact. This is unexpected when one considers the informants' statements that the harvesting of trees opens up the landscape; something they believe to be positive.

Another tension expresses itself in the comments regarding the environmental rules currently in place. These rules are a means of limiting human disturbance, primarily aimed at ensuring that there is browsing forage and shelter for the livestock. Although the main consequence of these rules is that they increase vegetation (36.6% of informants), the majority of informants (85%) believe that these rules are positive because, for example, they increase the condition of the environment. This contradicts previous sentiments about the negative effect of an increasing forest.

These seemingly contradictory statements reflect the tension between the importance of anthropogenic disturbance for enhancing local people's livelihoods (an undisturbed landscape has little immediate value to local people because of reasons already mentioned) and the possible negative effects that may and often do ensue. There are many examples of anthropogenic disturbance both enhancing people's livelihoods (Netting and Stone 1996;

Wiersum 1997; Kull 2002; Toledo *et al.* 2003; Wiersum 2004) and also resulting in a diminished resource base (McCracken 1987; Dolman 2000; Kozlowski 2000; Hoffman and Ashwell 2001).

The remainder of this discussion links my findings to the intermediate disturbance hypothesis (Connel 1978), and argues that this is most beneficial for maintaining a resilient socio-ecological landscape.

Dense forests, which have been the least disturbed, have the highest number of resources. However, dense forests have limited value to local people as they are difficult to access due to their dense vegetation and the fear associated with them. A number of informants have stated that they could live without them. This indicates that utilitarian value does not depend on how many resources a landscape contains, but rather how accessible they are. Abandoned fields and old settlements have experienced the highest intensity of disturbance and consequently have a low value and number of resources. They are, however, more important to local people than dense forests, where abandoned fields are a good source of the popular *Acacia karroo,* while old settlements provide resting camps for cattle and their edges provide an abundance of edible fruits. Grazing lands and the edge of old settlements have experienced an intermediate level of disturbance, relative to dense forests, abandoned fields and old settlements. These two sites contain many useful resources and are highly useful to people, especially as the resources are accessible. This supports the intermediate disturbance hypothesis, but from a human perspective. The intermediate disturbance hypothesis states that species richness is greatest in communities that experience an intermediate level of disturbance (Connell1978; Picket and White 1985). In terms of this thesis, this hypothesis can be rephrased to state that resource patches have the most value to local people when they experience an intermediate level of disturbance. This could be scaled up to hypothesize that landscapes have the most value to local people when disturbance levels are intermediate.

The time since cessation of a particular disturbance could be considered an important variable affecting the benefits supplied by an anthropgenic landscape. This successional gradient was not examined in this thesis, but would be an interesting aspect to follow up through more intensive sampling along a time gradient.

Dense forests are important for the long term survival of a socio-ecological landscape. Because they are biologically diverse, relative to the rest of the landscape, dense forests could play an important role during crises, such as drought and fire, as they are more resistant to both of these surprises than disturbed forest (Colding *et al.* 2003). They thus act as a safety net to the villagers. They could also be an important source of genetic material during the reorganisation phase, which is one of the stages in Holling's adaptive cycle (Holling and Gunderson 2002), as explained in the introductory chapter.

As indicated above, dense forests have limited direct value and the natural tendency is to want them removed. However, when disturbance is intermediate, either because of low technology or population they are difficult to penetrate, the forests remain inaccessible, and retain their fearful characteristics. On the other extreme, a population that is large, disturbance that is frequent and/or technology that has a significant impact on the local vegetation results in the vegetation opening up considerably, dense forests are reduced, they are no longer feared and it becomes easier to access them. The end result is that dense forests will disappear from the landscape. This again supports the notion that an intermediate level of anthropogenic disturbance should have the most beneficial impact on local people's livelihoods.

Different resource patches including the mountain, *Acacia* thicket in various stages of succession, secondary forest, and open grasslands, also supply a variety of different resources to the local people. This again indicates the importance of disturbance as well as geographical variability and topography in meeting the needs of local people. For example, if the area was flat and low lying, many of the medicinal plants, thatching grasses and clean water would not be supplied by the local landscape. Although a number of resource patches, such as the mountain, mixed *Acacia* thicket and open grassland, were ranked higher than other resource patches, the villagers recognized the importance of having all of the different resource patches in the landscape.

In sum, it can be argued that the variety of past anthropogenic disturbances have enhanced the resource base, as they each supply different benefits; for example, grazing lands are a good source of medicinal plants, the edge of old settlements provide an abundant source of edible fruits, particularly *Opuntia ficus-indica* and *Scutia myrtina*, while low lying agricultural fields provide an abundant source of the popular *Acacia karroo*, and high lying fields are an important source of *Acacia mearnsii*.

Due to the different ways ecosystems respond to disturbance (Frelich and Reich 1998; Scheffer *et al.* 2001) further research is needed in this area to fully understand the impact that different disturbances have on the landscape structure of Cathcartvale, the presence of dense forests and their ability to supply basic needs to local people.

The present anthropogenic disturbance has had significant effects on vegetation characteristics, which vary according to the type of disturbance, the vegetation's proximity to the village and associated harvesting pressure. This dimension was not examined in this thesis and there is thus room for research to be taken further in this area.

The level of confidence of the different benefits supplied by anthropogenic landscapes is moderated due to the quality of voucher specimens. Due to time constraints these were collected in late March, early April, at the beginning of autumn. There were therefore fewer seeds, fruits and flowers that could guide informants' identification of the species and their associated benefits. This increased the possibility of error. Although the choice of informants was based on their extensive knowledge of plants and their benefits, their concentration levels dipped towards the end of the two day workshop. This also increases the possibility of error.

In conclusion, anthropogenic disturbance is important for creating a beneficial socio-ecological landscape. Firstly, disturbance results in a more patchy landscape, which can meet local people's basic needs. Secondly, a disturbed landscape is more accessible, open and 'friendly' with fewer dangerous animals such as snakes and leopards. And thirdly, disturbance places a human stamp on the landscape, with which people can identify. It is thus a point of engagement between people and the landscape. However, disturbance is most effective when its intensity is intermediate. It should be carefully managed as an adaptive management strategy, where its effects are continually monitored. When its effects start to become negative appropriate action should be taken.

Chapter 6: The predominant worldview and eco-cosmology held by the people of Cathcartvale, Tidbury, Ntlini and Fairbairn and its influence on their relationship with the local landscape

6.1 Introduction

The central thread running through this thesis is that people and nature are part of the same integrated system (Fairhead and Leach 1996; Posey 1999a; Berkes and Folke 1998, 2001; Stepp *et al.* 2003), where landscape construction, formation and evolution are dependent on the complex interrelationship between human cultural systems and nature (Posey 1999a).

This chapter examines aspects of this complex relationship by investigating the influence that a people's worldview, values and belief system have on how they perceive, interact with and manage the natural environment in the Kat River valley of the Eastern Cape.

Human society constructs symbols of meaning relating to the natural world that both derive from and determine the nature of society's engagement with the natural world (Westley *et al.* 2002). These links between symbols and the natural world are expressed as worldviews (Westley *et al.* 2002), eco-cosmologies (Croll and Parkin 1992) and cognized models (Rappaport 1979). Related to this, Bowie (2000) explains that peoples' beliefs and knowledge determine their perception of nature, while Strang (2000) states that human interaction with the environment is determined by one's cultural values. We act according to these images rather than the actual structure of an ecosystem.

Miller (1998: 293) defines a worldview as "a set of assumptions, held consciously or unconsciously about the basic make-up of the world and how the world works." It is analogous to a set of coloured lenses, which affects how one views, relates to and understands the world, and like a road map it directs and guides one through life. It is important to note that worldviews are not static and unchanging. Miller (1998) believes that one's worldview provides answers to the following three basic questions asked by humanity:

- The epistemological question, which deals with the nature, limits and validity of knowledge.
- The metaphysical question, which examines the fundamental nature of reality and belief (Is there a God? What is the essence of nature and time?).
- The moral question, which determines one's values, ethics and morals.

Miller (1998) states that the way people answer these questions determines one's culture, and influence on the natural environment.

The worldview and values held by a group of people thus profoundly affects the way that they interpret, manage and place value on their local ecosystems (Strang 1997; Miller 1998). Hence, two groups of people inhabiting similar environments may see, experience, and place meaning and value on ecosystems in very different ways, thus making the respective groups part of two entirely different social-ecological systems (Strang 1997). This has profound influence on the way different groups utilise and interact with their environments. It is this idea that informs the contemporary debate on the link between biodiversity and cultural diversity. For example, 60% of human languages are spoken in only nine countries, which reflects a very high cultural diversity. It is no coincidence that six of these are also countries of mega diversity, with unusually high numbers of unique animal and plants species (Posey 1999a). This kind of example has led the 'Declaration of Belem' to state that there is an "inextricable link" between cultural and biological diversity (Posey 1999a).

It has been argued by many scholars that our modern 'western' systems of resource use and management derive from a worldview that was largely informed by Judaeo-Christian biblical theism, and the rationality of the Greek philosopher Aristotle (Thomas1984; Kinsley 1996; Callicott 1997). The emergence of a more secular worldview has its modern roots in 19th and 20th century Europe and has been fundamentally influenced by the Enlightenment era and ideas held by philosophers such as Descartes, Bacon and Kant (Miller 1998; Pierotti and Wildcat 1999). This philosophy led to the emergence of a more positivist and mechanistic way of seeing the world where "all beings, processes and phenomena are explained as manifestations of matter" (Miller 1998: 41) that are governed by mechanical principles. A fundamental aspect of this philosophy is the idea that humans (culture) are separate from and are in control of nature (McCormack and Strathern 1980; Miller 1998; Pierotti and Wildcat 1999). Miller argues that this led to a lack of moral

constraint when managing nature and, supported by the capitalist ideology of maximization of profits, resources were increasingly harvested and consumed for short term economic benefits.

In contrast to the more secular worldview, from which western scientific ideas of resource utilization, management and conservation are derived, are those societies that have a worldview embedded in animism. A fundamental idea in animism is that there is a shared animating spirit that infuses the universe, which informs the nature of the relationship between all life forms (both animate and inanimate) (Bird-David 1980). As Miller (1998:154) states, animist thinking believes that "the universe, which exists for itself, is animated, alive, capricious, divine." Although there is great diversity and local specificity in various animist worldviews there are some recurring features. In some instances animism is based on the idea that the whole world is a spiritual being, which is often anthropomorphized into the entity of the 'Great Mother'. This is found amongst many indigenous South and North American groups (Gonzales *et al.* 1999; Posey 1999a). Other scholars emphasise the fact that animist societies attribute social characteristics and human dispositions (conscious thought and socio-cultural patterns) to animals and other life forms. Such animist perspectives include directives, rules and taboos on how humans should interact with different animal species or classificatory groups (Arhem 1996). Humans may thus enter into a complex relationship with other life forms based on elaborate systems of exchange and reciprocity (Fienup-Riordan 1990; Arhem 1996). Kothari and Das (1999) explain that many indigenous societies, which are influenced by the animist perspective, believe nature to be an important component of the sacred realm because it is where the spirits reside. They state that these beliefs provide a basis for nature worship: certain animals, plants and landscapes are given divine status because they are imbued with spiritual power and are protected due to a fear of incurring the wrath of deities or spirits (Pierotti and Wildcat 1999). Pierotti and Wildcat (1999) describe how many indigenous peoples view certain animals and plants as ancestors, who existed before humans, and thus impart knowledge, act as teachers and are respected members of the community. The literature has many examples of cultural groups holding to an animist worldview (Fienup-Riorden 1990; Milton 1996; Ichikawa 1996; Masinde and Tavera 1999; Pierotti and Wildcat 1999).

The animist worldview significantly influences how people manage and value the landscape. Studies indicate that it has encouraged the protection of landscapes and

biodiversity. This is because nature is regarded as sacred and the emphasis is placed on conservation rather than progress (Miller 1998). Studies indicate that the world's biodiversity relates to the habitats of indigenous and local communities, who often hold many elements of the animist worldview (Hyndman 1994; Bharucha 1999; Kothari and Das 1999; Salmon 2000).

In many instances certain areas of the landscape are more imbued with spiritual power than others, and these are to be found in a range of habitats and include many different topographical features, for example sacred pools (Bernard 2003; Biegert 1999), forest groves (Wilson 1993; Bharucha 1999; Falconer 1999; Kothari and Das 1999; Laird 1999) and mountains (Bernbaum 1999; Palmer and Halbertsma 1999).

These sites of high spiritual intensity are found in both wild, natural places as well as domesticated zones that have been created or constructed by humans. Laird (1999: 351) explains that these areas are,

> "imbued with powers beyond those of humans; they are home to mighty spirits that can take or give life.....and include sites linked to specific events; sites surrounding temples; burial grounds or cemeteries housing the spirits of ancestors; the homes of protective spirits; the homes of deities from which priests derive their healing powers; homes to a powerful animal or plant species; forest areas that surround natural sacred features such as rivers, rocks, caves and 'bottomless' water holes; and sites of initiation or ritual".

These sacred areas have strict rules and regulations surrounding peoples' access to and use of the resources. They are places often associated with strict taboos out of respect and fear of offending the spirits that reside there. Consequently they often contain much biodiversity, including rare and endangered species, and hold pockets of what would have been natural vegetation across the landscape (Wilson 1993; Kothari and Das 1999; Laird 1999).

6.1.1 Animist beliefs among the Xhosa speaking groups in the Katberg

Literature indicates that the eco-cosmologies of the amaXhosa have many elements of the animist worldview (Hammond-Tooke 1975; Hirst 1990; Cocks and Moller 2002; Cocks and Wiersum 2003). The ancestral spirits are an integral aspect of this worldview and they are seen to permeate the natural world.

Past ethnographic studies on the Bantu people of South Africa, of which the Xhosa are a part, demonstrate that they place great importance on ancestral spirits (Shaw 1974; Hammond-Tooke 1975; Hirst 1990). The ancestors are regarded as the deceased members of one's paternal and maternal lines who continue their existence in the spiritual realm, but can influence and contact the physical realm through dreams, plants and animals. The most influential ancestral spirits are those of individuals who held authority when they were alive, for example homestead heads and clan chiefs (Hirst 1990). These ancestors are often associated with certain places in the environment and each clan is seen as having a strong link with one of the following: the river, the forest, the grasslands or the mountains (Hirst 1990). It is also believed that the ancestors can appear in dreams or in tangible form as a sacred wild animal *(isilo)* such as the snake, elephant or lion, which are associated and imbued with the power, fearsomeness and luck of the ancestors (Hammond Tooke 1975; Hirst 1997; Hunter 1979). The amaXhosa also believed that certain animals act as messengers, where they communicate the will of the ancestors to their descendents, either calling diviners or giving warning due to rituals being neglected. These include insects, birds, reptiles and amphibians (Hirst 1997).

The ancestors are believed to have great influence over the fortunes and misfortunes of their descendents (Hammond-Tooke 1989). When people perform the required rituals and show respect for the ancestors, the latter are believed to have the power to protect the living from evil forces and bring them luck, guidance and blessings. However, if the living neglect the ancestors they open themselves up to misfortunes and illness since the ancestors have little strength to help them against the evil forces. It is believed that the ancestors can send animals to alert the living that certain rituals are to be performed or to warn them of immanent danger. For example, if a swarm of bees enters one's home, one needs to make traditional beer, while the owl, hammerkop and dikkop (thickknee) are seen as messengers of impending danger and misfortune. This may either be an imminent attack from evil spirits and witches, an accident or some other misfortune (Hirst 1990). In some

instances it is believed that the ancestors can inflict harm on their descendents in order to discipline them for their lack of respect and failure to perform rituals (Hunter 1979). Appeasement of the ancestors through the performance of rituals and strict adherence to traditions is thus necessary to achieve health and prosperity (Hunter 1979; Hirst 1990; Cocks and Moller 2002). There are a variety of different rituals that are performed for the ancestors, which have diverse purposes, but they usually involve the brewing of beer and/or the sacrifice of a beast (McAllister 1997). In all of these rituals plants and animals play an integral role. There are a number of reasons why rituals should be performed. Hammond-Tooke (1975) identifies two main categories: a) life cycle rituals, which are performed for important stages of one's life, such as birth, initiation, marriage and death; and b) contingent rituals which are performed in response to particular signs, such as dreams, messenger animals and illness sent by the ancestors due to the neglect of custom.

Hammond-Tooke (1975), Hirst (1990) and Cocks and Moller (2002) all indicate that there is a strong belief in witches and evil spirits while Hunter (1979: 319) goes as far as to state that the belief in witchcraft and magic permeated "the whole of life" for the Mpondo people. Witchcraft and sorcery are blamed for many fatal or serious illnesses and people use many mechanisms to protect themselves. Most protective medicines against witchcraft and sorcery are derived from plants and animal extracts. For example, people often wash in medicinal plants to cleanse and protect themselves from evil (Hirst 1990; Cocks and Moller 2002).

The emphasis that is placed on the ancestors, witches and evil spirits, in the amaXhosa belief system, indicates the importance of the spiritual realm in influencing their daily lives.

The People of the River (*Abantu Bomlambo*) also influence the lives of the amaXhosa, where they play an important role in the initiation of diviners (Hammond-Tooke 1975) and are associated with the generation of water, rain, healing and fertility of the land (Hirst 1990). They are also dangerous as they can send illnesses called *umlambo,* which are characterized by pains and swellings of the body (Hammond-Tooke 1975). Hirst (1990) describes the People of the River as having fish-like tails, although they are human from the head to the waist. The literature is inconclusive as to whether they represent the ancestors (Hirst 1997) or not (Hammond-Tooke 1975). They are, however, closely associated with the ancestors and appear to operate in conjunction with them in the calling

of diviners (Bernard pers. comm. 2004). It is believed that the ancestors associated with the river live in a dry area, under the water of rivers, the sea and wetlands and lead a life similar to people in the physical world (Bernard 2003). They are particularly associated with deep river pools and these are regarded as sacred (Hammond-Tooke 1975). These sacred pools are used as sites for family rituals, where they appeal to the spirits for wealth, rain, good harvests and fertility (de Jager and Gitywa 1963; Bernard 2003). In return, participants give offerings of maize, sorghum beer, alcoholic spirits, tobacco and white beads (Hammond-Tooke 1975) during the important *intlwayalelo* rituals (de Jager and Gitywa 1963; Bernard 2003).

Sacred pools also play a key role in the training of diviners, where rituals are performed at certain stages of the initiation process (Bernard 2003). In rare cases a candidate diviner may be called under the river by the ancestors where they receive knowledge and wisdom from the People of the River (Hirst 1997). The amaXhosa describe this as a real physical submersion where they are taken through the water to the land of the ancestors, which is dry. The duration of being under water varies from a few hours to several years (Bernard pers. comm 2004). Certain animals are believed to be messengers from the People of the River, summoning the diviner under the water, and include the crab, otter, brown fly/horse fly, dolphin, snake, python, water monitor, hippopotamus, water duck, snake and frog (Hirst 1997; Bernard 2003). It is a great offence to kill any of these animals and if this taboo is transgressed it could result in drought and drying up of the water sources (Bernard 2003).

Hirst (1997) explains that Xhosa people view these sacred pools as extremely dangerous as they can cause drowning, especially if the People of the River are angered. This is backed up by Bernard (2003), who explains that in the past great care was taken not to anger the water spirits. Common people were forbidden to venture near sacred pools, as it was only those with a pure heart, such as diviners and chiefs, who were allowed to approach. In addition, only diviners requiring medicinal plants may harvest at the waters edge (Bernard 2003).

An important plant species associated with the People of the River, and central to many traditions, especially in connection with training diviners, is the sacred *ubulawu* (Hirst 1990; Luck 1999; Bernard and Khumalo 2004). This is the name given to the roots and bark of a variety of herbs and creepers, which produce white foam when ground to a

powder and stirred in cold water with a forked stick (Hirst 1990). This foam is important as it invokes the presence of the ancestors, which manifest themselves in the foam. When ingested it causes vivid dreams, in which the ancestors communicate with an individual (Hirst 1997; Luck 1999).

Cocks and Wiersum's (2003: 2) research reveals that a variety of wild plant products have high importance to the amaXhosa as they are widely used when performing their cultural practices and traditions. Importantly, their study was conducted in a village that had experienced disempowerment and modernization and thus indicates that although the amaXhosa have experienced dramatic change, they still practice and adhere to many traditional practices. In addition, Cocks and Mollor (2002) show that medicinal plants play an important role in amaXhosa religious beliefs, where they help to protect against evil spirits, are used during rituals, bring good luck, and remove poisons caused by witchcraft.

6.1.1.1 The importance of cattle in Xhosa life

The 'cattle complex' is a term used by anthropologists (Herskovits 1926; Hammond-Tooke 1975; Kuper 1982) to describe the central importance of cattle amongst the pastoral groups of sub-Saharan Africa. Although the Xhosa practiced both agriculture and pastoralism, Shaw (1974: 94) states that cattle were a man's "most treasured possession", his principle form of wealth and thus had high value. The concept of the 'cattle complex' thus emphasizes that the prestige, exchange and ceremonial value of cattle amongst these groups is more important than their economic value, and it is this principle that guides stock ownership and range management decisions (Kuper 1982). Despite major changes wrought by colonialism, apartheid and modernity this still holds true for many rural (and some urban) Xhosa speakers today.

Beyond cattle's economic and subsistence value (for meat, milk, dung, hides and as draft animals) they were essential exchange items and helped maintain good relations with the ancestral spirits and wider kin relations. Cattle still play a critical role in the performance of rituals; they are used for bride wealth, are important for social prestige (Hunter 1979; Kuper 1982) and provide an important form of insurance during economic crises (Ainslie 2002).

The high value that Nguni speakers attach to cattle is demonstrated by the complex system of describing and symbolically classifying each beast and that they are praised and celebrated in idioms, proverbs and songs (Shaw 1974; Hammond Tooke 1975; Hunter 1979; Kuper 1982; Poland *et al.* 2003). Hunter (1979) noted that the Mpondo had 57 different terms for describing cattle that were each known individually by name. A recent publication by Poland *et al.* (2003) demonstrates the complexity of the symbolism involved in the classification of cattle among the Zulu and how this is based on analogies with species from the natural world (i.e. birds, plants etc). This aesthetic appreciation for cattle was expressed in the following response by an Mpondo informant to an explanation of the problems of overstocking: "Oh but we love to fill our eyes with cattle" (Hunter 1979: 70). The importance of having cattle still continues in contemporary Xhosa society (Ainslie 2002).

As already mentioned, cattle are intimately linked to the spiritual realm and this is demonstrated in their system of stock management (Shaw 1974; and Hunter 1979). For example, Shaw observes that the Bantu peoples:

> ....bury doctored sticks in the kraal [cattle byre] to protect the cattle from witchcraft and disease; they sprinkle their cows and inoculate their bulls with certain medicines to stimulate fertility; they burn other medicines to promote the general well being of the cattle; and as an additional safeguard forbid newly-widowed and other ritually impure persons to approach the animals closely" (Shaw 1974: 96).

In addition, people consult diviners about their cattle, and the death of cattle is often blamed on witchcraft and sorcery (Hunter 1979).

The kraal (cattle byre) is where the livestock are housed at night time. It is a circular enclosure made from the branches of various species such as *Olea capensis* and *Ptaeroxylon obliquum* (Shaw 1974). The kraal is central to village life, and is where most of the rituals are performed and the head of the family is often buried. Because of its ritual significance most households construct a kraal, even if they don't own any cattle (Shaw 1974). Cattle are associated with the men of the household and the kraal is a gendered area where women are forbidden to enter.

Goats are regarded as the poor man's cattle. Although they play the same roles and are substitutable for cattle, they are not as effective, invoke far less emotion and are never praised (Hunter 1979; Kuper 1982).

This chapter focuses on the worldview and eco-cosmology held by the majority of amaXhosa in the Eastern Cape.

My key questions were as follows:

1. What are the worldview and eco-cosmologies held by the majority of amaXhosa in four villages in the Kat River valley; namely Cathcartvale, Tidbury, Ntlini, and Fairbairn, particularly as they relate to the ancestors and traditions?
2. What impact has this worldview and these eco-cosmologies had on local people's perceptions, values and management of their local environment?

6.2 Methods

The following list of methods provided the information for this chapter. The methods carried out in Cathcartvale are explained. This is followed by those conducted in Tidbury, Fairbairn and Ntlini. As explained in chapter two (the study area), Cathcartvale was my main research site, while Ntlini, Tidbury and Fairbairn were secondary research sites. Data collected during previous research (Fox 2002; Fox and Shackleton 2003) is used as a supplementary source for this thesis.

6.2.1 Cathcartvale

In Cathcartvale the following methods were employed:

- Thirty-six semi-structured interviews.
- A household survey of resource use.
- Two transect walks to sacred pools.
- Ten focus groups focussing on sites and species of value.

- One focus group, which examined the benefits to local people of each voucher specimen, as explained in chapter five.

The interviews focussed on a number of themes and these included the following:

- Xhosa identity.
- Xhosa values.
- Cultural change.
- The importance of traditions.
- The importance and role of the ancestors, their character and connection with the natural environment.
- The importance of being buried next to the graves of one's relatives.
- The value the villagers attach to Cathcartvale.
- The relationship the villagers have with their natural environment.
- Sacred pools – their importance, description, ecosystem function, harvesting restrictions, taboos, peoples feelings about them and the first words that come to mind when they are thought of.
- The five most important plant species to a Xhosa person.

Due to the complexity and depth of some of the themes the interviews were semi-structured, where I focused on particular themes, yet the questions varied between informants, depending on how the interview was progressing, the informant's knowledge, their interest and how much time was available. Sampling of informants was purposive, and included those selected at a community meeting for the depth of their knowledge. Sampling was also based on opportunity, where villagers were interviewed when an opportunity presented itself. For example, some interviews were conducted with people relaxing outside their homes. In addition, informants were selected on a random basis where I went from household to household. When somebody was available and willing, they were interviewed. Key informants, identified from this process, were interviewed more intensively. Informants included males and females of different age groups (young adults, middle aged and old people). See table 6.1 for a summary of the age groups and gender of people interviewed.

Table 6.1: Summary of the gender and age groups of interviewees.

Age category	Female	Male	Total
20-40	7	3	10
40-60	4	4	8
60 +	13	5	18
Total	24	12	36

The structured household survey of resource use conducted with the majority of households (47), provided quantitative information. Informants were asked the following relevant questions:

- Do they respect and revere the ancestors?
- Do they practice traditions? This refers to the ritual observances, practices and taboos that were adhered to by their forefathers.
- When did they perform their last household ritual?
- Where were they born?
- Would they hypothetically accept R1 million in exchange for leaving their village?
- Do they use and/or harvest medicinal and cultural plants?
- Has the abundance of these plants changed over the years?

The questions were open-ended. Data analysis was based on grouping questions into those that were similar.

Two separate transect walks to the sacred pools that occur in the river stretch associated with Cathcartvale were arranged. For each transect walk I was accompanied by a different informant. This validated the information collected, because the informants took me to the same sacred pools, and I could assess whether their feelings and responses to the different sacred pools were similar. At each sacred pool GPS readings were taken and the character of the pool was recorded on a tape recorder. Informants were asked the following questions: "What are your feelings regarding the particular sacred pool and why?"; "How important is the sacred pool for traditions?"; "Do the People of the River and ancestors live in the sacred pool?"; "Are you allowed to harvest resources from the sacred pool?" and "How has the sacred pool's character changed since the white farmers were here?". Questions relevant to each sacred pool were also asked. This information was recorded using a tape recorder. These walks provided valuable data in terms of:

- The character of sacred pools and how this relates to the presence of ancestors, the People of the River and practice of traditions;
- The informants' behaviours associated with sacred pools, depending on their natural condition; these were indicative of their emotions and reverence to the sites.
- The taboos associated with the different sacred pools.

Valuable data was also obtained from the ten focus groups. This method is described in chapter five. These focus groups allowed me to compare the importance of sites and species of cultural and consumptive value. These focus groups also stimulated discussion regarding the benefits of cultural resources and their significance to the lives of the amaXhosa in Cathcartvale.

Relevant data was also gathered during the two-day focus group, which examined the benefits of voucher specimens. This method is explained in detail in chapter five. This focus group provided semi-quantitative information regarding the usefulness of the different species, the percentage of species that have medicinal and cultural value, and any traditional management practices they have in place.

6.2.2 Tidbury, Fairbairn and Ntlini

The following methods were used in Tidbury, Fairbairn and Ntlini.

- Two stages of structured interviews were conducted with thirty respondents in each village. Informants were selected on a random basis, which revealed whether the informant was available and willing to be interviewed or not. About 65% of the informants were female and the three main age groups were between twenty and forty, forty and sixty and above sixty. The exact number cannot be provided because I was not rigorous enough in capturing age groups, and sometimes I did not record the gender.
- A one-day workshop held in Tidbury village.
- Five or six intensive, semi-structured interviews were conducted with key informants in each village.

The first set of structured interviews had three main focuses; i) the amaXhosa religious beliefs and eco-cosmologies ii) the perception of the environment as a whole and its importance, and iii) the sites and species of cultural significance, with associated taboos. See appendix 5 for the interview structure. This set the stage for the second set of interviews where informants, not necessarily the same as those interviewed in the first stage, were asked to rank the relevant cultural sites and species identified in the first stage. Sites and species of use value were also included to enable one to compare the relative importance of cultural resources. In this exercise, the participants had to accord beans to various sites and species, they also had to rank them in terms of importance, with 1 equalling most important, 2 equalling second most important and so forth. These values were tallied, averaged and the relevant rank was determined for each species and site. It is important to note that some of the species and sites differ between Tidbury and the other two villages. The reason for this is that Tidbury villages placed different value on a few sites compared to the other two villages. To gauge the importance of cultural sites informants were also asked what would happen if they were destroyed. See appendix 5 for the interview structure.

These two sets of interviews provided a preliminary understanding of the cultural practices of the amaXhosa in the Kat River valley and helped identify and obtain a relative value of the cultural sites and species important to the villagers.

In addition to the two sets of interviews, a one day workshop was conducted in Tidbury village. Tidbury was chosen because I felt that the workshop would be most beneficial in this village due to its size, where the whole village was welcome to participate. About sixty people, mainly women and children, attended the workshop. The structure of the workshop was guided by the Participatory Rural Appraisal (PRA) approach (Chambers 1992), where a species list, involving the species that are important for religious beliefs and rituals, was drawn up by the participants. This step was used to identify the species of significance and get people relaxed and thinking about relevant issues.

Secondly, a 'forum-theater' (Motteux 1999), which ultimately involved all participants, was held and documented on video. This exercise was beneficial as it provided a fictional context in which villagers could participate and interact with others in the group. This provided a useful forum in which the people could reflect on and internalize the key issues (Mottuex *et al.* 1999). The first aim of this 'forum-theater' was to introduce the main

themes of the workshop to the participants, namely the cultural importance of the environment. To achieve this a number of scenes were acted out by the children of Tidbury village, which was followed by three acts performed by a local drama group with extensive experience in the region. Throughout this exercise individuals from the audience were encouraged to participate. The second aim was to enable participants to act out their frustrations and fears at the potential threat of being moved from Tidbury village. All participants became involved in the play. The drama group acted as 'government officials' who informed the 'villagers' that there was a development project earmarked for the area and that the 'villagers' had to leave and go to live in an urban centre. A number of the participants had been involved in similar activities through Nicky Motteux's work in the Kat river region (Motteux *et al.* 1999) and it was, therefore, understood that this was not a real situation. This exercise acted as an important means to identify the sites and species of cultural value, and also to indicate how the participants value their village life and community as a whole.

In addition, five to six semi-structured interviews, equally distributed in terms of gender, were conducted in each village. The choice of these key informants was based on previous interviews, where those who showed the most interest and knowledge about environmental and cultural issues were chosen. Table 6.2 summarizes the gender and age groups of these key informants.

Table 6.2: Gender and age groups of key informants.

Gender	Tidbury	Fairbairn	Ntlini	Total
Male (40-60)	1	1	-	2
Male (60-80)	3	2	2	7
Female (60-80)	2	2	3	7
Total	6	5	5	16

Questions focussed on the following themes:

- The importance of the natural environment.
- Local people's definition of a healthy environment.
- Benefits of a healthy environment to the community.
- People's relationship and feelings towards a healthy environment.
- Factors leading to a healthy environment.
- Local people's definition of a degraded environment.
- The ancestors' feelings towards a degraded environment.

These intensive interviews promoted in-depth answers from informants. As a result the interviews provided significant insight into the beliefs and values held by the local villagers and the affect that these values and beliefs have on their relationship with the local natural environment.

6.3. Results

6.3.1 The significance of traditional practices/rituals

The results summarized in table 6.3 indicate that the villagers regard the performance of traditional rituals as that which defines them as Xhosa people. A large percentage of informants observe their traditions, with the majority of these (83.3%) being performed within the last two years.

Table 6.3: The importance of traditional rituals to Xhosa identity.

Village	Question	Response	Percentage frequency	No. of informants
Cathcartvale	Define a Xhosa person.	Belief in and practice of traditions/rituals.	100	6
Tidbury	How would you categorise yourself in terms of culture and belief?	Xhosa because of the practice of traditions/rituals.	74.1	20
		Xhosa because of belief in the ancestors and the practice of traditions.	7.4	2
		coloured, therefore claimed to have no traditions.	18.5	5
Cathcartvale	What is of value to a Xhosa person?	Traditions/rituals.	58.3	7
		Livestock and cultivating fields.	33.3	4
		Emulating the forefathers.	8.3	1
Cathcartvale	Do you practice traditions (rituals)?	Yes	91.7	44
		No	8.3	4
Cathcartvale	Do you believe in and revere the ancestors?	Yes	86.4	38
		No	13.6	6
Cathcartvale	When did you perform your last tradition (ritual)?	This year.	50	15
		Last year.	33.3	10
		Within the last four years.	6.67	2
		A long time ago.	10	3

The most commonly cited reason for the practice of traditions/rituals is that it is an act of obedience and respect for the ancestors. This is seen as critical as the ancestors control the villagers' daily lives, and can either bless the villagers in terms of health, prosperity and protection or else cause misfortune and sickness. The following three statements given by informants highlight this:

> *"The ancestors are still important because they are saving us in many things. Maybe there is an accident that is going to happen to you. Then that night you will dream of the ancestors telling you not to go there because you will fall in danger."*

> *"If you don't do traditions, make traditional beer and slaughter cows, the ancestors will be angry.... If they are angry, the whole family can die. Maybe today your brother is stabbed, tomorrow another one gets sick."*

> *"Ancestors are happy when you do things they want you to do. If you don't do things your father did, the ancestors won't be happy, livestock will not increase. Your social life will be full of ups and downs because you are not following in your fathers steps".*

The main purpose for conducting rituals is to appease the ancestors and thus maintain a state of well-being and remain in good health. These include rituals that should be undertaken at certain stages of a person's life, as well as a particular ritual required by an ancestor. The ancestors use the following means to request the performance of a ritual; through an *igqira* (the Xhosa name for a diviner), a dream or a sign from the natural environment. If the relevant individual does not obey this request the ancestors become angry and illnesses, especially those termed 'cultural sicknesses,' are often the result. These include bed-wetting and social misbehaviour by children and teenagers.

The brewing and offering of traditional beer (made from maize and sorghum), and/or the ritual sacrifice of a cow or goat are regarded as the essential ingredients for traditions. High value is thus placed on livestock, not only because they supply one with meat, milk, and act as a bank for times of crises, but they are also critical to the performance of rituals. Biodiversity, in the form of significant ritual plants, is as important as livestock for rituals

as they are the means by which the living, the ancestors and the beast are connected through the ritual sacrifice. Strict requirements are thus necessary for traditions to be acceptable to the ancestors and these are often rituals directly related to the use of the natural environment.

6.3.2. Sites of cultural value

When questioned, informants described how there are certain sites in the environment that are critical to the performance of rituals. These include sacred pools, burial grounds, kraals, the bush/dense forests and initiation sites, which each play a role in maintaining Xhosa culture and identity. It is at these sites where they can access their ancestors, as they are regarded as places of high spiritual intensity. They are also the portals where diviners can cross to the spirit world.

These sites are thus crucial to maintaining contact with the ancestors and ensuring the well-being of Xhosa people. This became clear when respondents were asked what would happen if these sites were to be destroyed. The following quotes are a representative sample of what people believed would be the consequences.

> *"It means that the ancestors would be homeless."*
>
> *"That can't happen here at this village because our health depends entirely on these sites."*
>
> *"We may be mentally ill. People could be mad."*
>
> *"Means death."*
>
> *"Means that our culture is dead".*

In the next section I will focus on the importance and value that the villagers placed on sacred pools.

6.3.2.1 Sacred Pools

Sacred pools are important for maintaining contact with the ancestors as it is believed that certain ancestral clans live under the water and carry out an existence similar to people in the real world, where they also have livestock and huts. Sacred pools are also home to the mermaid-like People of the River (*Abantu Bomlambo*) who are also involved in the training of certain healers. Occasionally, a chosen novice may be taken under the water by a snake-like force where they meet the spirits who teach them the art of healing. These sites thus provide a place of direct communication with the spirit world, where the amaXhosa can access blessing and health and also provide thanks and veneration through the performance of particular rituals. The sacred pools are therefore critical points in the landscape, where culture and connection with the ancestors is maintained. As one informant stated, "*It is where we work and practice our beliefs*".

Informants gave three common reasons for the importance of sacred pools. Firstly, *amagqirha* receive their training at sacred pools and will occasionally be "*taken under the water*" to be directly taught by the ancestors. This experience was described by a number of informants, and involves submersion under water at a sacred pool. The novice *igqirha* may be gone for a period of a couple of days to a number of years. It is imperative that the relatives do not mourn or cry for the individual who has been 'taken' or he/she will not be returned alive. If the villagers do not mourn, the person will come back as a very powerful *igqirha*, having been trained by the ancestors and People of the River in the spiritual realm. Secondly, sacred pools are important for the performance of rituals, especially those connected to the training of *amagqirha*. Thirdly, rituals are also performed to counteract illness experienced by an individual, not necessarily an *igqirha*. Informants thus equated their life and health to the performance of these traditions: "*Sacred Pools are very important to the people because the life of the people are dependent on sacred pools because our traditions are performed by amagqirha there in sacred pools*".

Sacred pools are also places where Xhosa people can be healed from physical sickness, for example wounds and rashes and certain illnesses associated with cultural factors (urinating while sleeping, mental disorders and behaviour that will lead one to jail). These cultural services are, however, most evident when sacred pools are healthy because the ancestors then reside in the area and are at their most powerful. A healthy sacred pool is regarded as one that is big; has deep, dark water that prevents you from seeing the bottom; is

aesthetically pleasing and has a number of plants associated with the People of the River growing on its banks and hanging over the water. These plants are discussed below. The common perception is that if these pools become environmentally damaged, or disturbed by the presence of too many people who are not entitled to go there, then the water spirits will move to another location that is more suitable. Correspondingly, those pools that have been abandoned have no spiritual power that the local people can access. Droughts or other extreme climatic conditions may also result. This would have a devastating impact on the local community's health and environment. Thus when asked, "What would happen if sacred pools became degraded or disappeared?" informants gave the following responses: "*we would get sick*", "*we would be in danger*", "*we could become blind*", and "*we can't be alive*". These responses are a sample to give an indication of the villagers' thoughts on this. The following quote sums up the importance of sacred pools for individual and community health. When asked if "the ancestors would be better able to help if the river was more natural?" the informant replied that *"if it was natural, we'd be stronger. Your physical health would be better as well, and the unity in the village would be stronger"*.

In the research area sacred pools are typically large pools of still deep water, with water flowing above and below, they often have steep banks, are described as being 'dignified', in other words heavy with presence, and are surrounded by particular species of trees and plants. The two most important plants are *Salix capensis* (umNgcunube), a species of river willow which is regarded as the tree of the People of the River, and *Typha capensis* (Umkhanzi). A number of informants stated that the presence of these two plants indicates the presence of the ancestors and the People of the River, and that traditions are usually only performed in sacred pools where these two plants are found. Plate 6.1 is an example of a important sacred pool in the Kat River valley, and plate 6.2 shows an example of a *Salix capensis* growing next to a sacred pool.

Because sacred pools house the People of the River, and are characterised by large pools of deep, dark water, they are deeply revered places and are surrounded by mystery and fear. A number of informants refused to talk about sacred pools because they feared they may attract the attention of the water spirits and may consequently be called to become an *igqirha*. Other informants described how scared they are of venturing too close in fear of disturbing the ancestors and the People of the River. This would incur their wrath, manifesting itself either in illness, a physical aliment such as a body rash or infection, drought or even death, especially by drowning. When informants were asked for "*the first*

words that come to mind when they think of sacred pools", four mentioned drowning or death, while two mentioned these as a consequence of disturbing the ancestors.

There are numerous taboos associated with sacred pools, and many people adhere to these in fear of angering the ancestors and the People of the River. Firstly, due to their sacred nature, people are normally only allowed to go to sacred pools when being trained as a diviner or if a special ritual is going to be performed, to propitiate to the ancestors, to ask for help, or to combat a cultural illness. Secondly, resources, even dry wood, are not allowed to be harvested around sacred pools unless one is an *igqirha,* or if the species are needed for a ritual being performed there. The following quote expresses many similar held sentiments:

> *"People don't just go and harvest near sacred pools because they could be punished by people of the river, maybe either as a drought, or you become blind or you become sick".*

In particular, strong emphasis is placed on not harvesting the trees of the People of the River, for example *Salix capensis* (umNgcunube) and *Typha capensis* (umkhanzi*).* Taboos also prevent villagers from fishing, swimming, washing clothes or collecting water from sacred pools unless there is a drought. In this case special permission must be obtained from the ancestors. Thirdly, people can only approach sacred pools at certain times of the day, when the ancestors are not resting. After dark, early in the morning and midday are forbidden times of the day, because this is when the ancestors are active and are likely to emerge out of the water to graze their stock. Finally, because crossing a sacred pool is generally taboo and dangerous, the relevant person must throw a stone requesting permission from the ancestors to do so.

The two transect walks to the sacred pools in Cathcartvale revealed that people's attitudes and adherence to the above taboos varied between sacred pools. Those that had the largest area, deepest water, steepest banks, most dense vegetation or relevant tree species growing on their banks, in other words those that are most 'dignified' (imbued with spiritual presence), elicited the strongest response from my two informants.

To illustrate this I will describe the informants' reactions to three sacred pools that had the above characteristics, compared to two that were less "dignified".

Plate 6.1 An important sacred pool in the Kat River valley.

Plate 6.2 Salix capensis growing next to a sacred pool.

The first sacred pool was fairly wide, with deep, dark water, and tall *Acacia mearnsii* trees growing on its banks. In addition, two river ducks flew off when we arrived. An informant described that the presence of these birds means that the People of the River live here, and because the water is deep and dark, and looks 'dignified', he is afraid of it and people cannot come and fish or swim here. The second sacred pool was also broad and looked deep, and was fairly inaccessible due to dense vegetation growing around it. The two informants both reacted strongly to this pool, explaining that the indigenous trees make it more "*dignified*", and that they are both scared of it because it is so *"big and deep and too dignified"*. They stated that *amaggirha* thus *"love to work or perform their ceremonies in sacred pools like this one which are broad and have a lot of dignity."* The third sacred pool is the longest and is also deep and has two very tall *Salix capensis* trees growing beside it. An informant explained that this pool is extremely dangerous and one would not come here to harvest resources unless one is an *igqirha.* This is due to the fear of being taken under the water and drowning.

The two pools that the informants were not scared of had the following characteristics: the first one was small, the water was brown and it was surrounded by a lot of *Acacia karroo* trees. An informant explained that people are not afraid of this pool, where they come here to swim and wash themselves. Rituals are also not performed in this sacred pool because it is too small. The second sacred pool, although fairly deep, was located next to a road often travelled by people, and was adjacent to some fields. An informant explained that the People of the River do not live here because, as he described, it is dirty where there are branches in the water.

As the indigenous trees growing around sacred pools increase, people's feelings towards them change. For example, an informant described how villagers were previously not scared of a certain sacred pool and used to swim there when they were young. However, he explained that since the vegetation has become more dense the pool has become *"a little bit dignified"*, and consequently people are afraid to go there. This fear is related to the belief that, due to an increase of vegetation, the river spirits may be there. Children are thus no longer allowed to swim in this particular sacred pool. Dense, indigenous riparian vegetation is thus indicative of ancestors' favoured spots and a greater presence of the water spirits.

This is different to the research findings at Ntlini and Fairbairn, which have both experienced a decline in the quality of sacred pools. Indicators that reflect their decline are a decrease in water depth, unhealthy and brown water, litter and the destruction of surrounding trees by floods. Respondents explained that because they have lost their dignity, people no longer respect and care for sacred pools and consequently children swim and *"throw empty bottles and cans there."* This compares to the past where *"when you looked at it you were afraid to go near it* [the sacred pool]".

Sacred pools play a practical role in the lives of the villagers. Ten of my informants, often without being asked directly, indicated that in comparison to the rest of the river, sacred pools never dry up. The reason for this is explained in the following informant's quote: *"Sacred pools will never become totally dry because those people living there* [the People of the River] *will never allow that. If the water is going down they will ask for rain".* Sacred pools consequently become important water sources during times of severe drought. In addition, numerous informants described the environmental benefits of sacred pools where they *"provide protection for certain animals and insects"*, are home to many birds nests, provide a place for wild animals to drink *"and beautiful trees will always be found surrounding sacred pools".* An informant explained why this is the case: *"As we respect sacred pools, most of us are afraid to even go near sacred pools. So those things are protected. We don't want to touch the things that are there".* This demonstrates the villager's awareness that human presence and resource use can have negative impacts on ecosystems. The consequence is that the vegetation surrounding sacred pools is more dense than that surrounding the rest of the river and provides a protective canopy. One can assume that this would reduce the effect of evaporation and drought. Another interesting factor is that informants described how *Salix capensis* has the ability to regulate the temperature of water, *"helps keep the banks stable",* and also enhances water quality. This is because the roots act as a filter, removing foam and dirt.

6.3.3 Plant and animal species of cultural value

6.3.3.1 Plant species

The seven plant species indicated in table 6.4 are highly valued by the amaXhosa in the four villages due to their cultural function. These plant species are crucial in maintaining the Xhosa way of life as they are necessary for the successful performance of rituals. If

requirements, such as the use of certain plants (*Olea europaea* subsp. *africana* in particular), are violated the ritual may be rejected by the ancestral spirits, and illness may result. There is thus a supposed strict adherence to the use of specific species. Plate 6.3 shows an example of *Olea europaea* subsp. *africana* and plate 6.4 is a group of *Salix capensis*.

A number of results validate the above statement that cultural species are highly valued by the amaXhosa in the Kat River valley.

When asked "*which species are most important to Xhosa people*", and "*which species does one find in a healthy environment*", the response was often those which are important to their ritual traditions, as indicated by the following quote:

> *"The most important species are ones for traditions: umnquma (Olea europaea* subsp. *africana), umdubi (Combretum* sp*) and umNgcunube (Salix capensis). These are most important to the life of a Xhosa person. And also plant used in traditions is ubulawo (Alepidea serrata* and many others*) and used together with those trees I have mentioned".*

When asked what would happen if these species were to be destroyed the responses, although variable, always gave a negative response. Comments included that the ancestors would be angry, the people wouldn't enjoy life, the villagers would suffer because they wouldn't be able to perform their rituals and culture, and ultimately that their nation would die, as indicated by the following two quotes:

> *"This would mean that the nation would be killed, particularly Tidbury village: it would destroy our culture."*

> *"Simply means the destruction of Xhosa people if these things are taken away from us".*

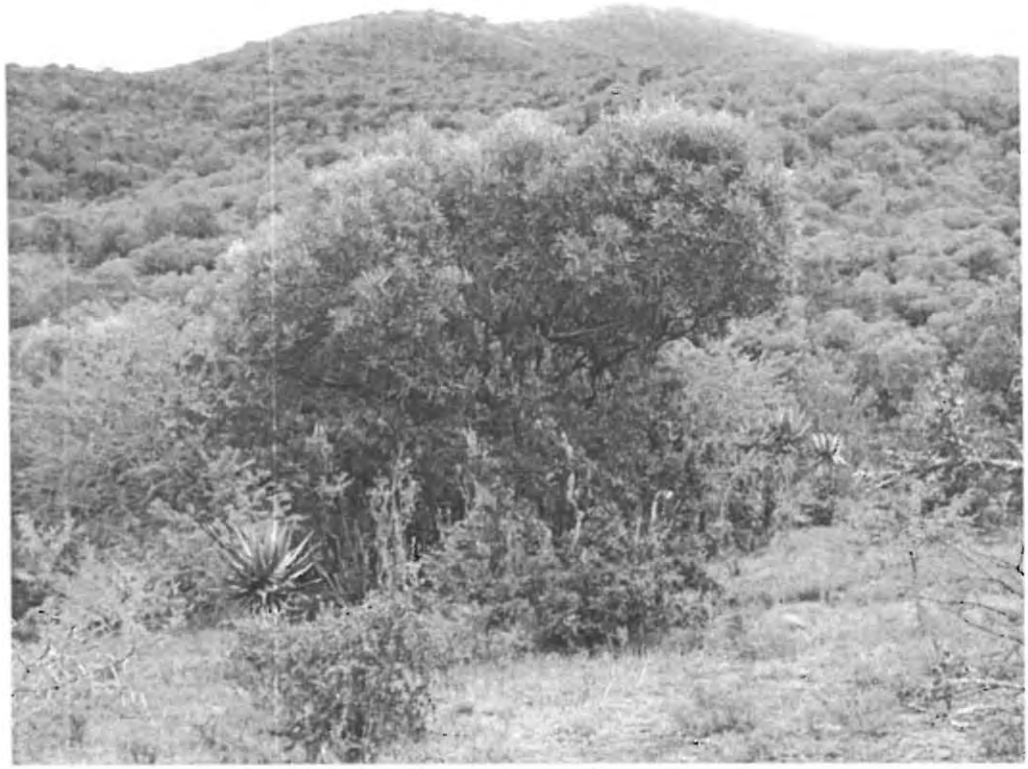

Plate 6.3 *Olea europaea* subsp. *africana*.

Plate 6.4 A group of *Salix capensis*.

Table 6.4 Plant species of cultural value to the amaXhosa in Tidbury, Fairbairn, Ntlini and Cathcartvale.

Xhosa Name	Scientific name	Cultural value	Use
Umnquma	*Olea europaea* subsp. *africana*	Extremely important	The branches are used as a plate on which the ritual meat is served.
Umthathi	*Ptaeroxylon obliquum*	High importance	Used to cook the parts of the slaughtered animal. Only eaten by members of the family performing the ritual.
Ubulawu	Ubulawo is a generic term that covers a suite of species. The species that is used depends on which clan one belongs to.	High importance	Used as a foam, which is drunk by both participants and the sacrificial animal. Ubulawu is believed to connect one to the ancestors. It is also taken orally by diviner novices for purging and as a spiritual cleansing agent to give clear dreams.
Umgcunube	*Salix capensis*	High importance	The branches are used to build the tent and mat, on which the *igqirha* trainee sleeps during the *fukuma* ritual[1]. When approaching a sacred pool the bark of this tree must be put in one's hair and on one's wrists.
Umkhoba	*Podocarpus latifolius*	Important	The ritual meat and traditional beer are laid on a mat made from the branches of this tree, which stays in a certain room in the house.
Umdubi	*Combretum erythrophyllum* or *caffrum*	Important	The *igqirha* trainee's tents may be built from this tree.
Umzi	*Cyperus textiles*	Important	When a goat is slaughtered for a young child, umzi is worn as a necklace to ward off evil spirits. It is also used to make traditional mats, which respondents stated are very important for Xhosa culture.

In addition, the ranking exercises undertaken in Tidbury, Fairbairn, and Ntlini, where species of both cultural value and use value were ranked against each other, reveal the importance of these species (see table 6.6). Refer to the methods section for an explanation of how the ranking scores were derived, where the lower the score the higher the rank. In Tidbury, of the top five ranked species, four of them, *Olea europaea* subsp. *africana*, *Ptaeroxylon obliquum*, *Cyperus textilis* and *Salix capensis*, had cultural significance. The average rank for cultural species is 4.34 compared to species of use value, 5.77. A Mann-Whitney U test indicates that the rankings of cultural species, compared to species of use value, is not significant (p=0.061). In both Fairbairn and Ntlini the first three ranked species all had cultural value, namely *Olea europaea* subsp. *africana*, *Ptaeroxylon obliquum* and *Alepidea serrata*. The average rank of cultural species in Fairbairn is 5.32

[1] The *fukuma* ritual occurs during a novice's training where he/she stays in a ritual seclusion hut, situated near a sacred pool, for a short period of time.

while the species of use value is 6.3. A Mann-Whitney U test indicates that these rankings are not significant (p=0.314). The average rank of cultural species in Ntlini is 5.56, while the species of use value is 6.2. A Mann-Whitney U test indicate that there was no significant difference between rankings of species with cultural and use value (p=0.464).

Table 6.5 indicates that cultural species are also of high priority in Cathcartvale, where the average rank obtained from the ten focus groups was second. See the methods section in chapter five for the explanation about how this rank was determined.

Finally, species of cultural value obtain special protection. This was indicated by many informants who stated that people should not harvest *Olea europaea* subsp. *africana*, *Salix capensis* and *Ptaeroxylon obliquum* unless they are required for ritual purposes. In theory these species are thus not utilized for general fuel wood purposes and building materials.

Table 6.5 The average ranks of resources from ten focus groups in Cathcartvale.

Ranking	Resource
1	Mountain water
2	Cultural species
3	Fuel wood
4	Livestock
5	Medicinal plants
6	Building materials
7	River water
8	Agricultural crops
9	*Imifino* (wild vegetables)
10	Honey
11	Wild fruits

Although a number of informants in Cathcartvale indicated that they do use *Olea europaea* subsp. *africana* and *Ptaeroxylon obliquum* for building material, and *Olea europaea* subsp. *africana* for fuel wood, a large percentage stated that *Ptaeroxylon obliquum* is not used as a building material. The main reason is because it is a cultural species. This differs from the time when the white farmers lived in the area, when it was heavily harvested for this purpose, as stated by local people. Twenty-one of the 22 informants in Cathcartvale believe that cultural species have increased since the white farmers left the valley. The community committee of Cathcartvale have had a significant influence on resource use through instigating a number of rules that prevent over-utilization of resources. See chapter five for a description of these environmental rules. Emphasis is placed on the importance of not destroying *Olea europaea* subsp. *africana* and *Ptaeroxylon obliquum*. A number of

informants stated that these are not allowed to be harvested at all, unless a few branches are required for a ritual, while others said that they can only be harvested when they are dry. The consequence for disobeying this rule is a fine imposed by the community committee. This differs from Fairbairn and Ntlini, which are both experiencing a loss of traditional values. In these cases informants expressed a concern that *Ptaeroxylon obliquum* and *Olea europaea* subsp. *africana* are increasingly scarce as people no longer protect them the way that they did in the past, as indicated by the following quote: "*In the past there were trees which were not just harvested. They were harvested for certain reasons. Trees like umthathi* (*Ptaeroxylon obliquum*), *umnquma* (*Olea europaea* subsp. *africana*), *igqange* (*Buddleja* sp.) *and umkhobe* (*Podocarpus sp.*). *They were only harvested for serious reasons. Not just anytime feel like harvesting them*".

Table 6.6 The ranking of species of cultural and use value in Tidbury, Fairbairn and Ntlini (species of cultural value are underlined).

Tidbury				Fairbairn				Ntlini			
Species	**Xhosa name**	**Rank**	**Score**	**Species**	**Xhosa name**	**Rank**	**Score**	**Species**	**Xhosa name**	**Rank**	**Score**
Olea europaea subsp. *africana*	Umnquma	1	2.1	*Olea europaea* subsp. *africana*	Umnquma	1	3.1	A suite of species depending on one's clan	Ubulawu	1	3.1
Ptaeroxylon obliquum	Umthathi	2	3.4	*Ptaeroxylon obliquum*	Umthathi	2	4.7	*Olea europaea* subsp. *africana*	Umnquma	2	3.5
Amaranthus hybridus	Imifino	3	3.7	A suite of species depending on one's clan	Ubulawu	3	4.9	*Ptaeroxylon obliquum*	Umthathi	3	4.6
Cyperus textilis	Umzi	4	4.6	Citrus (orange)	Iorange	4	5	Citrus (orange)	Iorange	4	5.1
Salix capensis	Umgcunube	5	5.5	*Cyperus textilis*	Umzi	5	5.1	*Amaranthus hybridus*	Imifino	5	5.1
Citrus (orange)	Iorange	6	5.6	*Amaranthus hybridus*	Imifino	6	5.1	Acacia karroo	Umnga	6	5.8
Opuntia ficus-indica	Itolofiya	7	5.6	*Acacia karroo*	Umnga	7	5.9	*Cyperus textilis*	Umzi	7	6.1
Acacia karroo	Umnga	8	5.7	*Opuntia ficus-indica*	Itolofiya	8	6.5	*Opuntia ficus-indica*	Itolofiya	8	6.2
Combretum sp.	Umdubi	9	6.1	*Salix capensis*	Umgcunube	9	6.8	*Salix capensis*	Umgcunube	9	6.5
Scutia myrtina	Isiphingo	10	6.4	*Combretum* sp.	Umdubi	10	7.3	*Combretum* sp.	Umdubi	10	7.1
Maytenus heterophylla	Umqaqoba	11	6.5	*Limeum aethiopicum*	Umula	11	9	*Limeum aethiopicum*	Umula	11	8.8
Schinus molle	Peperboom	12	6.9								

A high percentage (53.08%) of plants in the environment have medicinal value. This is based on the benefits of voucher specimens as identified in a two day focus group. This method is explained in chapter four. Table 6.7 gives a percentage breakdown of their different medicinal uses. The use of medicinal plants is closely related to their cultural beliefs, where 33% are used to manipulate the spiritual realm. This includes plants used for steaming, emetic and washing purposes. These are used for purification purposes and to prevent contamination from both the physical and spiritual forces. For example, they help ward off evil spirits. Thirteen percent of the plants are used for cultural and ritual purposes. Informants explained that the identification of their medicinal value is often a consequence of the ancestors who, through dreams, inform people of the species that have healing properties.

Table 6.7 Medicinal plant uses.

Reason for importance	No. of plants (N=77)	%
Physical ailments.	43	55.8
Steaming, emetic purposes and washing to protect individuals from evil spirits, or rid the body of them.	16	20.8
Protection from evil spirits.	14	18.2
Good luck.	12	15.6
Cultural and ritual purposes.	10	13.0
Livestock ailments.	7	9.1
Prevent bad luck.	4	5.2
Destroy illnesses caused by witchcraft.	3	3.9
Love charms.	2	2.6
Prevent lightning.	1	1.3
End conflicts.	1	1.3

Table 6.8 indicates that a large percentage of the population (71.4%) in Cathcartvale utilize medicinal plants, while a smaller percentage (50%) actually harvest them.

Table 6.8 Medicinal plant use in Cathcartvale.

Question/data	No. of respondents	No. of respondents (%)
Use medicinal plants	30	71.4
Collect medicinal plants	21	50
Do not use medicinal plants	12	28.57
Do not collect medicinal plants	21	50

Some potentially useful species are not harvested due to various cultural beliefs. Examples include *Phytolacca dioica* (Isidungamzi), *Ziziphus mucronata* (Umphafa), *Cassine aethiopica* (Umbomvana), *Hippobromus latifolia pauciflorus* (Ulathile), *Cussonia paniculata* (Umsenge),

Euphorbia triangularis (Umhlontlo), Azima *tetracantha* (Igcegceleya) and *Diospyros lycoides* (Umbongisa). *Cassine aethiopica* and *Cussonia paniculata* are not used as fuel wood because there is a fear that they attract lightning. *Phytolacca dioica, Hippobromus latifolia, Azima tetracantha, Cassine aethiopica* and *Diospyros lycoides* are believed to cause conflict within a household when used as fuel wood; and *Ziziphus mucronata* and *Euphorbia triangularis* are believed to cause illness when used as fuel wood, especially if one has twins.

6.3.3.2 Animals

Livestock, namely cattle and goats, play a central role in the life of a Xhosa person because they have high cultural value. Informants identified the following four benefits of livestock. They are critical for traditions; have economic value where they act as a bank; subsistence value where they supply milk and manure for building and maintaining houses; and they can also help with ploughing. The importance of livestock is indicated by the following dialogue that occurred during a focus group.

Interviewer: What would happen to your culture if the environment could no longer support livestock?
Interviewees: *People's life and culture would be destroyed because we depend on livestock to survive and to do traditions.*
Interviewer: What would happen to your relationship with the ancestors?
Interviewees: *The communication between us would break and this would be bring bad luck and we would die.*

The value placed on certain landscape types and species also indicates the importance of cattle to the local Xhosa people. For example, many informants expressed a dislike for dense forest because of the danger that livestock will get lost and die in this vegetation type. When informants were asked which plant species they value, they often chose species they believed were beneficial to livestock. Examples include *Coddia rudis, Portulacaria afra* and *Cussonia paniculata.*

Apart from livestock, a wide range of wild animals have cultural value and play five key roles, as indicated in table 6.9. A number of informants stated that animals, which are attributed a cultural significance, are protected from harm and utilization by the villagers. Those which symbolize the ancestors, act as messengers for the ancestors, or represent a particular clan experience an especially strong protection.

Table 6.9 Animal species of cultural value.

Cultural significance	Xhosa Name	English Name
Symbolize/represent the ancestors	Indlovu Inyosi Majola Umcelu	Elephant Bees Mole snake or brown house snake Wag Tail
Act as messengers for the ancestors	Umcelu Icikilishe	Wag tail Lizard
Represent a particular clan	Ingonyama Majola snake	Lion Brown house snake
Play a prophetic role: The rains are coming Good luck Bad omens and warning signs, e.g. the attack of evil spirits	 Intsikizi, Uthekwane Ihlungulu, intini and igala Isikhova, ibhubes, unomyayi, intsikizi and Iqgonqpolo/ ingqangqolo	 Ground hornbill, Hamerkop White necked raven, Otter, Bushy-tailed meerkat Owl, male Lion, Crow, Ground Hornbill, Cape Thick-knee

6.3.4 The value placed on the local landscape as a whole

In addition to the relevant cultural sites and species, the local landscape also has considerable value. This statement is backed up by the following two key results: i) the sense of continuity to place demonstrated by the villagers; and ii) the close link between the ancestors and a healthy environment. These two factors are indirectly a consequence of the high importance villagers place on the ancestors and their traditions.

6.3.4.1 Continuity to place

Table 6.10 is a summary of responses to four separately asked, open-type questions that express the degree of continuity to place experienced by the amaXhosa in the four villages. The number of respondents varied in each case, which was a result of the interviews being semi-structured. In addition, some of the questions were asked to respondents in all four

villages, while others were only asked in Cathcartvale. A chi squared test was used to examine whether the difference in respondent's answers was significant.

Table 6.10 Questions that examine attachment to place.

Question	Answer	No. of respondents	%
Do the ancestors prefer you to stay in one place?	Yes No X^2=20.48, $_{df1}$, p<0.001	41 9	82 18
Do you think that you are going to die here, or live here for a very long time?	Die here. Live in the village for a very long time. Don't know. No X^2=34.67273, $_{df3}$, p<0.001	32 12 7 4	58.18 21.82 12.72 7.27
Do you think your child will die in this village?	Yes Depends on them. No Don't know. X^2=9.666667, $_{df4}$, p<0.05	19 6 7 13	42.2 13.3 15.5 28.8
Informants were hypothetically offered R1 million to leave their village.	Rejected Accepted X^2 =10.96491, $_{df1}$, p<0.001	16 41	28.07 71.93

Informants explained that the ancestors prefer one to live in the place where they are buried. This is because it is where one should perform one's traditional ceremonies, as indicated by the following quote: "[The ancestors prefer you] *to stay in one place because my mum and dad died here, so difficult for me to move from here, because any traditional ceremony should be done here*".

Another indicator that suggests a strong attachment to place occurred during the role play at Tidbury. The 'government officials' threat to move the villagers was met with an angry uproar by the workshop participants. When they saw that the 'officials' were not changing their minds, they begged the 'officials' not to move them, trying to persuade them by saying that they would change the way they live.

Informants gave four main reasons for their reluctance to leave their villages. Firstly, the importance attached to one's ancestral graves acts as an important incentive to remain in one place. This is indicated by the following quote: *"I think that it is very important to stay where the grave of your mother and father are"*. This statement is representative of many similar

quotes and it was a continual theme throughout the four villages. In Cathcartvale, seven informants stated that one of the main reasons for not accepting the compensation money was that they cannot leave their parents, children and loved ones who are buried in the village. It would mean abandoning their ancestors. There is also a sentiment that the whole family should be buried in one place.

Box 1 presents a dialogue between a 'displaced person' and a 'government official' that occurred during the play, which also indicates the important role that graves have to play.

Box 1: Dialogue between a 'displaced person' and the 'government official'.

Displaced person: We have brought our grievances.

Government official: *What are these grievances?*
Displaced person: Our first grievance is that we were moved from our own place and were moved to a place which we don't like.

Government official: *When were you moved?*
Displaced person: A month ago government officials moved us. They gave us big papers saying that we must move, as the government said that the area will be developed.

Government official: *How can I help you?*
Displaced person: We want to go back as our forefathers were born there. We were also born there.

Government official: *But surely that doesn't matter, people are mobile all the time.*
Displaced person: What I am saying is that our graves are important because our forefathers are there. So we need to go back to our land where we were born. Graveyards are important to us. We can't actually leave this village because our forefathers are buried there.

The second main reason why informants do not wish to leave their respective villages is because it is their place of birth and they thus have a strong belief that they will die there. This reason came up in a variety of questions including the following two examples:

	Question	**Answer**
Example 1	How long until you leave this place?	*I love this place very much, was born here and must die here.*
Example 2	What is it like living in this village?	*I feel a great joy to stay here because I was born here and I won't go away. I will stay here.*

In Cathcartvale seven informants explained that they could not accept any hypothetical compensation because they were born in the village and thus have a deep sense of belonging to it.

The third reason, which relates closely to the fact that they were born in their respective villages, is that it is where they experience good health. A significant number of informants indicated that they would experience ill health, *"If I was to move from here, I would be very sick"*; unhappiness, *"sometimes you find that some other people move to other areas where they won't be happy";* and die if they left their village, *"When I go to another place I will die"*. Although not verified, two informants in Cathcartvale explained that many of the people who have left the village have died. Eight respondents cited the fear of ill health as a reason why they could not accept the compensation money and leave their villages.

Other reasons that informants could not accept compensation to leave their village are as follows; they enjoy staying in the village; they are used to the place; the money would soon be used up; they own their land; and their traditions work well here. Informants also pointed out negative aspects of township life as reasons why they wouldn't want to leave.

In sum, the principle reason local amaXhosa people cannot leave their respective villages is because it would mean abandoning the ancestors; there is a fear that they would soon die in

the new place; and they feel a close connection and place high value on the place where they were born. All of these responses are closely linked.

6.3.4.2. Relationship between the ancestors and a healthy ecosystem

The following local definition of a healthy environment is based on respondents' vivid descriptions of such an environment. It is, "*something that is breathtaking, something that if you put your eyes on they don't want to move, they just want to look at it. Your eyes stick to it*". The following criteria influence its attractiveness: how green it looks, the density of the trees, the degree of fresh air and the amount of colour and noise from birds and flowers. It is therefore a place of animal and plant diversity and one where all species important to Xhosa people can be found. As one person said it is a *"bush that is full of delicious things,"* while another informant described how he, *"can smell the medicines"* when he goes into such a bush. However, respondents made negative connections between dense forest and a healthy environment, and stated that it must be open so that they can walk through the forest, detect livestock and danger from a far distance and easily harvest resources. Eleven out of 35 responses (31.4%) made some connection between a healthy environment and livestock; either in terms of how the landscape should look, the species that should occur there or how healthy the livestock are.

A healthy ecosystem has the very important benefit of providing a medium that connects the villagers to the spiritual world. Respondents stated that the ancestors will only reside in a healthy natural environment, and similarly that the *amagqirha* will only perform their traditions in such conditions. This is demonstrated by the following two quotes:

> *"The ancestors love a healthy bush. You will see that the igqirha will work on a healthy bush and there are people who say that the ancestors are there deep in that healthy bush, that dignified bush. So the ancestors like a healthy bush."*

> *"If the river and the bush are healthy, you will hear people say I have seen the ancestor, I have seen someone next to the sacred pool resting. But if the*

river is degraded and there is no water in the river and no trees in the bush, you will never hear anyone saying I've seen such ancestors".

In addition, another informant stated that when a sick person is taken to a healthy environment to be healed, they will *"have nice dreams because the ancestors came through the dreams to that person"*. This, she argues, shows that the ancestors *"relate"* to a healthy environment. Another respondent claimed that a healthy environment is important to the ancestors because *"they themselves also feel healthy and alive,"* and they will also *"look after us more effectively if they live in such an environment*". Respondents also indicated that their state of well-being and health is affected by the condition of the environment, as demonstrated by the following quote, *"When the environment is healthy, my body and spirit is also happy".*

In comparison to a healthy environment respondents' descriptions of a degraded environment focus on its negative emotive appeal. It is thus an environment *"that does not attract a person and people are de-motivated to look at it"*. A respondent gave the following analogy:

"When you look at it [a degraded environment] *you don't have hope...It is just like a house that when you look at it you will swear that no one lives there although there are people who do. It is one that will not give you a hope even if you want to go there, whether they will listen to you. A degraded environment is just like that".*

In terms of indicators identified by respondents, it is an environment that has been over-harvested; the grass and trees are dry with few leaves (*"the forest has dried up*"); the area is denuded of vegetation, particularly trees; plant and animal diversity is limited, especially those species used by Xhosa people, for example indigenous building materials, medicinal plants and wild fruit; and there is a lot of *Acacia karroo*, other thorny species and soil erosion.

A degraded environment has a big impact on the relationship people have with their ancestors, because firstly, the ancestor's power decreases in such conditions and secondly, they often leave. For example an *igqirha* stated that she doesn't *"worship in a degraded environment because we know that they don't stay there. We know that they like a healthy environment*

where it has got trees, it is green and it is deep in the bush. So we never perform any traditional practices in such a degraded environment. I only go to a healthy environment". One respondent expressed deep regret for a degraded environment because *"we know that we worship ancestors and they live in that environment. So now they don't have a nice place to stay. And this affects the community because these people are their forefathers, so they feel bad that they don't have a nice place to stay".* In addition, an informant explained that a degraded environment would be a problem for the people still performing traditional ceremonies. This differs from those who no longer believe in the ancestors.

The following response to the question, *"If the environment becomes degraded, does the power of the ancestors change. Are they still able to help the people as much?"* gives some insight into the ancestor's reactions to a degraded environment.

> *"If the environment becomes degraded, the ancestors will definitely become very angry. For example the information that we gather here and we put it on paper, and we put this information carelessly at Jerry's*[2] *house and there comes a child who destroys all the information that you have gathered. Won't that make you angry? I think it will be the same if the environment became degraded. The ancestors would act in the same way".*

The close relationship between the ancestors and a healthy environment reinforces the argument that the landscape as a whole is valued. This is due to the considerable value and influence the ancestors have on the villager's perceptions and relationship with their landscape. If the ancestors value and relate to a healthy environment, the villagers will too. A healthy environment is not just made up of the cultural sites and species of value, but is rather a place of animal and plant diversity and is very attractive as described by a respondent: "[a healthy environment is] *something that is breathtaking, something that if you put your eyes on they don't want to move, they just want to look at it. Your eyes stick to it*". From this one can infer that people value the environment as a whole.

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[2] Jerry is a villager in Fairbairn who I stayed with

6.4 Discussion

Results indicate that the predominately animist worldview and religious beliefs of the amaXhosa in the Kat River valley hold many elements of the traditional Xhosa worldview as is expressed in the literature (Hammond-Tooke 1975; Hunter 1979; Bernard 2003).

Firstly, the villager's strong belief in the ancestors, where they have significant influence over their daily conduct, parallels Hunter's (1979) assertion that the ancestors control the lives of the amaXhosa. Secondly, the value, reverence and strong beliefs associated with sacred pools compares to Hirst's (1990) and Bernard (2003) findings concerning the role of sacred pools in the religious and cultural system of the amaXhosa. Thirdly, results regarding the role of medicinal plants, where they are important in controlling the spiritual dimensions of reality, are very similar to the results from Dold and Cocks' (2000), Cocks and Moller's (2002) and Dold and Cocks' (2002) research conducted in the Peddie region of the Eastern Cape. Their research demonstrates the role of medicinal plants in the amaXhosa religious belief system where they help protect people against evil spirits; are used during rituals; bring good luck; and remove poisons caused by a witch. For example, while 51% of plants are purchased to heal physical aliments, 4% of the medicines purchased are for cultural needs and 31% to enhance well being, of which 61% are to ward off evil spirits, 23% are to bring good luck and 5% are used to remove poisons caused by a witch (Cocks and Moller 2002). Finally, the importance placed on cultural plants, particularly *Olea europaea* subsp. *africana* (umnquma) and *Ptaeroxylon obliquum* (umthathi), parallels Dold and Cocks' (2000) research undertaken in the Peddie area, where *Olea europaea* subsp. *africana* was also ranked as number one in importance and is the most commonly used species. This is validated by Cocks and Wiersum (2003) who describe how a community, across gender, class and education levels, chose *Ptaeroxylon obliquum* and *Olea europaea* subsp. *africana* as the two most important plants in their lives. A similar study reiterated the important role of cultural plants, where children expect to continue to use natural resources for cultural purposes, while their utilitarian needs would be replaced by commercial goods (Cocks and Wiersum 2003). It can be argued that these cultural plants can be regarded as 'cultural keystone species'. This is a term coined by Garibaldi and Turner *et al.* (2004). They argue that there are species that play a keystone role in societies, which has parallels with ecological keystone species. These are species that are

important to people's livelihoods and are thus encoded in rituals, traditions, ceremonies and songs. They become part of the cultural foundation of a group of people. The authors believe that if these keystone species did not exist in a particular area, the society they support would be very different. A loss of these keystone species can thus affect the identity of a group of people. This parallels the amaXhosa of the Kat River Valley. Informants gave vivid quotes of the effect that localised extinction of these cultural species would have on their culture. For example, one informant stated that this, "*simply means the destruction of Xhosa people if these things are taken away from us*".

Thus, despite centuries of European contact, western influence and the impact of the white farmers (who were previously the dominant managers of the Kat River Valley), the amaXhosa of this region still retain many elements of their traditional world view.

Findings indicate that the importance the amaXhosa attach to traditions and the ancestors has a fundamental affect on their relationship with the local landscape, how they value and relate to it as well as their utilization of resources.

Firstly, there is a strong spiritual aspect to the amaXhosa's relationship with their local environment where it is treated as a medium, which connects them to the spiritual world. Secondly, certain plants and animals are accorded high ritual and symbolic value and are integral components of the eco cosmology held by the amaXhosa under study. Particular plants are treated with high respect, the main example being *Olea europea* subsp. *africana*, while specific animals act as links and communicators between the spiritual and natural realm. Thirdly, there are certain sites in the environment, which obtain very high value. Sacred pools are the example described in this thesis. These pools are treated with awe, respect and fear and specific practices are associated with them, while others have taboos limiting access.

These factors influence how the local amaXhosa utilize resources and impact their environment. It is argued that four cultural factors, three of which are mentioned above, could have a positive influence on biodiversity. These are as follows: setting aside areas as sacred sites; values that are place-centred; the importance placed on cultural plants; and the

relationship between a healthy environment and maintaining a good relationship with the ancestors.

Firstly, the reverence, respect and high value placed on sacred pools results in these areas being protected from heavy resource use. This is a practice common to many indigenous groups (Biegert 1999; Bernard 2003). The animal and plant species growing around sacred pools are thus less disturbed than those in other parts of the river. A significant body of literature focuses on the role that sacred areas play in maintaining biodiversity. For example, Wilson (1993) describes sacred forests, called *kaya*, which occur in Mombasa. He states that although they are often no more than two hectares these forest patches have huge ecological and cultural significance, where they are islands of biodiversity, housing rare and endangered species. Another example, set in the Western Ghats, demonstrates that most of the plant species in the Ghats are present when the forty sacred groves in the area, of which thirty are less than a hectare, are grouped together (Bharucha 1999).

Another possible positive aspect on biodiversity are the amaXhosa values which are place centred, and which encourage continuity to place. Numerous authors believe that continuity to place is an important characteristic of many local cultures as it allows for the development of affective values towards the environment (Strang 1997) and it encourages resource management systems which are responsive to ecosystem feedbacks and change (Gadgil *et al.* 1998). Consequently there are often parallels between biological diversity and societies which have been resident in a location for centuries (Nabhan 1997; Salmon 2000).

The third aspect is the positive relationship between the ancestors and a healthy environment. This encourages the villagers to put high value on this type of environment, thus promoting ecosystem custodianship. However, the reverse is also true: when ecosystems become degraded, the communities' intimate relationship with the environment diminishes due to a loss of their culture, traditions and the fear that the ancestors are moving away. People consequently care less and less for the environment as expressed in the following quote: "*As the environment is degrading people do not care more and more. They just say whatever is happening is none of my business*". This comment must, however, be seen against the backdrop of a complex process of cause and effects. The impact of Christianity and later

scientific, secular thought has played a role in encouraging the amaXhosa to abandon some of their beliefs and cultural practices (Bernard pers.com 2004).

The fourth aspect is the high value placed on cultural plants. These species of cultural value obtain special protection, where many informants indicated that people should not harvest *Olea europaea* subsp. *africana*, *Salix capensis* and *Ptaeroxylon obliquum* unless they are required for a tradition. Thus, the general feeling in Cathcartvale is that the number of cultural species is increasing. However, Cocks and Wiersum (2003) argue that because a species has a high cultural value does not necessarily mean that its use will be sustainable. They explain that of the thirty species, which are increasingly hard to find, the five most frequently mentioned all had cultural significance, namely *Ptaeroxylon obliquum, Olea europaea* subsp. *africana, Schotia affra*, *Cassine aethiopica*, and *Pappea capensis.* In Fairbairn and Ntlini informants expressed the concern that *Ptaeroxylon obliquum* and *Olea europaea* subsp. *africana* are increasingly scarce as people no longer protect them the way that they did in the past. My research indicates that traditional values should encourage protection of these species, but that when these values are no longer adhered to, unsustainable use may result.

There are also some cultural practices that could have a negative impact on biodiversity. These include the importance of medicinal plants and livestock to the amaXhosa of the Kat River Valley.

The importance of medicinal plants to the lives of the amaXhosa, and their high level of utilization (71.4% of respondents use them, while 50% collect them) could threaten the abundance levels of these plants. This assertion is backed up by Dold and Cocks (2002) who believe that as high as 93% of species used as traditional medicine are harvested unsustainably. Thirty-four of these species have been prioritized for conservation management, while three are listed in the current Red Data List of Southern African Plants. An indicator of this situation is the growing shortage of popular medicinal plant species with some plant species being extremely rare in unprotected areas (Dold and Cocks 2002).

There are a number of reasons for the above situation. Firstly, the use of a medicinal plant is interchangeable between species, which does not encourage sustainable use and an awareness

of the local extinction of individual species (Dold 2004 pers. com). This is particularly a problem for rare species as they can be quickly over-harvested.

A second reason is that trade in medicinal plants is now greater than at any other time. Because of its growing economic significance, collection is no longer confined to traditional healers, but includes entrepreneurs in both the formal and informal economy. The only skill required is plant identification. As a result many people in financial difficulty have become harvesters and traders of traditional medicinal plants. A problem is that many traders now view species in purely economic terms. Past cultural and mental taboos on over-harvesting are no longer applicable. This has negative consequences, such as the ring barking of trees and the collection of large quantities at one time, especially rare sought after species. An example is the uncommon *Curtisia dentate*, which is highly sought after, as it is one of the ten most frequently used plants (Dold and Cocks 2002).

The dominance of livestock in the lives of rural Xhosa people has an impact on the local landscape. Firstly, livestock have a strong influence on the ecosystem dynamics of an area by grazing on certain species and keeping an ecosystem in a certain stage of succession. When asked in a focus group what the environment would look like without livestock, the response was that, "*it* [forests] *would be too dense and that would be difficult. The grass would be too long – there would be many ticks and dangerous animals and snakes*".

In addition, the local Xhosa people try to maintain a particular area that suits cattle. The environmental rules that are in place in Cathcartvale are largely an attempt to ensure that there are enough tree species for livestock to graze, especially during drought conditions, and to provide them with shelter. Informants described the following environment as suitable for livestock: there must be areas of open grassland interspersed with a variety of species suitable for browsing. These species include *Olea europaea* subsp. *africana*, *Acacia karroo*, *Ptaeroxylon obliquum*, *Scutia myrtina*, *Coddia rudis*, *Portulacaria afra*, *Podocarpus* sp. and *Cussonia paniculata* as identified by informants. Small forests are also important as these provide forage during drought conditions, as well as shelter during excessive weather conditions. Areas of thick forest are viewed negatively because they do not supply adequate grazing land and it is very easy to lose one's livestock in such an area.

Hunter's (1979) comments indicate that the emphasis placed on cattle could have a negative impact on ecosystem integrity. She explains that the amaXhosa place importance on the quantity, rather than quality, of livestock because the function of cattle is largely for wealth, rather than milk. Consequently overstocking is a common problem. This was the case in the scarcely populated Pondoland where there has been an increase in erosion, while in the Ciskei, which is more densely populated, the region is approaching desert conditions (Hunter 1979). Shaw (1974) also states that, because a man's ambition is to have as many cattle as possible, little attention is paid to their quality, but rather particular colours or shaped horns. This compares to recent literature on the impact of pastoralism on biodiversity and ecosystem resilience. For example, Lane (1995) argues that the Barabaig's, of Tanzania, use of pastoralism as a livelihood strategy is a rational and sustainable form of land use. Brockington and Homewood's (2001) research on the effects of pastoralism on the Mkomazi game reserve in Northern Tanzania parallels Lane (1995). They argue that pastoralism is a rational choice for semi arid savannah's and that the level of disturbance by cattle enhance diversity. For example there is a greater concentration of wildlife where cattle also graze. Ainslie (2002) also disputes broadly held assumptions regarding the negative effects of Xhosa cattle ownership and management. Sullivan and Homewood (2003) explains that it is now realized that dry-lands experience non-equilibrium dynamics. This has changed the view that livestock cause the irreversible environmental degradation. Although my research indicates that cattle do have an impact on the environment, it is unclear whether this is negative or positive in terms of biodiversity and ecosystem resilience.

In conclusion, it has been shown that the predominant worldview held by the amaXhosa under study has many elements of the Animist worldview. Their worldview and eco cosmologies play an integral role in how they relate to, value and manage their local landscape. There are some factors, which could positively affect the resilience of their socio-ecological system. Other factors could lead to a loss of resilience.

6.5 Limitations

An assessment of the methods used to collect data presented in this chapter reveal a number of shortcomings. Firstly, attempting to understand the worldview and eco-cosmologies of a cultural group without undue generalization is an extremely complex and time consuming undertaking. The main anthropological tool used to understand the complexity of a culture and develop a trusting relationship is participant observation. Anthropologists often learn the language and spend many years living with a particular group of people. The interdisciplinary nature of my research, which required that I employed both natural scientific and social research techniques, meant that resources and time were limited. Consequently the longest period I sent in any village was eight days; therefore participant observation was not adequately undertaken. I did not have a sufficient grasp of the Xhosa language and thus had to rely on an interpreter. This increases the danger of misinterpreting informants' responses and also puts a language barrier between the people under study and the researcher. The consequence was that I was only able to scratch the surface of a complex reality and make generalised, possibly superficial observations. There is room for more specialised research into this facet of socio-ecologocal system.

Chapter 7: Discussion

7.1 Anthropogenic disturbance

The aim of this thesis was to examine the role of anthropogenic disturbance in the creation of a socio-ecological landscape. The following three key questions were asked.

1. What impact has past anthropogenic disturbance had on present vegetative characteristics?
2. What value does this disturbed landscape have to local people?
3. How do the local peoples' worldview and eco-cosmologies influence how they perceive, value and manage their local landscape?

These three questions were analysed and discussed in chapters four, five and six respectively. This chapter brings together the key findings from these three chapters to create two models. The first one examines what factors need to be in place for anthropogenic disturbance to increase the resilience of a socio-ecological system. Model two examines the factors that lead to a loss of resilience.

Anthropogenic disturbance is necessary for enhancing the potential of an area to support human habitation. This is the key finding of my research, which is also backed up by the literature (Taylor 2002; Hochtl *et al.* 2003). This is because anthropogenic disturbance opens up natural vegetation, increasing the accessibility of resources, the patchiness of the landscape and the number of useful species (Toledo *et al.* 2003), while the threat of dangerous animals decreases. A study conducted by Hochtl *et al.* (2003) indicates that the rewilding of the Val Grande National Park in Italy has had negative psychological, social and economic impacts on the local people who view this process as highly detrimental. Due to land abandonment and succession the villages and surrounding landscape are now described as 'scruffy', 'old', and 'forgotten'. The usability and accessibility of the landscape had decreased, which led to a loss of cultural knowledge and local identity. Consequently the area lost its value as a homeland (Hochtl *et al.* 2003).

My results, backed up by the literature, also indicate that certain types of disturbance can have negative consequences for biodiversity, ecosystem functioning and resilience and local people's livelihoods. In Cathcartvale the past anthropogenic disturbances have diminished species richness and substantially increased erosion, the percentage of bare ground cover and the number of invasive and weedy species (c.f. chapter four, section 4.3.2; 4.3.4 and c.f. chapter 5, section 5.3.3). There is, however, a tension between ecosystem and social interests, as these invasive species are often useful to local people. For example, the invasive *Acacia karroo*, and exotic *Opuntia ficus-indica* and *Acacia mearnsii* are highly valued and frequently used (c.f. chapter 5, section 5.3.1). One reason why these species are useful is that they are abundant and clump together, which enables resource harvesters to get a higher return for the investment of their time. This differs from indigenous species, which are often widely spaced, and not as abundant. It therefore requires a higher opportunity cost to harvest a useful amount of species. To maximize the productivity of a landscape, it is therefore necessary to change the natural mixed structure that exists.

A degraded environment has also impacted the livelihoods of local people in the Kat River valley. Fox (2002a) describes how the villagers of Ntlini and Fairbairn are struggling to meet their basic needs through natural resources. Fox (2002a) argues that this is because of the environmental degradation that has occurred around their villages.

There is, therefore, a fine line regarding the effect that anthropogenic disturbance will have on the character, productivity and resilience of a socio-ecological landscape. When anthropogenic disturbance is minimal, either because of a low population and/or low impact technology, there will be little impact on the density of the natural environment and it will remain of low practical value to the local people. This is happening on a small-scale in Cathcartvale. The change in land ownership from coloured and white farmers to the present, predominantly amaXhosa population has decreased the intensity of land management. Consequently areas in the landscape are increasing in plant density. Informants state that these areas are increasingly inaccessible and they are no longer used as places to harvest resources. A positive feedback occurs, where these areas become increasingly dense, inaccessible and unusable. Marten (2001) explains that a positive feedback stimulates change, while negative feedbacks provide stability.

A positive feedback also occurs when anthropogenic disturbance is intensive, either due to a high population, high impact technology and/or exploitative management practices. The vegetation is opened up considerably and is easy to access, with consequent heavy resource use. A point will be reached when the resource supply is severely diminished and local people will have to look for alternative resources to meet their basic needs. Consequently their dependency on the local environment decreases. This has happened in Ntlini village, where the environmental degradation that has resulted from both over-population and over-grazing, has decreased local people's dependency on their natural resource base (Fox and Shackleton 2003). Fox and Shackleton (2003) have also found that environmental degradation causes people to become disinterested in the environment. This negatively affects local institutions controlling resource use and can lead to a loss of ecological knowledge.

7.2 The role of dense vegetation in ecosystem resilience

Dense pockets of vegetation play a critical role in mitigating the effects of anthropogenic disturbance as they act as refugia, holding vestiges of genetic material that become vital during times of surprise and disturbance (Folke *et al.* 1998; Berkes and Folke 2001; Colding *et al.* 2003). Dense vegetation also retains ecological memory, thus helping the landscape regain its former state to which the local people have adapted. When ecological memory (Berkes *et al.* 2003) is lost the ecosystem's resilience is reduced, making it more prone to flip into a less productive stable state (Folke *et al.* 2003). Informants in Cathcartvale state that dense forests, although of little direct practical value, and often regarded negatively as they are a threat to livestock, become important during times of drought. This is because the resources are more accessible to the local people and they act as a valuable source of fodder for livestock due to a decrease in vegetation density. Results from my vegetation surveys indicate that dense forests do have a high diversity of species, many of which are rare in the rest of the landscape (c.f. chapter 4, section 4.3.2 and 4.3.4). In Cathcartvale they thus retain ecological memory and act as a biological reservoir for species.

To reiterate a fundamental theme of my thesis: there is a fine line between anthropogenic disturbance having either positive or negative consequences for ecosystem functioning and

resilience, and livelihoods. Many case studies indicate that small-scale anthropogenic disturbance is a powerful means of enhancing biological and landscape diversity and the overall resilience of the socio-ecological system (Fairhead and Leach 1996; Laird 1999; Berkes and Folke 2001; Folke *et al.* 2003; Toledo *et al.* 2003). There is, however, the ever-immanent threat of degradation, which results in a significant loss of diversity, benefits and value; both in terms of the landscape's use and cultural value. As Gadgil *et al.* (1998) explain, the natural, logical tendency for resource harvesters is to continually increase harvesting effort as this leads to an increase in the resources secured, even if the environment is degrading. However, if there is a sufficiently large percentage of an area that is protected from resource harvesting, then the resource population will persist irrespective of harvesting effort in the remaining landscape (Gadgil *et al.* 1998). These authors believe that the protection of certain areas (which often obtain sacred status) common among indigenous peoples, is a management strategy that has been adopted because of this principle. These protected areas play a crucial role after disturbance due to their species richness. Protecting areas in the landscape, either through religious and social sanctions (as in the case of sacred areas) or because of a fear of evil spirits or inaccessibility (as in dense forests) or legal protective mechanisms (as in national parks), could be the key to ensuring that anthropogenic disturbance leads to positive rather than detrimental ecosystem and social consequences (Fabricius *et al.* 2003).

There are as many as seventeen sacred pools along the river section associated with Cathcartvale village. These are protected areas because it is believed that the People of the River and the ancestors make them their home and release their wrath on those who dare to venture near without permission. There are also small dense forests scattered in the landscape, of which the villagers are fearful. Resources are therefore not harvested, partly because of their inaccessibility, but also because they are believed to house malevolent spirits as well as dangerous animals.

Informants described how sacred pools played an important practical role during times of drought as they never dried up, and therefore provided an invaluable water source for both people and livestock. This is because they are typically the deep pools of water, but also because they are surrounded by dense trees, which may protect the water from evaporation (c.f. chapter 6, section 3.2.1). There is a widely held belief that the roots of *Salix capensis*, a

tree associated with sacred pools and which is only harvested for ritual purposes, clean the water by filtering the leaves and sediment. If this is true, this could play an important role during drought, when the water is typically murkier.

The consequence of intensive anthropogenic disturbance, as mentioned earlier, is to open up dense vegetation and make resources more accessible. As was indicated, this results in a positive feedback cycle where the vegetation is increasingly opened up. The same feedback principle can be used with dense forests. Intensive disturbance begins to eat into dense forest, slowly opening it up. A positive feedback results because as resources become more accessible, an increasing number of people harvest them. The character of the forest changes as trees are removed, and it is no longer as dark and fearful. This encourages an increase in harvesting pressure. The final outcome is that former densely vegetated areas no longer act as genetic reservoirs and retainers of ecological memory. This compares to small-scale, less intensive anthropogenic disturbance, which does not have the intensity to impact dense forests. As a result dense forests remain in the area.

In Cathcartvale sacred pools, characterized by dense vegetation or trees associated with the People of the River, were regarded as having more sacred value and were treated with greater fear and respect than sacred areas that had more open vegetation. People were fearful of angering the spirits, either by venturing too close or harvesting resources from these pools, and the biological diversity of the area was thus protected. A low population, limited technology and strong beliefs in the spiritual realm encourage this condition to be maintained. In Ntlini informants blamed the increase in population for the environmental degradation and loss of sacred pools that villagers have experienced (Fox and Shackleton 2003).

7.3 Anthropogenic disturbance and the factors leading to a resilient socio-ecological system and a degraded socio-ecological system

The last section plots two scenarios that can result from anthropogenic disturbance; either a resilient socio-ecological system or a degraded one. The Kat River valley is used as an example for both of these scenarios. Two models have been created. Model 1 depicts the

relationships and connections that lead to a positive outcome in the Kat River valley. Model 2 examines the process that leads to negative outcomes in the Kat River valley. These models are based on the relationships and connections that I have found while doing my thesis. The reality is, however, more complex than what I have depicted. Connections, relationships and feedbacks that have not been identified also play a role in determining the outcome of anthropogenic disturbance in a particular socio-ecological system.

7.3.1 The process that leads to a resilient socio-ecological system as a consequence of anthropogenic disturbance

7.3.1.1 The Kat River Valley as a case study

As depicted in figure 7.1 anthropogenic disturbance leads to positive outcomes in the Kat River Valley when the following three factors are in place; firstly, disturbance is intermediate (box 3) because of low human and livestock population density (box 1) and low impact technology (box 2); secondly, there is secure land tenure (box 18); and thirdly, rituals guide resource use (box 22).

An intermediate level of disturbance increases landscape patchiness and species diversity, often including useful species (box 4). This landscape patchiness is important for maintaining ecological memory in the system (Folke *et al.* 2003) and the enhanced biodiversity increases the system's resilience (Tilman 1997). In addition, local people become more dependent on the natural environment as it supplies many of their basic needs (Fox and Shackleton 2003), as shown in box 10. This increases the value placed on the environment, which can encourage a close cultural-environmental coupling leading to sustainable resource harvesting. In Cathcartvale, for example, local people obtain, as a modest estimate, 21 species of fuel wood, 40 medicinal plants, 7 cultural species, 9 building materials, game meat, honey, clean water, forage and resources with an economic value such as prickly pear and aloe (c.f. chapter 5, section 5.3.1.1). This encourages high dependency on the local environment with an accompanying high appreciation and importance placed on it. Respondents of Cathcartvale stated that the environment was either important or very important to them. The main reason for this was that it supplies them with their basic needs (c.f. chapter 5, section 5.3.1). This high

dependency and value placed on the environment has led to the establishment of environmental rules (box 14), such as a prohibition on harvesting green trees (c.f. chapter 5, section 5.3.2) which are enforced by the Community Committee. These rules encourage sustainable resource harvesting (box 15). Figure 7.1 provides a simplified version of the steps leading to a resilient socio-ecological system (box 31).

A healthy landscape, as described by informants, is one that meets people's basic needs and is diverse in species and habitats (box 7) (c.f. chapter 6, section 6.3.3.2). Fox and Shackleton (2003) explain that when the environment is viewed as healthy, local people spend recreational time in the bush (box 10), which indirectly leads to environmental monitoring and accumulation of ecological knowledge (box 14). Local people also believe that the ancestors live in a healthy environment (box 12) (c.f. chapter 6, section 6.3.3.2). A few informants described how they would sometimes spend nights sleeping in this healthy bush and would be met by animals that represent the ancestors. They would also have vivid dreams in which the ancestors would communicate with them (Fox and Shackleton 2003). This encourages socio-ecological coupling (box 16) as cultural beliefs are reinforced through the natural environment and consequently harvesting practices are sustainable (box 17).

Intermediate levels of disturbance also result in dense forests being retained in the landscape, see box 5. This is because low population levels and/or low impact technology limits peoples' ability to exploit dense forests, which thus remain in the landscape (c.f. chapter 5, section 5.4). Research in Cathcartvale revealed that these dense forests are perceived to have little immediate practical value. Informants stated that they would prefer dense forests either to be few in number or else completely removed from the landscape (c.f. chapter 5, section 5.3.3). This is because they harbour dangerous animals and criminals, and pose a threat to livestock as they can get lost in dense forest. The natural tendency for the local people is to therefore remove dense forests. This is however, not easily achieved under intermediate levels of disturbance. Reinforcing this, dense forests are dark and dense, which instils fear in local people who are reluctant to harvest the often inaccessible resources (box 8) (c.f. chapter 5, section 5.3.3). Resources are therefore not harvested (box 9), and there is a negative feedback, resulting in stability where dense forests are protected and remain in the landscape (box 5). They consequently play an important role during times of drought by supplying resources and

acting as emergency fodder (box 13). This increases the resilience of a socio-ecological system (box 32) as it is better able to cope with disturbance.

Figure 7.1 indicates that secure land tenure (box 18) is an important factor when examining the relationship between anthropogenic disturbance and the resilience of a socio-ecological system. The villagers of Cathcartvale, who now own their land, have set up a community committee (box 19). This institution has set up a number of environmental rules (box 20), which are enforced by punishing offenders when the rules are not obeyed (c.f. chapter 5, section 5.3.2). This has increased the villager's responsibility towards the environment and has encouraged sustainable harvesting practices (box 21). A resilient socio-ecological system (box 32) is a likely outcome.

Figure 7.1 also indicates that anthropogenic disturbance, resulting in a resilient socio-ecological system, is encouraged when rituals guide resource use (box 22). Specific sites, including river pools, dense forests, caves, mountains, graveyards and the kraal, are used for the performance of rituals and obtain high cultural value (box 24) (c.f. chapter 6, section 6.3.2). Fox (2002a) explains that these sites are important in encouraging values to be place-centred, which leads to long-term occupation of an area and thus continuity to place (box 25). This has three important consequences. Firstly, continuity to place results in accumulated knowledge of ecological processes and functions, which gives one an understanding of how to sustain ecosystem services, but which take a long time to attain (Folke *et al.* 2003). Secondly, it encourages affective values for the natural environment (Strang 1997). The Aborigines' ancestors who have lived in Australia for forty-thousand years are a good example of this, where the emotional and spiritual attachment to place is considerable (Strang 1997). Thirdly, when a group of people have lived in an area for a long time, their practices and values are influenced by the landscape structure and function, and are adapted to enhance landscape elements rather than override them. This is because they perceive the landscape as it really is, rather than through the lens of where they have come from. Forman and Godron (1986) state that this results in the human footprint being positive. These factors all contribute to a socio-ecological system being coupled (box 30). This compares to when a group of people are new to an area and therefore lack accumulated knowledge about local ecosystem processes and functions (Strang 1997). This often leads to unsustainable management practices and a loss of

social and ecological resilience. In some cases crises can lead to learning and the adoption of sustainable management practices (Gunderson 2003). Another common experience is that the new inhabitants observe the landscape through the experience of their motherland. Consequently ideologies and management practices override landscape elements, which results in negative ecosystem consequences (Forman and Godron 1986), such as landscape homogenization, exotic species invasions and a loss of species diversity. Payne (1999) describes how the British settlers who arrived in South Africa managed the environment in an attempt to create a mini-England. Strang (1997) describes a similar phenomenon when the British moved to Australia. Forman and Godron (1986) explain that different ecosystems respond differently to use, so that practices which are sustainable in one area may lead to degradation in another.

A number of cultural landscapes have strict taboos and punishment is carried out by the ancestors or People of the River if disobeyed. For example, people are restricted from harvesting resources around sacred pools, as well as venturing too close to them (box 27). People believe that if these taboos are transgressed the guilty individual may drown or become sick (c.f. chapter 6, section 6.3.2.1). These sites are deeply revered (box 28) and because of the above taboos they have high species richness and retain natural vegetation which could protect the water from evaporation. Many informants testified to the important role sacred pools play during drought conditions (box 31), as they never run out of water (c.f. chapter 6, section 6.3.2.1). In addition, certain plants and animals are used for rituals or are associated with the ancestors who guide the performance of rituals, see box 23. These animals and plants obtain high value. For example in Ntlini, Tidbury and Fairbairn plants that have ritual value were ranked the highest, above species with high practical value. In Cathcartvale the second highest valued resource, below mountain water, was a cultural species, while the two favourite species were *Olea europaea* subsp. *africana* and *Ptaeroxylon obliquum*, which are both critical for the successful performance of rituals. These plant and animal species are protected from everyday use in some cases. For example, local people are reluctant to use *Olea europaea* subsp. *africana* and *Ptaeroxylon obliquum* for building materials, while there are strict taboos on harvesting *Salix capensis* unless it is used for a ritual (c.f. chapter 6, section 6.3.2.2.1). This indicates that the ritual aspect of the environment is very important to the local amaXhosa people, often more so than the practical aspect. In addition, the environment holds a lot of

cultural symbolism. For example, sightings of a particular bird or animal (the wagtail or lizard for example) could mean that the ancestors have a message for you. This increases the cultural value placed on the local environment (box 26). Sustainable harvesting practices develop and are guided by institutions that regulate resource use. The environment and culture become closely coupled (box 30). For the amaXhosa of the Kat River valley, this expresses itself through ritual action. Certain species are integral to the performance of rituals (c.f. chapter 6, section 6.3.2.2.1) and they have consequently become keystone cultural species (Garibaldi and Turner 2004). These are species that play a keystone role in societies, which has parallels with ecological keystone species. Because of their role in people's livelihoods cultural keystone species are often encoded in rituals, traditions, ceremonies and songs and become part of the cultural foundation of a group of people. These factors lead to stronger environmental protective controls and a resilient socio-ecological system (box 32).

7.3.2 The process that leads to a degraded socio-ecological system as a consequence of anthropogenic disturbance.

7.3.2.1 The Kat River Valley as a case study

As shown in figure 7.2, two factors can lead to unsustainable management practices that result in environmental degradation in the Kat River Valley: namely external factors (box 1) and intensive local disturbance (box 15) caused by a high population density of people and livestock (box 12), commercial exploitation (box 13) and high impact technology (box 14). External influences, such as the Western cultural influence (especially through inappropriate education); land reform; and environmental degradation caused by previous land owners, can act as catalysts to decouple a previously adapted cultural-ecological system (box 2). Consequently the symbolism, stories and meaning held in the environment are no longer relevant. The reverence for sacred areas decreases (box 3), while cultural keystone species are no longer used in rituals and thus lose their value (box 9). Sacred areas (box 4) and particular species (box 10) thus experience harvesting pressure, with a consequent decrease in species richness (box 11) and a loss of social and ecological memory (box 8). This increases the system's vulnerability to a surprise or disturbance, flipping the system into a less productive

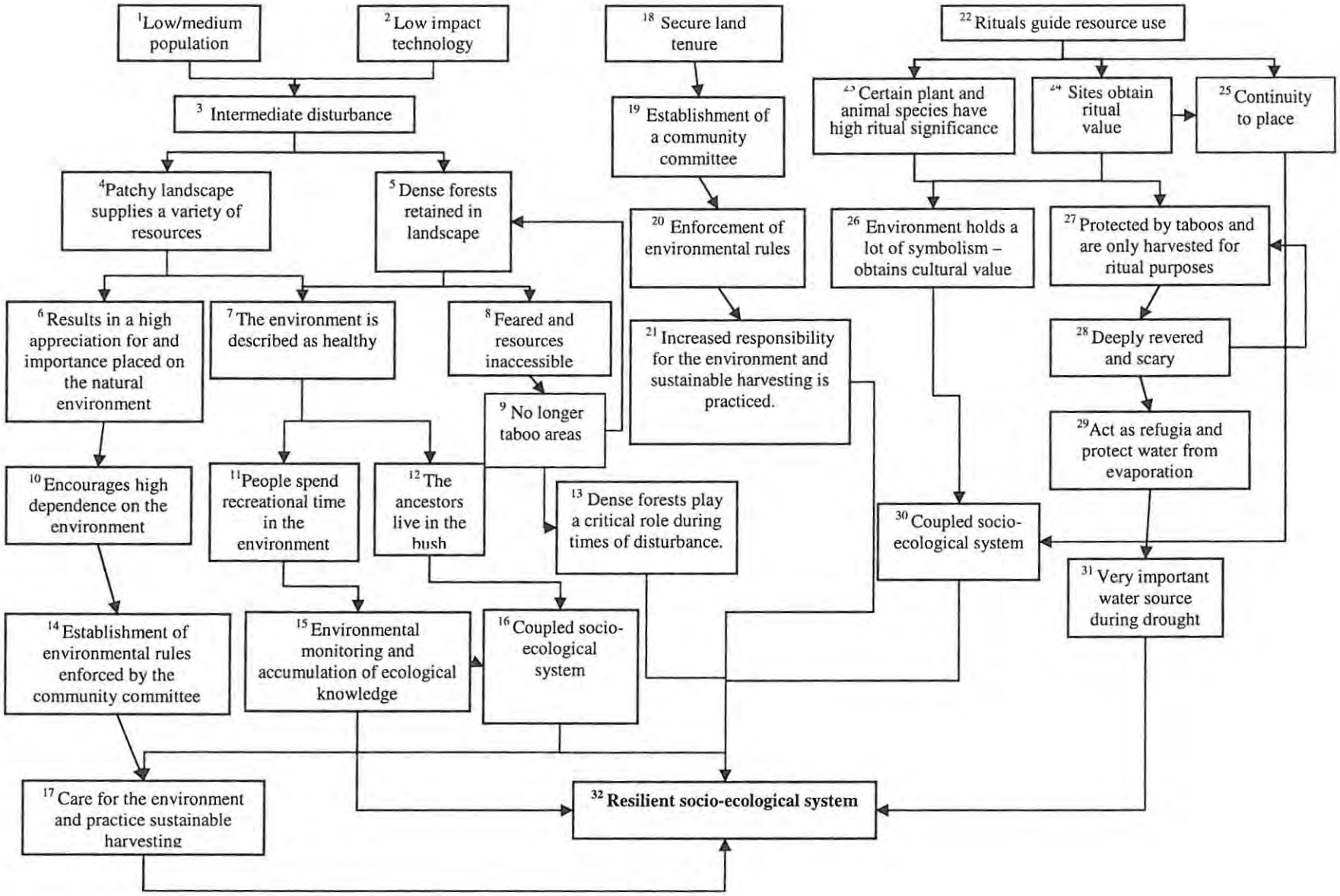
[1]Low/medium population
[2] Low impact technology
[3] Intermediate disturbance
[4]Patchy landscape supplies a variety of resources
[5] Dense forests retained in landscape
[6] Results in a high appreciation for and importance placed on the natural environment
[7] The environment is described as healthy
[8] Feared and resources inaccessible
[9] No longer taboo areas
[10] Encourages high dependence on the environment
[11]People spend recreational time in the environment
[12] The ancestors live in the bush
[13] Dense forests play a critical role during times of disturbance.
[14] Establishment of environmental rules enforced by the community committee
[15] Environmental monitoring and accumulation of ecological knowledge
[16] Coupled socio-ecological system
[17] Care for the environment and practice sustainable harvesting
[18] Secure land tenure
[19] Establishment of a community committee
[20] Enforcement of environmental rules
[21] Increased responsibility for the environment and sustainable harvesting is practiced.
[22] Rituals guide resource use
[23] Certain plant and animal species have high ritual significance
[24] Sites obtain ritual value
[25] Continuity to place
[26] Environment holds a lot of symbolism – obtains cultural value
[27] Protected by taboos and are only harvested for ritual purposes
[28] Deeply revered and scary
[29]Act as refugia and protect water from evaporation
[30] Coupled socio-ecological system
[31] Very important water source during drought
[32] Resilient socio-ecological system

Figure 7.1 The process that leads to a resilient socio-ecological system as a consequence of anthropogenic disturbance.

state. This leads to a loss of social and ecological resilience (box 31). In certain villages in the Kat River valley informants testify that plants used for rituals are no longer highly valued (box 9) and thus experience unsustainable harvesting practices (box 10). For example, a villager in Ntlini explained that in the past *Olea europaea* subsp. *africana* was harvested in a sustainable manner, where only a few branches would be collected. This compares to the present situation where children will destroy the whole tree when harvesting it (Fox 2002). In addition, for some people, sacred pools have lost their symbolism and are no longer associated with the People of the River or ancestors. In Ntlini and Fairbairn sacred pools were no longer revered and respected by the wider community (box 3) and people began to harvest the valuable resources that grew near them. A positive feedback resulted because when sacred pools were harvested they were no longer as dense, and were thus harvested by the wider population (box 7 and 4). Informants in Fairbairn testified that the sacred pools are also less respected and people will throw rubbish in them (box 5) (Fox and Shackleton 2003). Informants explained that when this starts to occur the ancestors leave the pools and they are therefore no longer taboo areas (box 6). This leads to further cultural-environmental decoupling and increased harvesting pressure (box 6 and 2). In Ntlini it was mentioned that the whole river used to be a sacred area, but as a result of degradation there are now very few sacred pools (Fox and Shackleton 2003).

Intensive disturbance caused by commercial exploitation (box 13) of, fuel wood and medicinal plants for example, high impact technology (box 14) and an over population of people and livestock (box 12) can have two outcomes. Firstly, it can result in a diminished resource base (box 16), which local people view as highly negative and will lead them to describe the environment as degraded (c.f. chapter 5, section 5.3.1, chapter 6, section 6.3.3.2). When this occurs there is a higher opportunity cost for resource harvesters as it is more difficult to find the necessary resources (box 18). Consequently they are more reluctant to harvest resources, preferring to purchase goods to meet their basic needs, which reduces their dependency on (box 22) as well as knowledge of their local environment (box 23). The appreciation of and value placed on the natural environment consequently decreases (box 26) and environmental/traditional rules are not adhered to (box 28). This intensifies unsustainable harvesting practices and ultimately leads to environmental degradation (box 30) and a loss of social and ecological resilience (box 31).

When the natural environment is viewed as degraded local people spend less recreational time in the bush and no longer sleep there at night (box 19). This limits their capacity to accumulate ecological knowledge and monitor the environment's condition and there is consequently a loss of ecological knowledge (box 23). Local people also explained that the ancestors would leave the bush if it became degraded (box 20) (c.f. chapter 6, section 6.3.3.2). These two factors also lead to cultural-environmental decoupling (box 24) as people are no longer visited by animals that represent the ancestors, nor do they have vivid dreams in which the ancestors communicate with them, sharing, for example, knowledge about medicinal plants (Fox and Shackleton 2003). All of the above leads to a loss of knowledge, appreciation and value of the environment (box 26). Consequently local people are less inclined to adhere to traditional and environmental rules, and poor harvesting practices are reinforced (box 28).

The second consequence of intensive disturbance is the reduction of dense forests, as these are more easily penetrated (box 17). They consequently open up, become more accessible, less dangerous and are no longer feared (box 21). This leads to a positive feedback, where dense forests experience increased harvesting pressure, as people who were previously unable to access dense forests are now able to. Consequently dense forests are reduced, experience a loss of species diversity and ecological memory (box 27) and no longer act as refugia (box 25), or supply fodder or resources during droughts (box 29). This, coupled with landscape homogenization, leads to environmental degradation (box 30) and decreases the resilience of the ecological system, making it more prone to flip to a less productive state after disturbance or surprise (box 31) (Adger 2000; Folke *et al.* 2003).

The models depicted in figure 7.1 and 7.2 have been informed by experiences from the four villages examined in this thesis, namely Cathcartvale, Tidbury, Ntlini and Fairbairn. However, these models do not represent the reality of a single village, as they each have a mix of factors that lead both to a resilient and a degraded socio-ecological system. However, of the four villages, Cathcartvale had many of the factors that lead to a resilient socio-ecological system, while the experience in Ntlini had many parallels to figure 7.2.

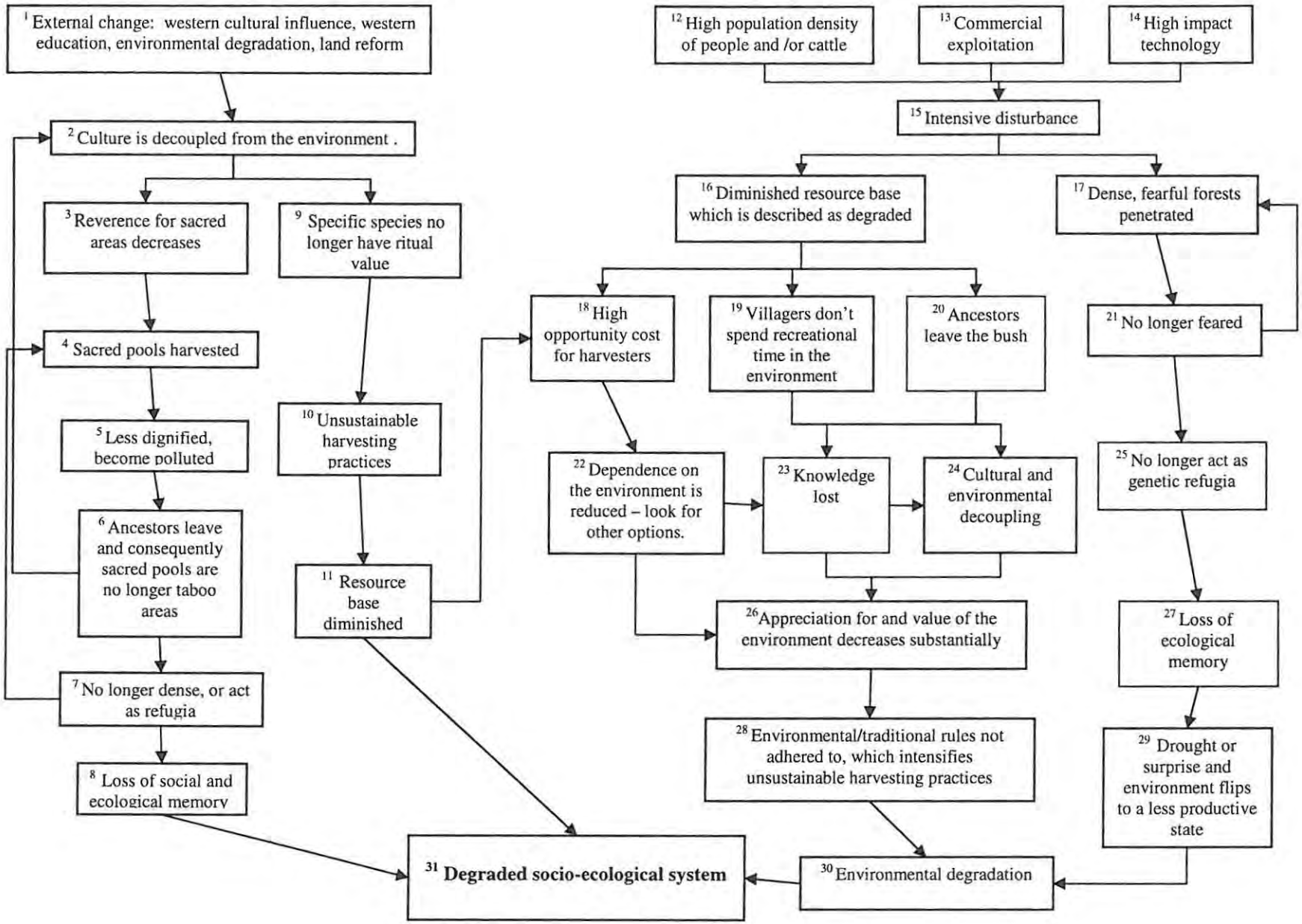
[1] External change: western cultural influence, western education, environmental degradation, land reform
[2] Culture is decoupled from the environment .
[3] Reverence for sacred areas decreases
[9] Specific species no longer have ritual value
[4] Sacred pools harvested
[5] Less dignified, become polluted
[10] Unsustainable harvesting practices
[6] Ancestors leave and consequently sacred pools are no longer taboo areas
[11] Resource base diminished
[7] No longer dense, or act as refugia
[8] Loss of social and ecological memory
[12] High population density of people and /or cattle
[13] Commercial exploitation
[14] High impact technology
[15] Intensive disturbance
[16] Diminished resource base which is described as degraded
[17] Dense, fearful forests penetrated
[18] High opportunity cost for harvesters
[19] Villagers don't spend recreational time in the environment
[20] Ancestors leave the bush
[21] No longer feared
[22] Dependence on the environment is reduced – look for other options.
[23] Knowledge lost
[24] Cultural and environmental decoupling
[25] No longer act as genetic refugia
[26] Appreciation for and value of the environment decreases substantially
[27] Loss of ecological memory
[28] Environmental/traditional rules not adhered to, which intensifies unsustainable harvesting practices
[29] Drought or surprise and environment flips to a less productive state
[30] Environmental degradation
[31] Degraded socio-ecological system

Figure 7.2 The process that leads to a degraded socio-ecological system as a consequence of anthropogenic disturbance.

7.4 Conclusion

The former anthropogenic disturbances of white and coloured landowners have had a significant influence on the vegetation characteristics of the present landscape. This is in terms of increased landscape heterogeneity, reduced species richness, and a change in vegetation composition, species abundance, percentage cover and species heights. Areas of dense forest have a higher species richness and number of medium, tall and very tall trees than former grazing lands, agricultural fields and old settlements. In addition, species which are common in these areas are often rare in dense forests, while the reverse is also true. Sites of anthropogenic disturbance are dominated by invasive species, exotics and weeds. These effects are a consequence of anthropogenic disturbance rather than soil properties. Different kinds of anthropogenic disturbance have different effects in terms of species diversity, species abundance, and vegetation composition and structure. Former grazing lands are more species rich and structurally diverse, have a higher percentage cover and a lower percentage of *Acacia karroo* than areas that were under agricultural production or used as a settlement.

Local people are heavily dependent on this disturbed and topographically variable landscape to meet their basic needs. They use as many as 21 species of fuel wood; 40 medicinal plants; seven cultural species; nine building materials; resources with an economic value such as prickly pear and aloe; game meat; honey; clean water; and forage of different densities, which obtain value at different times in the year and under different drought conditions. This dependency on the local environment encourages people to place high value on it.

Past anthropogenic disturbance is a contributing factor to this high dependency, as it increases the supply of valuable resources. Anthropogenic disturbance has therefore added value to local people's livelihoods. The variety of resource patches, at different stages of succession, caused by different kinds of anthropogenic disturbance, coupled with topographic variability, has increased the variety and accessibility of resources useful to local people. The most important source of medicinal plants is on high altitude former grazing lands, while edible fruits, particularly *Opuntia ficus-indica* and *Scutia myrtina*, are found on the edge of old settlements. Abandoned fields are the best source of the popular fuel wood, *Acacia karroo*, while low lying grazing lands provide a wide diversity of fuel

wood species. In addition, invasive, exotic species, associated with disturbed landscapes often had high value to local people. Examples include *Acacia mearnsii* and *Opuntia ficus-indica* and the indigenous, but invasive, *Acacia karroo*.

Informants were generally adverse to dense forests as they harbour dangerous animals and criminals, cattle get lost and die in dense forests, people are fearful of them, and it is difficult to access resources because of their impenetrable nature. They therefore have little immediate practical value and informants placed greater value on an open landscape with few dense forests. However, informants do recognize the role of dense forests during drought conditions because the vegetation becomes less thick, resources are accessible and cattle use them for forage and shelter. Dense forests, which have high species richness and contain species that are rare in the rest of the landscape, act as species refugia, and retain ecological memory. They could thus play a critical role in the long-term resilience of the socio-ecological system.

Anthropogenic disturbance has contradictory effects where there is a fine line separating whether it will have positive or negative repercussions for local people's livelihoods. In some cases disturbance will simultaneously have positive and negative repercussions. For example, the former road network is an important means of accessing resources but it is also a significant cause of erosion. Informants enjoyed the benefits of a disturbed landscape but were also aware and affected by some of the consequences, such as *Acacia mearnsii* flourishing on grazing lands, which reduces grass cover and makes the soil gray and compact.

The local AmaXhosa still retain many elements of their traditional worldview and eco-cosmologies, which has many characteristics of the Animist belief system. High emphasis is placed on the spiritual aspect of reality. Misfortune and blessing are believed to have their source in the spiritual realm and the focus is therefore on controlling the spiritual realm by appeasing the ancestors. This worldview has had fundamental affects on people's relationship with their local landscape and how they value and manage it. Certain features in the landscape, including sacred pools, graveyards, caves, forests and the kraal are important in connecting people to the ancestors and People of the River, while specific plants are critical for the successful performance of a ritual. These sites and species obtain very high significance in the lives of the amaXhsosa. Some species, such as *Olea europaea* subsp. *africana* are integral to the amaXhosa belief system and can therefore be classified

as cultural keystone species (Garibaldi and Turner 2004). Informants believe that sacred pools play an important role during times drought because, as they testify, these pools never run out of water. Sacred pools are therefore important aspects of this socio-ecological system that lead to its long-term resilience. Many informants expressed the desire to be buried in the place of their birth and where their ancestors are buried. Cultural sites and species encourage this desire as there are the means of connecting with the spiritual world. This encourages continuity to place. When compared to the literature, these values and beliefs parallel many indigenous and local people who have co-evolved with their local environments to develop management practices that maximize the positive impacts of anthropogenic disturbance.

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Appendices

Appendix 1: Observed and expected values for chi squared test

Gravel content	Land Use			
Observed	*Old Settlements*	*Abandoned Fields*	*Grazing land*	*Totals*
Low	4	3	9	4
Med	1	4	7	1
High	2	3	11	2
Totals	7	10	27	7
Expected	*Old Settlements*	*Abandoned Fields*	*Grazing land*	*Totals*
Low	4.0	5.7	15.4	4
Med	1.0	1.43	3.9	1
High	2.0	2.9	7.7	2
Totals	7	10	27	7

Texture	Land Use			
Observed	*Old Settlements*	*Abandoned Fields*	*Grazing Lands*	*Totals*
Sand	1	0	12	13
Clay Loam	3	4	8	15
Clay	3	6	8	17
Totals	7	10	28	45
Expected	*Old Settlements*	*Abandoned Fields*	*Grazing Lands*	*Totals*
Sand	2.0	2.9	8.1	13
Clay Loam	2.3	3.3	9.3	15
Clay	2.6	3.8	10.6	17
Totals	7	10	28	45

pH	Land Use			
Observed	*Old Settlements*	*Abandoned Fields*	*Grazing Lands*	*Totals*
4.9-5.6	4	2	8	14
5.8-6.1	0	3	14	17
6.2-7	3	5	5	13
Totals	7	10	27	44
Expected	*Old Settlements*	*Agricultural Fields*	*Grazing Lands*	*Totals*
4.9-5.6	2.2	3.2	8.6	14
5.8-6.1	2.7	3.9	10.4	17
6.2-7	2.1	3.0	8.0	13
Totals	7	10	27	44

Species Richness	Land Use			
Observed	*Old Settlements*	*Abandoned Fields*	*Grazing Lands*	*Totals*
Low	5	16	13	34
Med	4	8	13	25
High	0	2	20	22
Totals	9	26	46	81
Expected	*Old Settlements*	*Abandoned Fields*	*Grazing Lands*	*Totals*
Low	3.8	10.9	19.3	34
Med	2.8	8.0	14.2	25
High	2.4	7.1	12.5	22
Totals	9	26	46	81

Species Richness	Gravel Content			
Observed	*Low*	*Med*	*High*	*Total*
Low	11	4	4	19
Med	4	5	5	14
High	2	3	6	11
Totals	17	12	15	44
Expected	*Low*	*Med*	*High*	*Total*
Low	7.3	5.2	6.5	19
Med	5.4	3.8	4.8	14
High	4.3	3	3.8	11
Totals	17	12	15	44

Species Richness	Texture			
Observed	*Sand*	*Clay Loam*	*Clay*	*Totals*
Low	5	6	8	19
Med	3	5	6	14
High	5	4	3	12
Totals	13	15	17	45
Expected	*Sand*	*Clay Loam*	*Clay*	*Totals*
Low	5.6	6.3	7.2	19
Med	4.0	4.7	5.3	14
High	3.5	4.0	4.5	12
Totals	13	15	17	45

Species Richness	pH			
Observed	*Acid 4.9-5.6*	*Medium 5.8-6.1*	*Optimum 6.2-7*	*Totals*
Low	7	6	6	19
Med	3	6	5	14
High	4	4	3	11
Totals	14	16	14	44
Expected	*Acid 4.9-5.6*	*Medium 5.8-6.1*	*Optimum 6.2-7*	*Totals*
Low	6.1	6.9	6.1	19
Med	4.6	5.1	4.5	14
High	3.5	4	3.5	11
Totals	14	16	14	44

Appendix 2: Species names and their numbers given on the X axis in figure 4.2, which compares the abundance of different species between anthropogenic landscapes.

No	Name	No	Name	No	Name
1	*Aloe ferox*	42	*Carissa lispinosa*	83	*Chaetacme aistata*
2	*Asparagus myrsoides*	43	Unknown	84	Unknown
3	*Opuntia aurantiaca*	44	*Cartha edulis*	85	*Allophyllus decipiens*
4	*Nicotinna glaua*	45	*Rhus pallens*	86	Unknown
5	Unknown	46	*Rhus Crenata*	87	*c.f. Mimusops* sp.
6	Unknown	47	Unknown	88	*Otholoium* sp.
7	*Bambusa* sp.	48	*Capparis sepiarica var. citrifoilia*	89	*Hippobromus paciciflorus*
8	*Sarcostenna viminale*	49	Unknown	90	*Calpurnia* sp.
9	Unknown	50	Unknown	91	Unknown
10	*Scolopia zeheri*	51	*Diospyros scabrida*	92	*Lycium* sp.
11	*Heteromorpha trifoliata*	52	*Leucosidea sericea*	93	*Diospyros lycoides*
12	*Leucas capensis*	53	*Scurtia myrtina*	94	*Apualytes dimidiata*
13	*Rubus alceifolius*	54	*Clemantia brachiata*	95	Unknown
14	*Psydrax abouatum*	55	*Senecio* sp.	96	*Acacia karroo*
15	Unknown	56	Unknown	97	*Salix capensis*
16	*Buddleza alysophylla*	57	*Helichrysum cymosum*	98	*Euclea undulata*
17	*Canthium inerme*	58	*Asparagus setaceus*	99	*Schotia latifolia*
18	*Cassine aethiopica*	59	*Mysine africana*	100	*Euphorbia triangularis*
19	*Cassine papillosa*	60	Unknown	101	*Mimusops obouata*
20	Unknown	61	*Olea capensis*	102	*Zanthoxylum capense*
21	*Coddia rudis*	62	*Sida* sp.	103	*Grewia occidentalis*
22	*Calpurmia sylutica*	63	*Viscum* sp.	104	*Pavetta* sp.
23	Unknown	64	*Plumbago auriculata*	105	*Olea europaea* subsp. *africana*
24	Unknown	65	*Opuntia ficus-indica*	106	*Ziziphus mucronata*
25	*Celtis africana*	66	*Passiflora* sp.	107	*Maytenus heterophylla*
26	*Ehretia rigida*	67	Unknown	108	Unknown
27	*Canyza scabrida*	68	*c.f. Polygala virgata*	109	*Cussonia spicta*
28	Unknown	69	*Conyza scabrida*	110	Unknown
29	*Senecio angulatus*	70	*Solanum psuedocapsicum*	111	*Ptaeroxylum inerme*
30	*Rhamnus prinoides*	71	*Rhus dentata*	112	*Solanum Hispidium*
31	*Euclea schimperi*	72	Unknown	113	Unknown
32	*Cotyledon* c.f. *cabriculata*	73	*Fabraceae genus inlatus?*	114	*Hilisus aethiopica*
33	*Halleria lucida*	74	Unknown	115	*c.f. Clausena* sp.
34	Unknown	75	Unknown	116	*Maytenus pedimculum*
35	*Pappea capensis*	76	*Aricranthus* sp.	117	*Acaciamearnsii*
36	*Tecomaria capensis*	77	Unknown	118	*Merium oleander*
37	*Brachylaena illicifolia*	78	*Cissampelos capensis*	119	*Phylice c.f. axillaris*
38	*Azima tetracantha*	79	*Canthium ciliaris*	120	*Indigofera* sp.
39	Unknown	80	*Senecio linifolius*	121	*Ziziphus micronata*
40	*Boscio aloides*	81	*Jasimuna angulare*		
41	Unknown	82	*Canthium c.f. ciliatum*		

Appendix 3: Household survey of resource use

Details of respondent
Name: Gender: Age: Clan: Born: Length of stay: Education: Occupation: Status of household

Household Economy
2.1 What is the gross monthly income of each breadwinner?
2.2 What are your sources of income?

Cultivation and animal husbandry
3.1 What kinds of livestock does this household have?
Cattle: Goats: Sheep: Pigs: Donkeys: Horses: Chickens:

3.2 What crops do you farm?

3.3 How many fields do you have and how big are they?

Religion/culture

4.1 Are you a Christian?

4.2 Do you believe and communicate with the ancestors?

4.3 Do you practice rituals?

4.4 What rituals do you practice?

4.5 When was your last ritual?

Resource use

Fuel wood

5.1 Does your household collect fuel wood?

5.2 Who in your household collects fuel wood?

5.3 How often is it collected?

5.4 How much is collected?

5.5 How do you collect it? (i.e. cut branches, collect dry sticks etc.)

5.6 What species are used?

5.7 What are the three species most preferred?

5.8 What species are most abundant?

5.9 Are there specific places that you go to collect fuel wood.

5.10 How many different places are there.

5.11 Do you always go to the same place.

5.12 What do these places look like

5.13 How has the abundance of fuel wood changed over the years?

Building Materials

6.1 Does your household collect building materials?

6.2 Who in your household collects building materials?

6.3 How often is it collected?

6.4 How much is collected?

6.5 What harvesting techniques do you use?

6.6 What species are used?

6.7 What species are preferred?

6.8 What species are most abundant?

6.9 Are there specific places that you go to collect fuel wood?

6.10 How many different places are there?

6.11 Do you always go to the same place?

6.12 What do these places look like?

6.13 How has the abundance of building materials changed over the years?

Medicinal plants

7.1 Do you use medicinal plants?

7.2 Who in your household collects medicinal plants?

7.3 Do you collect them yourself or buy them from villagers?

7.4 How often do you collect it?

7.5 How much do you collect?

7.6 What techniques do you use to collect medicinal plants?

7.7 What species are used most commonly?

7.8 What species are most abundant?

7.9 Are there specific places that you go to collect medicinal species?

7.10 How many different places are there?

7.11 Do you always go to the same place?

7.12 What do these places look like?

7.13 How has the abundance of medicinal plants changed over the years?

Cultural species

8.1 Does your household collect cultural species?

8.2 Who in your household collects the plants?

8.3 How often is it collected?

8.4 How much is collected?

8.5 How do you collect the species?

8.6 What species are used?

8.7 What species are preferred?

8.8 What species are most abundant?

8.9 Are there specific places that you go to collect cultural species?.

8.10 How many different places are there?

8.11 Do you always go to the same place?

8.12 What do these places look like?

8.13 How has the abundance of cultural species changed over the years?

Appendix 4 Species and their benefits (Voucher specimens identified Dold, A.P. at the Selmar Schonland Herbarium)

KEY

DKN: Don't know name **DKS: Don't know species** **FW: Fuel wood**

BM: Building material **Cul: Cultural plant** **Med: Medicinal plant** **For: Forage** **Ed: Edible** **TV: Total value**

C: Cow **G: Goat** **DK: don't know**

Xhosa Name	Latin Name	FW	BM	Cul	Med	For	ED	TV
Ikati	*Opuntia aurantiaca*	0	0	0	0	0	0	Negative value
Ishwadi	Not known	0	0	1	0	1	0	Very high
Umthole	*Acacia Mearnsii*	2	2	0	0	0	0	Med
Umnga	*Acacia karroo*	3	1	1	0	3 G 1 C	0	Med
Umkhondo	*Agapathus praecox*	0	0	0	1	0	0	Med
Black Iqwili	*Alepidea ametyiblica*	0	0	0	2	0	0	Very high
Ikhala	*Aloe ferox*	0	0	0	1	1 G	2	High
Uxhobakhulu	*Anenome* sp.	0	0	0	1	DK	0	Med
DKN	*Apualytes dimidiata*	0	0	0	0	0	0	Low
Ubushwa	*Arctotic arctotoides*	0	0	0	1	2 G	0	Low
DKN	*Aricranthus* sp.	0	0	0	0	1	0	Low
Umgxam	*Asparagus myrsoides*	1	0	0	0	2 G	0	Not NB
Igcegceleya	*Azima tetracantha*	0	0	0	1	2 G 1 C	0	Low
DKS	*Boscio aloides*							
Isiduli/Igcange	*Brachylaena illicifolia*	1	0	0	0	0	0	Low
DKN	*Buddleza alysophylla*	0	0	0	0	2	0	Low
Uyakayakana	*Bulbine abysinica*	0	0	0	1	0	0	High
DKN	c.f. *Clausena* sp.	0	0	0	0	2	0	Low
DKS	c.f. *Mimusops* sp.							
DKS	c.f. *Polygala virgata*							
Umbhete	*Calpurmia sylutica*	0	0	0	1	1 G	0	Low
DKN	*Canthium* c.f. *ciliatum*	1	0	0	0	0	0	Not NB
Umqayimbila	*Canthium inerme*	1	0	0	0	0	0	Not NB
Inxina	*Canyza scabrida*	0	0	0	1	2 G	0	Med
Intsihlo	*Capparis sepiarica* var. *citrifoilia*	0	0	0	1	0	0	Med
DKS	*Cartha edulis*							
DKN	*Cassine aethiopica*	0	0	0	0	2 G 1 C	0	Low
DKS	*Cassine papillosa*							
Umvumvu	*Celtis africana*							
Isihlahla	*Cerapegia stapelliformis*	0	0	0	0	0	0	Not NB
DKS	*Cissampelos capensis*							

Iqwaka/ Instinde	*Coddia rudis*	3	1	0	0	1	1	High
DKS	*Conyza scabrida*							
Iphewala	*Cotyledon* c.f. *cabriculata*	0	0	0	1	1 G	0	Low
DKN	*Crassula muscosa*	0	0	0	0	0	0	Not NB
Umsenge	*Cussonia spicta*	0	0	0	0	3 G 1 C	1	Med
Incumncum	*Cyunera perpensa*	0	0	0	0	0	3	Low
Idlebezebhokwe	*Cyunera perpensa*	0	0	0	1	0	0	Low
Umbungisa	*Diospyros lycoides*	0	0	0	0	2	1	Low
Umqoboqobo	*Diospyros scabrida*	1	0	0	0	0	0	Low
Intsema	*Duvalia reclinata*	0	0	0	1	0	0	Med
Umqokolo	*Ehretia rigida*	1	0	0	0	0	3	Low
DKN	*Euclea schimperi*	0	0	0	0	0	0	Not NB
Umhlontlo	*Euphorbia triangularis*	0	0	0	1	0	0	Med
Umanzamdaka	*Gerbera pilliselloides*	0	0	0	1	0	0	Med
Isichwe	*Girgera* sp.	0	0	1	1	2		High
DKS	*Gomphocarpus* sp.							
Umnqabaza	*Grewia occidentalis*	1	0	0	0	2	3	Med
Umathunga	*Haemonthus* sp.	0	0	0	2	1G	0	High
DKN	*Halleria lucida*	0	0	0	0	2	0	Low
Ubuhlungubebhokwe	*Helichrysum cymosum*	0	0	0	1	2 G 1 C	0	Low
DKS	*Hermannia* sp.							
DKN	*Hilisus aethiopica*	0	0	0	0	0	0	Not NB
Ipapiri	*Hippobromus paciciflorus*	1	0	0	0	0	0	Very low
Inongwe	*Hypoxis* sp.	0	0	0	2	1	0	High
DKN	*Indigofera* sp.	0	0	0	1		0	Low
DKN	*Kiggelaria africana*	0	0	0	0	2	0	Low
Unotyhelana	*Kniphofia* sp.	0	0	0	1	DK	0	Low
Umficamficana	*Lantana rugosa*	0	0	0	1	2	0	High
Inzinzibala	*Leucas capensis*	0	0	0	1	0	0	High
Isidwadwa	*Leucosidea sericea*	2	0	0	1	2 G	0	Med
Ithembu	*Maraea reticulata*	0	1	0	0	1C	0	High
Umkhoba	*Merium oleander*	0	1	0	0	0	0	Very high
White umhlonyane	*Merribium ulgare*	0	0	0	1	1 G	0	Med
DKN	*Nicotinna glaua*	0	0	0	0	1 C 2 G	0	Low
Umlahleniselefila	*Olea capensis*	0	0	0	1	0	0	Low
Umnquma	*Olea europaea* subsp *africana*	1	2	1	1	3	0	Very high
Itolofyia	*Opuntia ficus-indica*	0	0	0	0	1 C	3	Very NB
DKS	*Pappea capensis*							
Ikokodini	*Passiflora* sp.	0	0	0	0	0	1	Not NB
Icimamlilo	*Pentanisia prunelloides*	0	0	0	1	0	0	Med
DKN	*Phylice c.f. axillaris*							
Ilathiba	*Phyllanthus* sp.	0	0	0	1	2	0	High
Lafhile/plumbago	*Plumbago auriculata*	0	1	0	0	0	0	Low
DKS	*Psydrax abouatum*						0	

Umthathi	*Ptaeroxylum inerme*	1	2	1	1	0	0	High
Umamfobe	*Rhamnus prinoides*	0	0	0	0	0	0	Not NB
Uchithibhungu	*Rhoicissus tridentata*	0	0	0	1	0	0	Med
Intlokoshane	*Rhus Crenata*	1	0	0	0	1	1	Med
Iqwaka with black berries	*Rhus dentata*	2	0	0	0	2 G 1 C	1	Med
Amachirha	*Richerdia leissilensis*	0	0	0	1	1	0	Low
Umgcunube	*Salix capensis*	0	0	1	0	0	0	High
White Iqwili	*Sanchus*	0	0	0	1	DK	0	Med
DKN	*Sarcostenna viminale*	0	0	0	0	0	0	Not NB
Black umhlonyane	*Schistostaphium* sp.	0	0	0	1	1 G	0	Low
Umqaqoba	*Scolopia zeheri*	1	0	0	0	2	0	Low
Isiphingo	*Scurtia myrtina*	3	0	0	0	2 G 1 C	3	Med
Um-oki	*Senecio angulatus*	0	0	0	0	1	1	Med
Ityholo	*Senecio angulatus*	0	0	0	1	2 G	0	Low
Inkanga – big one	*Senecio pterophorus*	0	1	0	1	2 G 1 C		Med
Ilapesi	*Senecio* sp.	0	0	0	0	0	0	Not NB
Umkwenkwe	*Sideroxylon inerme*	0	0	0	1	0	0	Low
Unozitholana (ubulawyo)	*Silene undulata*	0	0	1	1	1 G	0	Very high
Umthuma	*Solanum Hispidium*	0	0	0	1	0	0	Low
Small umthuma	*Solanum psuedocapsicum*	0	0	0	0	0	1	Low
Igqange	*Tarchonanthus camphoratus*	2	1	0	0	2 G 1 C	0	Med
Umvumvu	*Trema arienteli*	1	1	0	0	0	0	Med
Umbhuvu	Unknown	0	0	0	0	2 G	2	Low
Brother of Iqwaka	Unknown	1	0	0	0	2	0	Low
Upiyopiyo	Unknown	0	0	0	1	1	0	Low
Ingcari	*Vepris undulata*	0	0	0	0	0	0	Not NB
DKN	*Viscum* sp.	0	0	0	0	0	0	Negative impact
Umlungumabela	*Zanthoxylum capense*	0	0	0	1	2	0	Low
Umphafa	*Ziziphus micronata*	1	0	0	0	0	1	Low

Appendix 5: Two semi-structured interviews conducted with villagers of Tidbury, Ntlini and Fairbairn

5.1 First interview structure

Age: Gender: Religion: Employment: Pension:
Number of Cattle: Goats: Chickens: Pigs Donkeys:

1.1 How long have you lived in your village?
1.2 How long have you lived in the Kat River Valley?

2.1 Can you tell me a bit about the history of your village?
2.2 Can you think of any important historical events?
2.3 How long has this village existed for?

3 Do you enjoy living in (Ntilini, Tidbury, Fairbairn) village?

4 What are the best qualities associated with this lifestyle

5.1 Would you prefer to live in an urban area?
5.2 If no why?
5.3 If yes, why do you still live here?

6. Do you experience any problems in this village

7.1 How would you categorise yourself in terms of culture?
7.2 What does it mean to be Xhosa?
7.3 Can you think of any important characteristics?
7.4 Can you identify five things which are important to your culture? For example are there any rituals which are important.

8.1 Could you go into some detail about the ancestors?
8.2 How would you describe your relationship with them?
8.3 Are they still important to you?

8.4 Are there some ancestors which are more important than others?

8.5 What makes the ancestors happy?

8.6 What makes them angry?

8.7 What happens when they are angry?

8.8 What type of relationship do the ancestors have with the environment.

9.1 Please describe what your environment consists of.

9.2 What positive and negative characteristics and features of this environment are important to you?

10.1 Can you think of any plant species that have cultural significance?

10.2 Can you think of any animal species that have cultural significance?

10.3 Can you identify anyone who you would associate with any of the identified species?

10.4 Are there any taboos regarding access to the species and their type of use?

10.5.1 Do you think that any of the above mentioned species hold less significance today than in the past?

10.5.2 If so what has changed to decrease their value?

11.1 Are there any species that are valuable to you because they are beautiful?

11.2 Are there any species that are valuable to you because they prevent soil erosion?

11.3 Are there any species that are valuable to you because they enhance water quality?

11.4 Are there any species that are valuable to you because they enhance water quantity?

11.5 Are there any species that are valuable to you because they provide you with shade?

11.6 Are there any species that are valuable to you because they enhance the fertility of the soil?

12.1 Can you think of any sites that have cultural significance/value?

12.2 Can you identify anyone who often frequents these sites?

12.3 Are there ant taboos regarding access to the sites and its type of use?

12.4 If so, who controls access to the site?

12.5 Do you think any of these hold less significance than they did in the past. If so, what has changed to decrease their value?

13.1 Are there any places in the environment which are beautiful?

14.1 What do you do to relax?

14.2 Are there any places in the environment that you go to relax?

15.1 If I offered you a million rand would you leave your village?

5.2 Second interview structure

Age: Gender: Religion Length of stay in the specific village

1. How long do you see yourself living here for?
2. How long do you see your children living here for?
3. What is your favourite place in the whole world?
4. Exercise where sites and species, of both use and cultural value were ranked in terms of importance.
5. Do you think that it is right for a government official to put a monetary value on the above sites and species?
6. If the environment was degraded but the relevant species/sites were fine, what would the ancestors feel?
7. If the species were degraded but the rest of the environment was fine, what would the ancestors feel?

8.1 Do you see yourself as different from animals?

8.2 Do you see yourself as better than animals?