Getting the science right, or introducing science in the first place? Local 'facts', global discourse – 'desertification' in north-west Namibia

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pp. 15-44 *in* Stott, P. and Sullivan, S. (eds.) 2000 *Political Ecology: Science, Myth and Power*. London, Edward Arnold.

Abstract
Critique of 'received wisdoms' of environmental degradation tends to swing between poststructuralist demolition of the validity of a peculiarly western natural science and a realist perception that 'getting the science right' will accurately reveal 'what is really happening'. In this chapter I argue, however, that both these stances ignore a basic characteristic of many environmental narratives: that they have become reified as 'scientific truths' in the absence of what most natural scientists would consider the praxis of science. I hinge discussion around a particular environmental narrative, that of 'desertification' in north-west Namibia. The case study traces the construction of a national discourse of 'desertification', and elaborates differences between biophysical researches both linked to, and independent of, institutions which receive funding in the name of an international concern over 'desertification'. Oral testimony accounts from local people further situate ideas of environmental degradation, suggesting them to be metaphors for wider concerns regarding claims to land and other policy processes. A critical realist engagement with these contexts implies two things. First, that academic research regarding environmental knowledges is incomplete without some political interaction with the structural processes enabling power to define what knowledge is. And second, that in contrast to the archaic portraits of science featured in some relativising sociology of science there is much room for conceptual exchange between a biophysical science embracing both form and change, and an actor-oriented applied social science grappling with conflicts between local dynamics and national or global structures.

Key words
'Desertification', poststructuralist theory, critical realism, policy, oral testimonies, Namibia

1. Introduction

Poststructuralist deconstruction of 'received wisdoms' of the environment tends to lay blame at the door of a simplistic and peculiarly western natural science: portrayed as hamstrung by its tendency to bracket research questions from their wider socio-political and historical contexts, yet hegemonic in its ability to assert 'power at a distance' (cf. Murdoch & Clark, 1994 following Latour) and thereby constrain people's lives in often brutally repressive ways. The extreme relativist's position is to deny that there can be any validity to scientific analyses of environmental problems, since far from constituting a defensible means of observing 'real world' phenomena such analyses are embedded in particular individual, social and historical moments and cannot be divorced from the power relations they uphold. In other words, to throw the scientific baby out with the bath-water. To the relativist's amusement, the realist might claim instead that we just have to get the science right: that with new tools and techniques, and with new conceptual influences over data collection and interpretation, the 'truth' will be revealed allowing rational planning and management of the environment for the common social and environmental good.

In this chapter I argue that both these perspectives ignore a fundamental aspect of many modern environmental narratives, particularly those relating to the 'developing world'. That is, that they have become accepted as 'fact' in the complete absence of what most natural scientists would today

acknowledge as the praxis of science; i.e. the standardised and 'transparent' collection of data to explore propositional or 'testable' statements, and the interpretation of such data within a defendable, albeit changing and contentious, theoretical framework.

My discussion hinges around a particular environmental issue, that of 'desertification' in north-west Namibia, identified as the outcome of disintegration of local-level resource management institutions and considered 'undisputed fact' by the country's donor-funded Programme to Combat Desertification. Most assertions of degradation and imminent system collapse in the area, however, have been made without the support of any 'scientifically derived' data whatsoever, and have certainly occluded local narratives and wider ecological theorising about the environment. Significantly in the context of a post-apartheid southern Africa, where the opportunity exists to formulate radical policy enabling self-determination in the pastoral use and management of existing and expanded communal rangelands, a pervasive discourse of 'desertification' driven by international environmentalist ideals justifies land policies based on increasing control and regulation rather than fostering flexibility in land-use. Several analyses similarly identify links between negative environmental discourses and severely repressive policy (cf. Homewood and Rodgers, 1987; Fairhead and Leach, 1996; Homewood and Brockington, 1999).

Nevertheless, assertions of degradation incorporate a number of propositional truths which are amenable to analysis and potential falsification through the praxis of science within the limits of interpretation imposed by spatial and temporal scale (cf. Allen & Starr, ??; Solbrig, 1991; Scoones, 1997; Sullivan, 1999) and conceptual framework[1]. Institutional alliances, of course, also constrain the interpretation of data. As reviewed here, however, a critical realist approach to recent independent analyses seems to provide little support for specific claims of widespread desertification in north-west Namibia. Not surprisingly, such analyses also converge with individual oral testimony accounts of ecological dynamics in the area.

In this case, the question is not about getting the science right, but about introducing science into the debate in the first place. Given the acknowledged strength of 'science' in policy discourse, the implications of this can be profound: if researchers are prepared to allow their choice of publishing outlet to be governed in part by criteria other than academic research assessments, then I would argue that the pathways exist whereby data can strengthen the power and voice of local narratives and concerns in contesting national and global policy debate. In other words, if we as academics are

[1] cf. debate regarding the validity of equilibrium and nonequilibrium concepts to arid and semi-arid rangelands in Illius & O'Connor (1999) and Rohde & Sullivan (in prep.).

to talk any sense at all about the problems of representing local narratives in regulatory environmental discourses, then we need to complement our political ecology musings with some political engagement. As Peet & Watts (1996: 37-38) acknowledge with their term 'liberation ecology', the challenge is to recognise the emancipatory and 'politically transformative' potential of environmental researches, which, they suggest, should include a 'nuanced' and 'thickly textured' empiricism.

There is a second issue here, however. The literature regarding environmental degradation resounds metaphorically with calls for cross-disciplinary and 'hybrid' approaches to research (cf. Batterbury & Bebbington, 1999), a call echoed in recent meetings on issues relating to 'environment and development'[2]. In other words, towards breaking down the dualisms between natural and social science, realist and relativist analytics. The commitment on the part of both natural scientists and social theorists to learn and take seriously the other's language, however, is conspicuous largely by its absence. A case in point is Atkinson's 1991 reactionary treatise on 'political ecology': an unproblematised and uncritical acceptance of environmental degradation narratives with little consideration of either the hegemonic impacts of these northern 'citizen science' discourses on developing country contexts, or of paradigmatic shifts in the biophysical sciences regarding ecological dynamics and complexity.

Put bluntly, and at risk of essentialising categories, while natural scientists are alienated by what they see as the unnecessarily obscuring jargon of poststructuralist analysis, an anti-science humanities (cf. Dunbar, 1995) appears unaware of new models and thinking in the natural sciences, continuing to portray an archaic picture of science as an unreflexive endeavour in which scientists are ignorant of the contexts in which they work. In this chapter I maintain instead that observed discontinuities between data and discourse, as suggested by the case material, point to an identification of far greater parallels in conceptual thinking between an integrative (cf. Holling, 1998: 3) 'realist' science and 'constructivist' social theorising than is normally acknowledged. In other words, that a poststructural political ecology (cf. Escobar, 1996) could do well to give more space to dramatic conceptual shifts occurring in the physical and life sciences (see also Sullivan, submitted). These offer cogent and coherent challenges to what could be termed a temperate-zone Enlightenment foundationalism, built on seemingly fundamental principles of equilibrium, gradual change, and predictability in a relatively constant environment. It is suggested that these tenets will

[2] cf. discussion at a workshop on 'constructivism and realism in environment and development' held at the London School of Economics, 14th December 1998, and at a conference on 'African environments – past and present' at Oxford University, 5th-8th July 1999.

be, and are being, displaced inexorably by a language of non-equilibrium, unpredictable and continual change, contingency and sensitivity to historical processes, and emergent complexity from local level networks. All of these have become crucial concepts in both anthropology and ecology researches of African drylands. By indicating convergences of language and metaphor that introduce possibilities for communication across the apparently impermeable boundaries separating realist 'science' and relativist discourse theory, such thinking might make genuinely possible the hybrid, post-disciplinary arenas of environmental anthropology and political ecology.

2. A dryland on the brink of collapse?

2.1 Building a discourse

The former Damaraland 'homeland' of north-west Namibia (Fig. 1) has been the focus of a long history of assertions of devastating environmental degradation, generally made with reference to human misuse of resources. As long ago as 1786, the explorer Thompson wrote of the region that 'some people who have visited a part of Caffraria[3] have said that it appeared to them to have been a country worn out by time, and had once been fruitful' (in Jill Kinahan, 1990: 44). Reiterating this dismal view, Native Commissioner Hahn (1928: 222) wrote that '[t]here can scarcely be a doubt that this barren coast-girdle gradually increases in breadth and encroaches gradually upon the more fertile parts of the country, which in time will become as barren as the coast-land now is ...'. In this tradition, and following field visits in the 1950s, an 'ethnologist' for the South African administration wrote of the pro-Namib settlement of Sesfontein that '...the whole … area has been overgrazed so thoroughly that only the large trees remain in a level plain of bare sand. There are no young trees nor can any raise its head owing to the intensive browsing of the numerous cattle, goats and donkeys ... as the large trees die off one by one and no others take their place it seems that all vegetation must eventually disappear ...' (Van Warmelo, 1962: 39). Consultancy reports from the 1970s similarly maintained that '[a]buse of natural resources in the past has aggravated the problems of the livestock industry in the Homeland ... severe degradation has occurred' (Loxton *et al*, 1974: 22).

Since independence in 1990, declarations of degradation and pending environmental collapse have fallen thick and fast. Apparently: '... environmental catastrophe (is) imminent in most of the communal areas ...' (United Democratic Front, 1991: 5); the '... rural economy in the arid western parts of Namibia has steadily declined over the last few decades, its reserves of pasture depleted to critical levels' (John Kinahan, 1993: 385); 'The ravaged landscape is testimony to mass

[3] An early name describing the region known today as north-west Namibia and south-west Angola.

overgrazing ...' (Næraa *et al.*, 1993: 82); '... eventually the whole ecosystem will suffer severely and collapse' (Infoscience, 1994: 22); 'Reduction in vegetation cover and subsequent soil denudation following overgrazing ... can be found in all regions, in particular, …Kunene' (Seely and Jacobson, 1994: 31; see also Seely *et al.*, 1995: 53); and '… overgrazing has resulted in the virtual disappearance of perennial grass leading to continuous soil erosion' (Giorgis, 1995: 232). The current head of the Directorate of Resource Management, Ministry of Environment and Tourism, recently summed up this thinking for the Hoanib river catchment in the statement that this, '... is now a desert landscape; grass, or for that matter any growth other than huge acacias is nowhere to be seen. All and all, it is an ecological system put off balance and in danger of collapsing altogether. The only way that something can be done about this, is to have fewer ... livestock' (quoted in Menges 1992 in Rohde, 1997: 368).

The former Damaraland is not an isolated case: statements echoing these sentiments can be found for communal areas throughout the country. For example, Malan and Owen-Smith (1974: 140) assert for the Kaokoveld (north Kunene) that severe overgrazing is a problem, particularly in valley areas dominated by woodland savanna, where it is thought to have '… virtually exterminated most perennial grass species' so that 'for much of the year the ground ... is bare and trampled into a fine dust'. For the Kalahari sandveld of Hereroland it is considered that an increase in livestock numbers, particularly cattle, throughout this century has caused '… overgrazing, soil erosion, and trampling of the rangeland', perceived to 'drastically decrease the grassland productivity' (Kakujaha-Matundu, 1994: 6, 22). Similarly, widespread concern has been expressed regarding vegetation degradation through overgrazing and deforestation in the former Owambo region of north-central Namibia, particularly the central Cuvelai floodplain, leading to the assertion that central Owambo is approaching the limits of its human and livestock carrying capacity under present subsistence strategies (cf. Loxton *et al.*, 1983: 87, 114; Jensen, 1990: 15; Erkkiliä and Siiskonen, 1992: 152-155; Marsh and Seely, 1992: 17, 25; NISER, 1992: ix; Marsh, 1994: 44-50; Soroses *et al.*, 1994: 6-14; Mubita, 1995: 68-70).

In most cases, and certainly with regard to the north-west, these confident assertions were made without reference to a shred of supportive natural science 'evidence'. The praxis of science thus has barely entered the discourse. Nevertheless, these assertions and perceptions by a few 'experts' somehow have assumed the validity and sanction of 'science', to the extent that contextualized research into whether or not desertification processes are occurring, or what form these may take, has been treated as an undertaking of little worth. A case in point is the instruction to a working group of researchers, invited to participate in discussions to formulate a plan of research for the

second phase of the country's Desertification Programme (see below), to begin by assuming that desertification has occurred (pers. obs., Planning Workshop, 1995).

Furthermore, and following Leach and Fairhead (1998), assertions and impressions of desertification haved gained currency only through the occlusion of significant contexts: of historical circumstances and political processes shaping and constraining land-use by communal area inhabitants (cf. Lau, 1979, 1987; Fuller, 1993), and of local narratives and knowledge concerning landscape and biophysical resources (cf. Sullivan, 1996a, 1999, in press, submitted). In addition, they fail to incorporate current academic debate regarding the significance of abiotic factors, primarily rainfall, in driving productivity and land use in dryland environments over and above the density-dependent effects of livestock[4].

Current fears of 'desertification' in Namibia thus are institutionalized in the country's 'Programme to Combat Desertification' (NAPCOD): a joint initiative of the Desert Research Foundation of Namibia (DRFN), the Ministry of Environment and Tourism (MET) and the Ministry of Agriculture, Water and Rural Development (MAWRD) (with the DRFN running most of its activities), funded by the Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) of the Federal Republic of Germany (Seely and Jacobson, 1994; Wolters, 1994; Seely *et al.*, 1995: 57-61; Mouton *et al.*, 1997: 1). Through its media programme NAPCOD has considerable potential to mold a desertification-aware national consciousness, which pervades thinking regarding land reform and natural resources management projects alike. NAPCOD, therefore, can be seen as both a response to, and a cause of, desertification concern. The Programme's position is summarised in its recent policy review which states, '[t]hat land degradation has, and is continuing to, take place at an alarming rate *is an undisputed fact*' (Dewdney, 1996: iii emphasis added; see also Mouton *et al.*, 1997). Similarly, economic assessment of the impacts of desertification in Namibia, while acknowledged as based on '… assumed and reported, rather than scientifically documented, change' (Quan *et al.*, 1994: foreword), have considered it as given that desertification is occurring.

[4] See, for example, Sandford (1983), Wiens (1984), Coughenour *et al.* (1985, 1990), Caughley *et al.* (1987), Homewood and Rodgers (1987), Ellis and Swift (1988), Warren and Agnew (1988), Westoby *et al.* (1989), Abel and Blaikie (1990), Adams (1990, 87-112), Boonzaier *et al.* (1990), Galvin (1990), Biot *et al.* (1992), Behnke (1993), Behnke *et al.* (1993), Ellis *et al.* (1993), Dahlberg (1994), Milton and Hoffman (1994), Norbury *et al.* (1994), Thomas and Middleton (1994), Dean *et al.* (1995), Scoones (1995), Sullivan (1996b), Jacobson (1997), and Jacobson and Jacobson (1998).

2.2 Institutionally-driven biophysical research

Since the inauguration of NAPCOD in 1994, a handful of short-term studies incorporating biophysical approaches have been carried out under its auspices. What is interesting about these is first, that their stated agenda is to document processes of desertification (i.e. desertification is a *fait accompli*), and second, that their findings have been interpreted as indicating processes of desertification without considering alternative, and possibly more parsimonius, explanations. What is perhaps of graver concern is the manner in which these studies are socialising young Namibians to view the land-use practices of their communal area country-folk as environmentally degrading and in need of reform, while inadvertently deflecting interest from over-arching policy issues such as land redistribution[5].

For example, the 1994-1995 DRFN Summer Desertification Project, conducted in arid pro-Namib farmland of southern Kunene and northern Erongo Regions, had as its starting point the consideration that '… farmers of this area are experiencing difficulties with an ever-deteriorating rangeland that makes livestock farming only marginally productive' (Kambatuku *et al.*, 1995: 3). A primary objective of this study was thus to '… gather vital information on desertification' (Kambatuku *et al.*, 1995: 4). For this reason, two of the eight study sites were located in an area which appeared so desolate and severely degraded that it was given the working name of the 'Moonlandscape'. Not surprisingly given this framework, the project found a number of biophysical 'degradation-correlates' with grazing pressure (see Table 1). Overall, it was suggested that reductions in primary productivity and changes in plant species assemblages were occurring as a result of unsustainable grazing pressure, particularly around boreholes, and that these changes may be irreversible at sites considered severely overgrazed.

These conclusions were drawn, however, without appreciation of either the effect on the area of several years of below-average rainfall, or the residual potential for ecosystem productivity given appropriate abiotic conditions. In other words, alternative possible explanations for the research findings were not considered. The complex ecological dynamics of this arid area were forcefully illustrated by the late rains of 1995, occurring only a couple of months after the completion of the

[5]This extends to current uncontextualised interpretations of early ethnographic texts. For example, the classification of Damara-speaking Namibians as 'culturally hunter-gatherers' who have only acquired livestock in very recent times is now considered extremely problematic (see references in Sullivan (in press), and the 'Kalahari debate' in relation to ahistorical views of Bushman peoples, cf. Wilmsen, 1989). Nevertheless it has been reasserted unproblematically in recent DRFN texts in statements that '[t]he Damara people, who were hunter-gatherers, followed the example of Hereros and became cattle and goat farmers' (Kambatuku *et al*., 1995: 2).

DRFN project, which transformed the entire study area into a landscape reminiscent of prairie grasslands. Even the 'Moonlandscape' became an unrecognisable sea of palatable *Stipagrostis* spp. grasses (Jacobson and Jacobson, pers. comm.; Jacobson *et al.*, 1995), an outcome which certainly could not have been foreseen within the constraints of the conceptual framework informing the study.

The 1996-1997 DRFN Summer Desertification Project similarly focused on the pro-Namib farming areas of southern Erongo Region, an area introduced in the following terms:

> 'More than 100 years of heavy grazing has left much of this region appearing severely degraded. This overgrazing has been caused by a wide variety of factors such as poor management, greed, government subsidies which encouraged overstocking, and local overpopulation. The major problem induced by overgrazing has been denudation of the vegetation, with soil nutrient depletion as possible consequences of this …. This problem appears particularly acute in the drier areas of this zone, especially around water holes' (Ward, 1997: 2).

Let's leave aside the ahistorical framing of the research area and issues[6] and focus on the natural science aims of the project. Two of the study objectives were to determine whether degradation increases with proximity to settlement in a communal area, and whether a communal area with high stocking-levels suffers greater degradation than an adjacent commercial farm with lower stocking-levels. These aims were tested using comparisons of a variety of vegetation and soil parameters at the communal area of Otjimbingwe and two commercial farms in Erongo Region (Table 1). While the overall conclusion of the project was that '… communal farming ... is not more destructive to the natural environment than commercial farming' (Apollus *et al.*, 1997: 7), land degradation through overgrazing by livestock was considered as given throughout the study area (Kisco *et al.*, 1997: 1; Munukayumbwa *et al.*, 1997: 1; Ward, 1997: 2). This supported several recommendations for destocking (cf. Apollus *et al.*, 7-8). Furthermore, and as points 6 and 7 in Table 2 indicate, interpretations of the lack of differences in indices for the two areas are distinctly constrained when considered against possible alternative explanations. Interestingly, the apparent lack of a 'tragedy of the commons' in the communal areas seems to have supported a reframing of the study's conclusions in an autonomous publication (i.e. with no mention of NAPCOD) which also incorporates an expanded data-set with measures of herbaceous productivity in wet periods as well as dry (Ward *et al.*, 1998). In this, the study findings are interpreted as pointing '… both to the resilience of arid environments to high stocking levels and the over-riding influence of abiotic variables on environmental quality' (Ward *et al.*, 1998: 357).

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[6] According to which, the impoverishment of regional herding economies over the last few centuries due to mercantile and imperial expansion (cf. Lau, 1987), the devastating effects of rinderpest in 1897 (cf. Bley, 1996) and the persecution of Namibians under German colonial rule and a later apartheid administration (cf. Bley, 1996; Hayes *et al.*, 1998) might never have happened.

2.3 Independent biophysical research

Significantly, research conducted in this same area but independently of NAPCOD and drawing on ecological theory embracing non-equilibrium and non-linear dynamics, constructs something of a counter-narrative to desertification explanations. For example, a recent study based on analyses of archival landscape photographs for 38 sites matched with recent repeat images, and of matched aerial photographs between 1958 and 1981 corresponding to six of these ground photo sites, increases the time-depth of discussion back to the late 19th century (Rohde, 1997a, 1997b). This appears to tell the following story: that an increase in woody vegetation has occurred throughout the region since the first half of this century; that this increase includes species used intensively for browse, firewood and building material, and is independent of degree and type of land-use and of land tenure; and that, when analysed in conjunction with available rainfall data can be attributed to climatic factors over the last 100 years, primarily a period of relatively high rainfall averages during the first few decades of this century (Rohde, 1997a; 1997b: 307-331, 341-375). This analysis seems to contradict '… the stereotypical belief that communal farming and ... densely populated communal settlements, cause irreversible environmental degradation', and supports a '… case for climate change as the dominant factor affecting trees and shrubs within an inherently resilient environment' (Rohde, 1997a: 135; 1997b: 314, 376). With regard to herbaceous vegetation, these analyses also illustrate '… that dry periods in the past resulted in denuded landscapes' similar to those observed recently (cf. the 'Moonlandscape' referred to above) without apparently hampering the potential for herbaceous productivity in years with above-average rainfall (Rohde, 1997b: 309).

Similar interpretations have been drawn from a recent structured ecological survey of vegetation designed to assess settlement impact in the northern part of Khorixas District, southern Kunene Region (Sullivan, 1998; 1999). This dataset comprises 2760 woody plant individuals in a stratified sample of 75 transects, and 48 quadrats, half fenced to exclude livestock, in which herbaceous vegetation was monitored over two growing seasons. A number of standard ecological variables, including patterns in community floristics, diversity, cover and population structure, were analysed in relation to measures of use by people and livestock around three focal settlements. In contrast to common expressions of degradation, these data indicate the following. First, none of the measured vegetation variables demonstrated that land-use pressure was having a negative impact on anything but a local scale confined to within settlements. Second, for woody vegetation, widening the scale of analysis from that surveyed in a preliminary study of resource-use impacts in the area (Sullivan and Konstant, 1997) suggested that localised settlement impacts are within the range of variability expressed by a variety of vegetation measures over larger scales, including areas currently experiencing little or no utilisation by people or livestock. Third, that patterns in the woody vegetation dataset at both community and individual-species levels failed to provide consistent evidence for the degrading effects of resource utilisation, even though woody species, through the stability conferred by their longer lifespans, can act as longer-term and more robust indicators of vegetation change. Fourth, that tree populations demonstrate high recruitment and regenerative potential despite assertions that '[t]here are no young trees nor can any raise its head owing to the intensive browsing of the numerous cattle, goats and donkeys' (see above). Finally, and as Fig. 2 demonstrates, that herbaceous productivity is highly resilient under good rainfall conditions, and even in areas under intensive utilisation by livestock. In an attempt to bring some natural science data into this discussion, Fig. 3 and Table 2 provide with explanatory notes some of the 'results' of this analysis.

Despite these findings, much of which are available in Namibia as published and unpublished manuscripts, 'Damaraland' has been selected for further NAPCOD work '… due to *the fact* that desertification in (this) area is progressing rapidly' (Kamwi, 1997: 2, emphasis added). While

adhering to principles of participation and support for community action in the sustainable use of natural resources (cf. Kroll and Kruger, 1998; Seely, 1998), environment and development programmes informed by NAPCOD apparently continue to build on an unproblematised acceptance of desertification caused by land-use practices in the communal areas.

2.4 National sustaining of a global discourse

The different picture emerging from contextualised and empirical data analyses begs the question of why environmental collapse through human-induced desertification has remained such an overarching interpretive and explanatory framework in relation to land-use in this part of Namibia (and beyond)? Two offerings are made here in response to this question.

The first identifies effects on national knowledge production of the transmission of a reactive, 'northern' environmentalist worldview, informed by concerns of pending ecological collapse as formulated by 'deep ecology', 'ecophilosophy' and in some calls for a 'political ecology' (cf. Fox, 1990; Atkinson, 1991). This is exported by an international development community via the various UN summits and conventions, and donor-funded projects, on environment and development, introducing very real constraints to the developing economies of 'the south' who have to demonstrate adherence to 'green' values and policies in order to qualify for support (cf. Davies, 1992 *in* Leach and Mearns, 1996: 25-26). Importantly for resource-poor countries like Namibia, local scientists who do not conform to the agendas of internationally-funded programmes find their opportunities for both presenting opposing views and obtaining research-funding to investigate alternative scenarios are seriously compromised (Marais, pers. comm., June 1999). Global-local interlinkages thus amount to the creation of what Escobar (1996: 50) terms an 'ecocracy', in which the north retains dominance via the managerial ethic justified by a normalising environment-development discourse of 'sustainable development'.

Given the demonisation of desert in international 'green' environmental ideals[7], Namibia, the whole of which 'is rated as potential desert' (UNCOD, 1977; Tyson, 1986: 86), is at a distinct disadvantage. No wonder then that national policy-makers have essentially toe-ed the international policy line by framing a commitment to 'sustainable development' within an overarching 'Green Plan' (Brown, 1992) (something of a contradiction in terms given the short proportion of time that most of the country could actually be considered 'green'), and focusing concerns regarding the sustainability of development within its institutionalised, and much publicised, efforts to fend off

[7] An internet search on 'desertification' on 21st July 1999 produced 5047 'hits', providing some indication of the extent of concern regarding this environmental issue.

desertification. As such, desertification, although based on specific propositional and potentially falsifiable statements, has to be alternatively understood as a constructed and self-reflexive 'institutional fact' (cf. Thompson *et al.*, 1986), which supports the flow of resources from the international donor community to sustain implementing institutions, and which upholds the validity of intervention by these institutions and associated 'experts' (cf. Roe, 1995: 1066). The situation has not been helped by the sanctioning, until fairly recently, of the apartheid administrations of South Africa and Namibia which, according to Dean *et al.* (1995: 258), has fostered 'research parochialism' and contributed to the twin existence of 'a plethora of opinions' with 'a dearth of published and reliable scientific evidence' in relation to dryland degradation. The sudden flow of research-funding to a post-apartheid southern Africa, to quote a Namibian colleague, has '… created a feeding frenzy in resource-hungry institutions willing to sell their integrity for a few pieces of silver' (Marais, pers.comm., June 1999).

Continuing in this Nietzchean/Foucauldian vein of tracing the 'genealogy' of the 'undisputed fact' of desertification brings us to a second identification of the 'correlative' power relations masked by this 'truth': namely that institutional appropriation of this international environmentalist agenda supports the continuation of policies and projects based on the regulation of rural land-use practices in the name of preventing degradation. With regard to pastoralism these include: attempts to persuade pastoralists to destock[8]; adherence to demarcation of communal land into individual holdings as the means of land tenure reform (cf. Republic of Namibia, 1997; i.e. Scoones' '… politics of straight lines' (1996: 44)); and a focus on intervention in local institutions of resource management because the assumed collapse of these is considered to underpin perceived degradation (cf. Sullivan 1999). All of these processes have been documented as contributing to increased poverty, landlessness and social tension in drylands throughout Africa (cf. Brokensha & Riley, 1986; Barrow, 1990; Oba, 1992; TGLP Project, 1997). At the same time, the underlying structural situation of inequity in land distribution remains unchanged.

2.5 Local narratives: 'And the wind is now our rain'

Unsurprisingly, people using the land have their own opinions about its state of health. But what is

[8] For example, among conservationists it is hoped that a byproduct of increasing the pathways whereby local 'communities' can benefit from revenues generated by wildlife tourism will be a reduction in herd sizes and a corresponding lowering of the risk of environmental degradation (cf. Ashley *et al.*, 1994; Ashley & Garland, 1994; Jones, 1995; Ashley, 1997), while the project manager of a current Ministry of Agriculture, Water and Rural Development Project of the Sesfontein-Khowarib basin, southern Kunene Region, in 1996 maintained that if desertification was to be avoided in the basin then all livestock should be removed from the area.

particularly revealing is the manner in which ideas and perceptions of landscape are linked with national socio-political processes. This section draws on oral testimony material regarding local individuals' perceptions of ecological dynamics. Selected transcripts are from a broader field project conducted in the first part of 1999 intended to collate the views of Damara-speaking people on a range of contemporary issues, particularly those relating to land and resource management (Sullivan & Ganuses, forthcoming). The discussions forming the basis of this fieldwork were open-ended but structured to cover specific issues, such as whether or not people thought that there had been changes in their local environment during their lifetime, what form such changes had taken, and what was considered to have caused them. Interviewees included men and women, young and old, and from a range of locations throughout north-west Namibia: all were known to the interviewers, myself and Suro Ganuses, from several years' fieldwork in the area. It should be noted that this period of discussions took place towards the close of a severely below-average rain season.

Rainfall as the driving force behind dramatic temporal and spatial variations in vegetation is depicted vividly in these interviews. For example:

> At this plain the grass comes out when it rains, but the rain isn't falling now; … When the rain falls you can't see the ground or the people for the grass. If it is ||*hao* (i.e. the time when the land is green) you cannot see the children for the grass. When the rain falls the grass and the |*hînis* (*Tribulus* spp.) come out over the whole place and our dresses get yellow (from walking through the yellow flowers of |*hînis*). When it rains, in the places where people stay the grass comes out like in the past. But if it doesn't rain then there is no grass. There is nothing. At Hurubes where the people are staying with cattle and goats (cf. Bergsig, Palmfontein etc.) the grass still grows when the rain falls. (|Hairo, April 14, 1999; Sesfontein/!Nani|aus).

> The rain that falls (this year) is only half of what it should be and there is nothing growing. The first rain which came (this season) only touched the ground a little bit. After that it hasn't fallen. … But that year when you were coming and going it rained (1994-1995 season); that rain was good! Yes, if the rain comes, the trees stand alive. If the rain falls things look clean. If there is no rain the leaves get dry, and some of them have no leaves. Only rain makes the ground green and brings the new leaves. (Habuhege, April 19, 1999; Ani≠gab, !U≠gab River).

> When she falls you can see the places where she falls; the sky gets dark while some areas are left out. This year she has cut this place out. And the wind is now our rain. The clouds cover the whole sky so that it is dark and you can see the rain standing in the sky. And the red wind (which brings the sand) comes before the rain and you think the rain is coming. But no, there is nothing; the rain moves off with the wind. The wind breaks through our houses and falls strongly like the rain. But there is no rain. Yes, it is very difficult. (Meda, April 19, 1999; ||Gaisoas, !U≠gab River).

> When I am in the field with the livestock I see the changes. When I first came to Malansrust the drought was very bad. Then after that we get the rain and it was very good; the ground became green. But now the drought is back again. It is just this area that you can see which is green and otherwise there is no grazing again. There are big differences between the years. The cattle start to die and that is why my boss has taken them to Kamanjab area. The rain moves so that this year it hasn't fallen at this farm but only around it. We see the rain come but it just passes through without falling here. For the whole of this season the rain didn't come to this area. And then last month, when the season is supposed to be over, the rain started falling here and the place became green. (Willem, April 18, 1999; Malansrust Farm, Aba-||Huab River).

Overlying the capriciousness of rainfall, however, is a clear sense of things having deteriorated; having become in some sense 'dirty' or 'untidy'. As |Hairo says, '… it is different now; it is untidy', and as Habuhege iterates, '… first the place was clean but now the place has become poor, shabby'. Generally this is linked to a perception of overall decline in rainfall, coupled with a shift in the distribution of rain such that it seems to occur later in the season. So,

> The rain used to fall when the old grass was still there; the old grass would get dark as it became wet from the rain, and the new grass would come up through the old grass. Yes, the rain is not falling as it used to fall. Before, when the rain fell we didn't eat because we couldn't make fire to cook food. When we planted mealies the rain washed the seeds away; also those of watermelons. Sometimes people too were swept away by the water and drowned. It is different. At this time of year we should be living with grass and with everywhere being green and our hearts would be awake. But now it is just the sun which works, and things are not the same.

> … it seems that in Sesfontein there is something that has taken the rain away.' (|Hairo, April 14, 1999; Sesfontein).
>
> Yes it is different. Some trees have nothing on them and some trees have something on them. But before they looked healthy. The trees had leaves. Now some of the trees have been burned red by the sun, scorched by the sun so they've died, died out. Yes, it fell much better then and the grass stood about; and the rivers flowed. (Habuhege, April 19, 1999; Ani≠gab, !U≠gab River).
>
> When we had to move here things were better … but in about three years' time the area looked different because of severe drought. Yes, when we first came here the rain was falling and the river was flowing. Now the river hasn't flowed for two years. Our things that we brought with us when we first came here died when we got to this place. The cattle are dead, the goats are dead. And because the rain fell only a little in the following years they died like that. … And the people that remain will also die because of hunger and starvation. To think that our leaders said 'it's a good land!' Do you see these houses? All of the people have moved out because of the drought.
>
> In front of this house it gets green when it rains; |*kînin* (*Tribulus* spp.) and grasses come out. But there is nothing like this now. Maybe they will come when it rains, but now there is no rain. Now I don't know if there are still seeds lying in the ground; if God graces us then maybe they will grow again.
> (Meda, April 19, 1999; ||Gaisoas, !U≠gab River).

It is actually rather difficult to establish from existing rainfall records that a decline in rainfall has occurred (cf. Sullivan, 1998)[9]. So what are we to make of prevalent perceptions of such a decline, and of its apparent effects on people's lives and livelihoods? I believe that narratives of deteriorating rainfall instead provide a powerful metaphor for portraying the impotence people feel in the face of a century of apartheid-rule, followed by an extremely uncertain policy environment during which quality of life has fallen in real terms for many of Namibia's citizens. Just as rainfall is something that is uncontrollable, so there are a number of social and political processes which appear intractable to many and which constrain options for self-determination. A sense of powerlessness in the face of current change is conveyed by |Hairo who says:

When we grew-up in the past the rain was falling. Now I think, 'what's going on?' The clouds come but they don't bring any water; I think to myself what's happening, what's going on? When !Nauriseb[10] was here the grass was like this and we would break pieces of *tsaurahain*

[9] This is indicated, for example, by a lack of correlation between rainfall from one year to the next. In analysis of rainfall data for four stations in north-west Namibia only the data from |Uis had a significant, but relatively weak, serial correlation (r = -0.52, p = 0.03, N = 18). Data for Fransfontein, Khorixas and Sesfontein were not correlated (r = -0.08, p = 0.58, N = 56; r = -0.09, p = 0.60 N = 37; and r -0.08, p=0.70, N = 24 respectively) and appeared randomly distributed when plotted graphically.

[10] The first Damara leader of Sesfontein/!Nani|aus.

(*Colophospermum mopane*), *≠âun* (*Grewia* spp. cf. *bicolor* and *flava*), *|homexarebe* (*Geigaria acaulis*), *|ânan* (*Commiphora virgata*), pack them together like a small circular hut and make a fire, and we would stand in the smoke from that fire; the adults that were there would then run to escape the smoke from that fire leaving only !Nauriseb when all the people had moved away, with the fire still making smoke. The old people tell us of these things which happened then at this place. Now none of these rituals are practised and I thought that maybe this is why the rain does not fall the same as before.

> Maybe the heart of the people was at one then and is following different paths now, and maybe it is because of this divisiveness that the rain is not falling. Before, the people had the same aims and did the same things but maybe the rain doesn't fall now because of these differences of the heart. Before, the old people would do the same things, but now everyone has got their own heart, from the child up to the adult. It because of the many 'governments' who are trying to change things. When there was just one government things went well; now there are many and everyone wants to get up and have their say. There is no King, and the old government is now finished here in Sesfontein. … Even the white people would leave if the King said 'go away'. There used to be one king here and one pastor; a woman would sleep at her parents' house and would only go to her own house when she was married. Now there are so many governments and leaders, how can the rain fall in this chaos?

As an elderly woman |Hairo is clearly nostalgic for a time in the past when people's roles in society were relatively clear-cut and where the settlement's hierarchy was well-established and well-organised. Perceptions that modernisation processes and a lapse of customs are the ultimate causes of reduced rainfall have similarly been recorded for the Sahel (Cross & Barker, 1994). What |Hairo is also articulating, however, is a feeling of non-involvement – of non-representation – in the current plethora of new environment and development initiatives in the area. Although ironically operating under a 'community-based' and 'participatory' rhetoric, many such initiatives rely on local committees which are not democratically elected and proceed with little involvement of the wider 'community' in terms of either consultation or decision-making (cf. Sullivan, in prep.).

Perceptions of deterioration are in many cases inseparable from feelings of powerless in relation to exerting control over the use of land and its resources. As Meda describes:

> When the rain fell strongly that time (i.e. 1994-1995) then really too many people moved here to ||Gaisoas. Herero people with many cattle, goats and donkeys. With lots of those things they came to this land and when the rain falls and the grass came out they damaged the grass. This makes the land very bad. It empties because the grass didn't grow up and pour out its seeds. But now if the people did not move here in those years when the rain falls then maybe something will remain. Too many people move in even though the rain is half of what it was. In some areas the tufts of perennial grasses are no longer there, but maybe when it rains they will come out again.

Similarly, Willem, a farm labourer for a largely absentee herder at Malansrust Farm[11] states:

> The trees here are better than when I first came but the grass is not here. Because the fences are broken the livestock of other people move in and trample the grass. ... the other day I took more than twenty cattle back to Blaauport Farm but then they moved in again. At night time there are cattle everywhere. This camp here can not afford to take all the livestock of this area; they finish the grass and trample the ground, and when the rain falls the seeds don't come out, and those that do are blown away by the wind. As we are talking the livestock of the other farms are behind that mountain and they will move in here. … everyday they move in. And they don't ask; the livestock themselves move in because there are no fences. And if you mend the fences the elephant come and break them down!

In these passages, livestock are quite clearly linked to ideas of land degradation. However, such descriptions only seem to arise in contexts of contested claims to land and grazing, normally associated with instances of recent immigration of herds into an area where others consider themselves to have relatively long-term claims to the land. Namibia's post-independence constitution provides for all Namibians to move to wherever they wish on communal land with the *proviso* that they '… take account of the rights and customs of the local communities living there' (Republic of Namibia, 1991: 28-29). The problem is that there is no institutional basis for monitoring the effects of such movements or for protecting the rights of existing residents. In situations where options for movement are greatest amongst the wealthy (cf. Rohde, 1993; Sullivan 1996a), and where ethnicity as a major axis of difference tends to conspire against certain groups (cf. Botelle & Rohde, 1995; Twyman, 1999; Taylor, 1999), this otherwise liberal context can be deeply disempowering. Expressing concern over the impacts of livestock on available grazing resources is one way of vocalising anger and frustration at the inequalities supporting such immigration. This is particularly so when some families know themselves to have been blatantly impoverished by the policies of previous years, and who perceive the current situation to be one whereby other Namibians are better able to exploit resources now unavailable to them. A case in point is that of Meda quoted above: her family was evicted in the 1950s from her home area of !Ao||aexas (Aukeigas) when it was gazetted as Daan Viljoen Game Park for the use of Windhoek's white inhabitants; their subsequent movement to the marginal environment of the western reaches of the Ugab (!U≠gab) River caused large losses of their primary source of wealth and subsistence, i.e. livestock; and their applications to the new government to have their ancestral lands restored to them have been all but ignored. On top of all this, since 1994 she and other inhabitants of the western Ugab River have had to cope with an influx of elephant to the area.

[11] The former 'homeland' of Damaraland, the northern of which now falls in Kunene Region, consists in part of a number of former commercial farms which were used by settler farmers and then redistributed to communal farmers when the 'homeland' was created in the 1970s. Since then these surveyed and fenced farms have been owned by the state and used as communal land.

To sum up, people articulate a view of vegetation changes as driven primarily by extreme rainfall events in a way which resonates strongly with recent non-equilibrium theories of ecological dynamics in drylands. While perceptions of deterioration - in rainfall and productivity – exist in local environmental knowledges, these appear inseparable from expressions of dissatisfaction with wider socio-political processes. As such, statements affirming deterioration are inextricably linked with descriptions of situations which individuals see as being exclusionary and undermining. Instead of being a simple biophysical process, ideas of 'land degradation' thus cogently describe people's concerns over broader land policy, their anxieties over their lack of power to determine how land is used, and their frustrations over longstanding land claims.

3. Discussion

People in the 'actual' dryland environments of the south are not passively subject to either the forces of their biophysical environment, or the political power infusing consensual views of environment and development. In contrast, and not surprisingly, people actively manage what are socially and culturally constructed landscapes, as opposed to wild environments of unmediated forces, and access internationally-funded environment and development programmes in local and national contexts in opportunistic ways. These actions notwithstanding, however, and as Fairhead & Leach state (1996: 292), the intersection of global environmental discourses with local contexts seems to foster distinct relations of disadvantage whereby resource users are constructed as '… incapable resource stewards' thus '… instilling the imperative to intervene and improve the situation on their behalf'. Today such intervention is justified by the colonising languages of 'sustainable development' and 'degradation', both of which constitute what Escobar (1996: 56) refers to as a '… semiotic conquest of social life by expert discourses and economistic conceptions'.

So, if we have reached some academic consensus that the environmental narratives constructed during a period of modernist colonial expansion, and extended in today's climate of globalising soundbites, are politically-driven and conceptually flawed, then what next for 'political ecology'? Turning back to my introduction I would iterate that the only routes consistent with a political ecology stance are to consider political engagement ourselves with the issues with which we work, and to embrace a more communicative stance with regard to breaking down disciplinary boundaries, particularly those characterising the natural or realist *versus* social or constructivist divide.

3.1 Putting the politics into political ecology

At a conference not long ago I struck up conversation with an eminent scholar of Namibian forestry and historical land tenure issues. On asking him why his potentially emancipatory work was largely unavailable in Namibia – a question prompted by several queries regarding his work while recently in the country – I was somewhat taken aback by the response that 'well, it won't do me any favours [to publish in Namibia]'. As academics building our careers on the back of deconstructing consensual environmental narratives and emphasising their correlative marginalising effects, I would suggest that our positions become untenable if we do not make the effort to release our work and perspectives into the arenas from which they came, and to which they are (hopefully) relevant. As many of us already do, this means, for example, complementing our northern academic record by publishing in local academic journals, collaborating with local people and institutions, working with other media such as radio and, perhaps, 'doing consultancy' as a means of 'infiltrating' national and international policy fora. One of the challenges we face in these endeavours, of course, is persuading academic research assessment of the validity of these activities.

A second challenge, however, comes, one might say, from within: from a certain academic posturing which maintains something of a self-reinforcing bubble of cynicism regarding either our ability to engage meaningfully with 'actual actors' in 'actual environments', or our justification in perhaps constructing new environmental orthodoxies to replace the old. Regarding the former, I would maintain that we are subjectively positioned (i.e. actors ourselves) within the global-local interlinkages (i.e. actual environments) we write about and which are infused with myriad environmental knowledges. In other words, we do not have the luxury of locating ourselves outside these contexts because we are already part of them: as Hobart (1996: 20) states regarding anthropological fieldwork in Bali, '[b]efore I had spent a night in the village I was a political issue'. Thus, instead of being naïve to think that our fieldwork and our writings can contribute to debate in a transformative sense, we are perhaps naïve to think otherwise; to think that by being part of a northern academic tradition our research is thereby, or should be, apolitical and divorced from either local contexts or global policy-oriented discourse.

Regarding the latter: if knowledge is now socially constructed, historically located and politically coloured then we could see this as an opportunity to contribute to the construction of knowledges which we feel, as individuals and as academics, are defendable. When we talk about 'received wisdoms' of the environment and their alienating effects, and following Gordon (1998), we are implicitly acknowledging situations whereby it is not simply that 'knowledge is power' (cf. Foucault; Giddens), but rather that it is power which defines what knowledge is. By extension, it is at least partially the continuing ignorance and occlusion of alternative knowledges – of local environmental and other narratives – which allows the globalising institutions of the north to uphold the hegemonic and normalising discourses they do. As academics, and as emphasised above, we are in a unique position to penetrate these discourses in multiple contexts and at different levels. Perhaps this is a hopelessly optimistic suggestion; but to me it seems infinitely preferable to an ethically-nihilistic doctrine of non-engagement posited by the 'philosophies of despair' (Dunbar, 1995: 5) of extreme post-modern relativism.

3.2 A role for ecology in political ecology?

Contextualising the production of environmental dogma so that its political implications are clarified is one route to explaining the institutionalisation of degradation 'truths'. A second route points to the now oft-asserted recognition that the so-called 'objective' understandings of environmental and socioeconomic phenomena arrived at by 'science' are themselves constrained by historically-located cultural ideals peculiar to all aspects of Western Enlightenment thought. In particular, degradation discourses are inseparable from a wider inappropriate application of a language of 'boundary-conventions' constructed to describe closed thermodynamic systems (cf. Shapin and Schaffer, 1985: 342 *in* Latour, 1993: 16) to the analysis of complex, open systems including living organisms, the abiotic and biotic interactions of ecosystems, and the economic and political 'systems' of people (cf. Jantsch, 1980; Biot *et al.*, 1992; Behnke *et al.*, 1993; Sullivan, 1996b, submitted; Stott, 1998 a and b). The perhaps inevitable outcome has been the construction of an ideology of equilibrium and predictability in which environments are readily conceptualised as degraded because neither they, nor the peoples inhabiting, utilising and constructing them, are seen as dynamic and changing at all scales and in all directions. Within this ideology, logical questions and concern focus on optimization and adaptation, rather than on innovation and diversification; on maintaining stability or equilibrium through constraining activities seen as the source of disturbance; on uni-directional, linear conceptions of (normally negative) change; and on collapse to the most probable, least-ordered state.

Focusing on these flaws in the historical evolution of science, however, does not in itself justify a throwing out of the scientific baby with the poststructuralist bathwater. Not only does this undermine the possibilities for communication latent in the observational empiricism shared by

people throughout the world, but this position becomes untenable if it is understood that the ecological or integrative biophysical sciences, or at least elements of them, have themselves moved radically beyond a solely reductionist analytics of living complexes within an unflexive framework of equilibrium thinking.

At risk of drawing imprecise and unjustifiable analogies across disciplinary divides (cf. Sokal and Bricmont, 1998), therefore, I would argue that shifts in realist biophysical sciences, particularly the construction of a 'new' integrative science of complex systems (cf. Jantsch, 1980; Prigogine, 1989; Kauffman, 1993, 1995; Holling, 1998), have a rich potential to interact with a relativist rejection of normative structures. Moreover, this interchange of concepts and language can constitute part of a more unifying metalanguage, as advocated by Stott (1998: 1), drawing 'key signifiers' (cf. Eco, 1984) from an embracing of non-equilibrial and contingent dynamics. Key to this thinking is a conceptual and formal commitment to resolve the contradictions inherent in accepting that patterns in biological, ecological, social or economic 'aggregates' are both emergent or 'ordered' *and* continually evolving; influenced by historical contingency and unpredictable from analyses of the specific behaviours of individual components.

Perhaps in contrast to a relativist sociology of science, I suggest, therefore, that there might be much room for conceptual exchange between a biophysical science which embraces both form (i.e. structure) and change (i.e. innovation) in living complexes, and an actor-oriented applied social-science grappling with conflicts between local dynamics and national or global structures. In furthering political ecology researches of hegemonic environmental discourses, and in better representing currently obstructed environmental knowledges, I believe the fostering of such communication is critical. Africa's drylands are proving a compelling context for this debate. They are variable within time-scales of immediate importance for crucial livelihood decisions. Moreover, this variability is unpredictable. These environments and the lifestyles they support thus present deep conceptual challenges to a northern Enlightenment worldview founded on notions of predictability, linearity, efficiency and equilibrium. Over the last fifteen years these challenges have been grappled with in anthropological researches which emphasise the coherence of seemingly haphazard mobility and herd management strategies among Africans engaging in pastoralism and pastoro-foraging (cf. Sandford, 1983; Coughenour *et al*., 1985; Homewood and Rodgers, 1987, 1991). These views are now consolidated in what is becoming a paradigmatic 'new ecology' of non-equilibrium focusing on arid and semi-arid environments (cf. Wiens, 1984; Ellis and Swift, 1988; Behnke *et al.*, 1993; Sullivan, 1996b), which emphasises the significance of abiotically-driven variability and draws heavily on anthropological understandings of nomadic and transhumantic pastoralism. Given the profound policy implications of 'new' debate, and the incisive parallels to be found between the critical realism of biophysical research, the actor-oriented approaches of a rather more constructivist social anthropology, and local narratives, it would seem that there is much justification for engaging with, rather than constructing barriers to, a range of analytics.

Acknowledgments
In Namibia, Suro Ganuses from Sesfontein and Phil Hutchinson were my companions and fieldwork would have been impossible without them. Thanks also go to the Damara farmers with whom I talked about landscape, herding and rainfall. Fieldwork funding from the Nuffield Foundation, the Economic and Social Research Centre, and the Desert Research Foundation of Namibia is gratefully acknowledged. The paper has been written under a British Academy Post-doctoral Fellowship.

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Table 1. 'Findings' and alternative readings of the 1994-1995 and 1996-1997 Desert Research Foundation of Namibia (DRFN) Summer Desertification Projects conducted in southern Kunene and northern Erongo Regions.

Identified indicators of desertification and some reinterpretations
1994-1995 DRFN Summer Desertification Project
The toxic invasive plant *Geigaria ornativa*, interpreted as a sign of heavy grazing pressure, was common at all study sites with sandy soils and intense grazing, although it actually occurred in its highest proportion at the site with the greatest grass cover (Jobst, 1995: 32). Similarly associated with heavy utilisation by livestock close to boreholes was the reduced incidence of perennial grass species and the encroachment of *Acacia mellifera* and *Acacia tortilis*. These factors were interpreted as the possible beginning of piosphere* development and perhaps of 'desertification' (Jobst, 1995: 32-36). Little emphasis, however, was given to the high recorded levels of between-site variability in both species composition and biomass which indicated that factors other than proximity to boreholes and the consequent impacts of livestock might be driving these variables.
Soil parameters were also related nonlinearly to distance from boreholes, with higher nutrient levels occurring in the immediate vicinity of waterpoints due to manuring by livestock (Mouton, 1995: 16). No significant differences in these parameters were found for sites on sandy soils under different grazing pressures, and differences between sites on silts were attributed to factors other than grazing (Mouton, 1995: 17). Grazing intensity thus appears a poor predictor of soil factors.
High germination rates for planted seeds in soil samples taken from the study sites indicated that plant growth potential was high in all but the two 'Moonlandscape' sites considered to have experienced the most intense grazing history (Kambatuku, 1995: 41). Despite the crusted and compacted silty soils of these sites, however, unexpectedly high productivity following heavy rains in February 1995 points to both the significance of rainfall, and to problems with drawing conclusions of '… the existence of desertification' (Kambatuku, 1995: 52) from biophysical data collected for a single temporal sample falling at the end of a drought period. Biomass production was also lower in sites categorised as heavily utilised but proximity to a waterpoint, i.e. associated with heavy livestock impact, had no significant effect on germination or productivity (Kambatuku, 1995: 45).
Soil samples from sites classified as heavily grazed had lower numbers of both seeds and nematodes, the former representing seed bank status and the latter indicating presence of soil biota required for organic matter decomposition and nutrient cycling (Nghitila, 1995: 55-60). Again, this was interpreted as supporting the case for rangeland degradation in the area, but see comments for point 3 above.
1996-1997 DRFN Summer Desertification Project
1) Distance from the communal area settlement of Otjimbingwe had significant negative and positive effects on the height of browse line and distance measured between woody individuals respectively, but had no statistical effect on tree size distribution (Apollus *et al.*, 1997: 4). These results were interpreted as indicating that '… local overgrazing is occurring', exacerbated by higher wood removal closer to the settlement (Apollus *et al.*, 1997: 6). Given that distances of only up to 1200 m from the settlement were measured the results also indicate that these effects were extremely small-scale, and might be considered low in relation to the expected demand for natural resources in this relatively densely populated settlement.
No significant differences were observed in grass height either at different distances from Otjimbingwe, or between Otjimbingwe and the neighbouring commercial farm of Tsaobis (Apollus *et al.*, 1997: 4). This was considered probably because '… the whole area has been equally overgrazed' (Apollus *et al.*, 1997: 7). The different stocking-levels for the areas studied, however, suggest that a more parsimonious explanation lies in the overarching role of low rainfall in constraining herbaceous productivity in both areas, particularly in view of the fact that this study was conducted towards the end of the dry season.
1) With regard to soil factors, organic carbon content was higher in Otjimbingwe than in the commercial farms, while a range of bioassay measures used to assess fertility displayed no significant differences between the two (Apollus *et al.*, 1997: 4-5). This was considered due to depositions of organic carbon at Otjimbingwe through the flooding of the Swakop River (Apollus *et al.*, 1997: 7). The role of manuring by livestock in raising soil fertility was overlooked (although see Ward *et al.*, 1998: 368), and the results were interpreted as follows: '[t]his is a good indication that the soil in the Otjimbingwe area is not totally exhausted of its nutrients. If the people of the area could be convinced to

reduce their livestock numbers, land degradation could be greatly reduced and even reversed. That is, through better land management in the area the vegetation … can once again flourish' *(*Apollus *et al.*, 1997: 7*).*

1) Similarly, '[e]ven though the communal area has 20 times more stock than the commercial farms the soil quality is basically the same. Once the stock numbers are reduced, the communal area has great potential to recover'. (Apollus *et al.*, 1997: 7). An alternative explanation might be that both soil fertility indices and the high recorded stocking-levels indicate that land-use practices in the Otjimbingwe area in fact are 'sustainable', and that land degradation, in terms of reduced soil fertility and secondary productivity, is not occurring.

* i.e. the growth of degraded areas of land in a circular pattern around waterpoints or settlements, due to 'the radial nature of a point-centred livestock system' in which '… the available grazing resource increases exponentially with distance from a borehole ... creating annuli of different herbivore use intensities' (Perkins and Thomas, 1993: 184).

Table 2. Output of a simple factorial analysis of variance (ANOVA) of herbaceous vegetation cover abundances by treatment of quadrats as enclosed or unenclosed (i.e. released from *versus* subject to livestock grazing respectively) and by year (i.e. representing different rainfalls) and site location (representing settlement impact). Results significant at less than p = 0.01 are printed in bold and marked with an asterix. Study located in the Sesfontein-Khowarib basin, southern Kunene Region, north-west Namibia (discussed in detail in Sullivan, 1998).

enclosure by year:	**main effects:**						**interaction:**		
	enclosure			year			enclosure by year		
	df	**F**	**p**	**df**	**F**	**p**	**df**	**F**	**p**
total live above-ground biomass	1	0.06	0.8100	**1**	**79.96**	***0.0005**	1	0.01	0.9410
grasses	1	0.01	0.9450	**1**	**79.52**	***0.0005**	1	0.01	0.9430
forbs	1	0.67	0.4160	**1**	**25.02**	***0.0005**	1	0.00	0.9580
plant litter	1	**8.12**	***0.005**	**1**	**17.66**	***0.0005**	**1**	**6.59**	***0.012**
bare ground	1	**11.67**	***0.001**	**1**	**54.07**	***0.0005**	**1**	**6.46**	***0.013**
enclosure by site:	**main effects:**						**interaction:**		
	enclosure			site			enclosure by site		
	df	**F**	**p**	**df**	**F**	**p**	**df**	**F**	**p**
total live above-ground biomass	1	0.15	0.6990	**5**	**5.58**	***0.0005**	5	0.02	1.0000
grasses	1	0.05	0.8310	**5**	**5.41**	***0.0001**	5	0.02	1.0000
forbs	1	1.37	0.2450	**5**	**9.44**	***0.0005**	5	0.14	0.9840
plant litter	1	**7.14**	***0.009**	**5**	**10.57**	***0.0005**	5	0.26	0.9340
bare ground	1	**8.67**	***0.004**	**5**	**6.59**	***0.0005**	5	0.38	0.8610

Table 2: explanatory notes

This analysis tested for differences in the means of herbaceous vegetation cover abundances for each of 48 quadrats to assess the extent to which these differences could be explained by enclosure of the plots, growing season and site, as well as the interaction of these with each other. These parameters were entered as factors in a simple factorial analysis of variance model with cover, namely of above-ground live biomass, grasses, forbs, plant litter and bare-ground, as dependent variables. Cover is widely used as a measure of livestock impact and, according to the degradation view, might be expected to be positively related to distance from settlement and exclusion of livestock, with the latter being more pronounced after two years. The proportion of each quadrat recorded as bare ground would be expected to show the opposite pattern.

The output of this analysis listed in Table 2 instead suggests the following. First, that the effects of both year and site were highly significant with regard to all of the cover variables. The strength of the relationships (indicated by the F-ratios) were greater for year indicating that temporal variability, reflecting rainfall, had a stronger impact on productivity than spatial variability. Conversely, the incidence of livestock grazing was only ever significant for plant litter and bare ground and not for above-ground biomass. This effect of enclosure was maintained only in combination with year and not when tested in combination with site which further analysis indicates was due to higher abundances of plant litter within the fenced quadrats in the second year of study.

Overall, the analysis mirrors floristic exploration of the dataset (Sullivan, 1998), confirming that patterns in the dataset were determined by site location and growing season, and emphasising the spatial and temporal patchiness of this dryland environment. In fact, the differences in growing potential represented by the two seasons monitored in this study completely preempted any anticipated effect of the exclusion of livestock on above-ground biomass; the clear pattern is one of between-site variability in species composition and productivity in response to a good growing season in 1995, followed by extreme uniformity between sites due to the dry conditions of 1996. High differentials in productivity in relation to variable rainfall have similarly been described for desert dune habitats of the Namib (Seely & Louw, 1980), for *Eragrostis* spp. and *Aristida* spp. in the semi-arid eastern Karoo (360mm a^{-1}) (Hoffman *et al.*, 1990; see also O'Connor & Roux, 1995), and coefficients of variation of >50% were the norm for a range of life history parameters of serotinous plants in the central Namib (Günster, 1994). Drought thus acts as an 'equaliser' in areas that in fact retain the potential to be extremely productive and diverse given appropriate abiotic conditions. It is well-known that productivity in desert ecosystems is dependent on an absolute minimum amount of precipitation (the zero-yield threshold), above which productivity tends to increase linearly with increasing rainfall (cf. Walter, 1939; Noy-Meir, 1973; Seely, 1978; Rutherford, 1980; Hadley & Szarek, 1981; Le Houérou, 1984). In addition, fine-tuned combinations of temperature, precipitation, soil conditions and topography are significant in defining the potential

for productivity and allowing the establishment of species (cf. Ludwig & Whitford, 1981; Cox, 1984; Günster, 1995: 107). With this in mind, the herbaceous cover recorded in this study following the 1995 growing season indicates that, given the right combination of conditions, the nutrient-rich silts of the Hoanib Basin can be extremely productive, despite the long-term use of this area for grazing by communal farmers and despite the tendency for these alluvial soils to have a disproportionately low water-retaining capacity in arid environments (Noy-Meir, 1973; Frost *et al*., 1986; Van Rooyen *et al*., 1994). In this case, saturation of the system by torrential rain over a short time period early in February 1995, combined with reduced evaporation due to a run of cloudy days, appear to have been the elements which allowed 'escape' of primary productivity in north-west Namibia during this season.

The build-up of plant litter observed in quadrats where livestock were excluded, however, could indicate that under 'normal' conditions livestock might be having a detrimental effect on soil fertility through preventing the accumulation of plant litter. Such an interpretation should be balanced, however, against evidence for the promotion of soil fertility through manuring by livestock; bioassays carried out for this study, for example, indicated a relatively high potential for plant growth in sites close to settlements where livestock pressure was concentrated (see also Perkins and Thomas, 1993: 188; Mouton, 1995: 16), and increases in soil fertility due to manuring by grazing livestock may also enhance the nutritional value of herbaceous species (cf. Rethman *et al*, 1971: 57).

Fig. 1. Map of Namibia showing the location of the former ‘homeland’ of Damaraland in relation to post-independence regional boundaries.

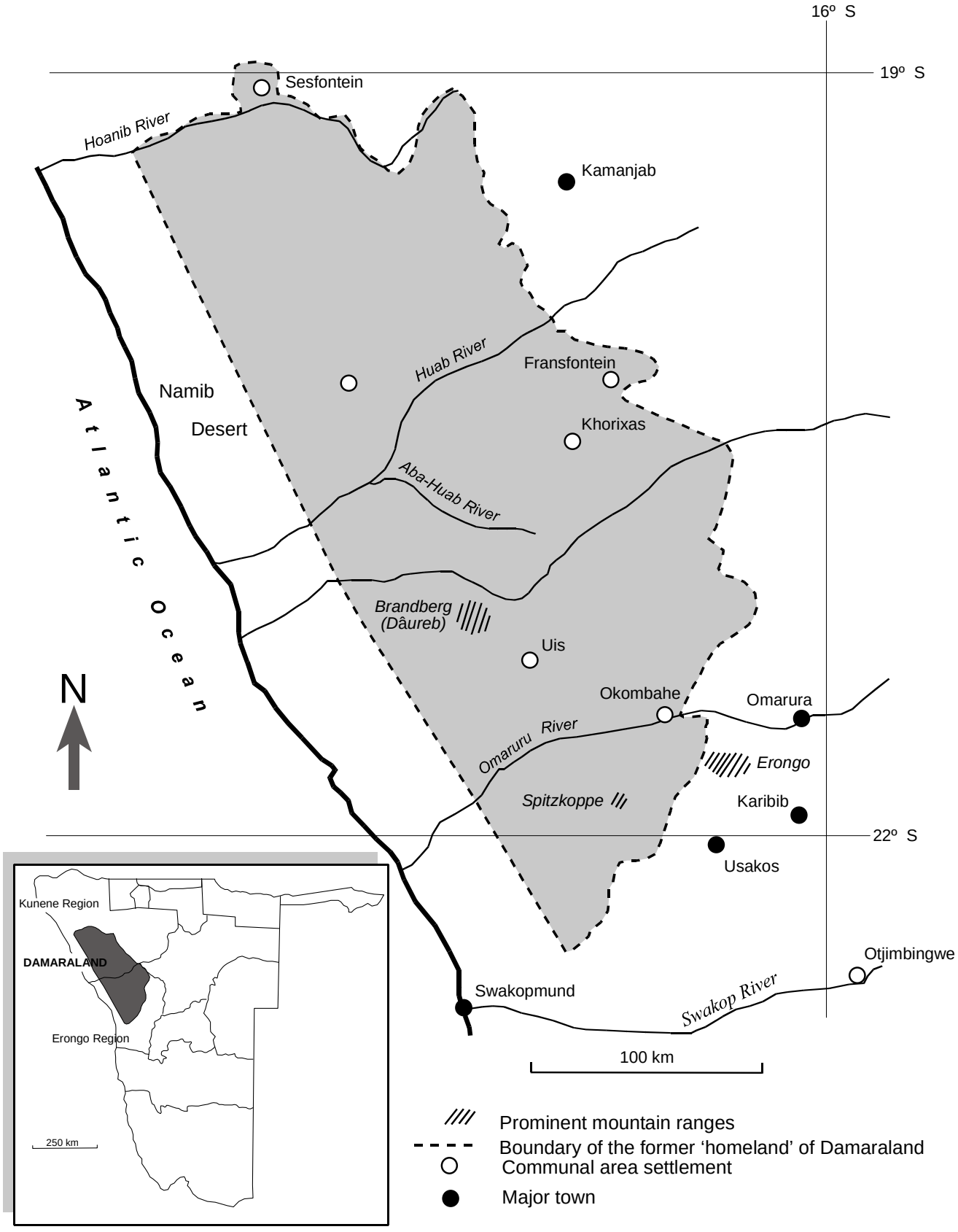

Fig. 2. Fixed point photographs of herbaceous vegetation under different rainfall conditions at a site on the outskirts of Khowarib settlement, southern Kunene Region, north-west Namibia; a. May 1995, with >200 mm rain, b. July 1996, with 84.5 mm rain, dispersed throughout the season.

a.

b.

Fig. 3. Graphical representation of the findings of analysis of the population structure, as measured by basal diameter, of the tree *Acacia tortilis* in relation to settlement impact, as reflected indirectly by distance from settlement (see accompanying notes).

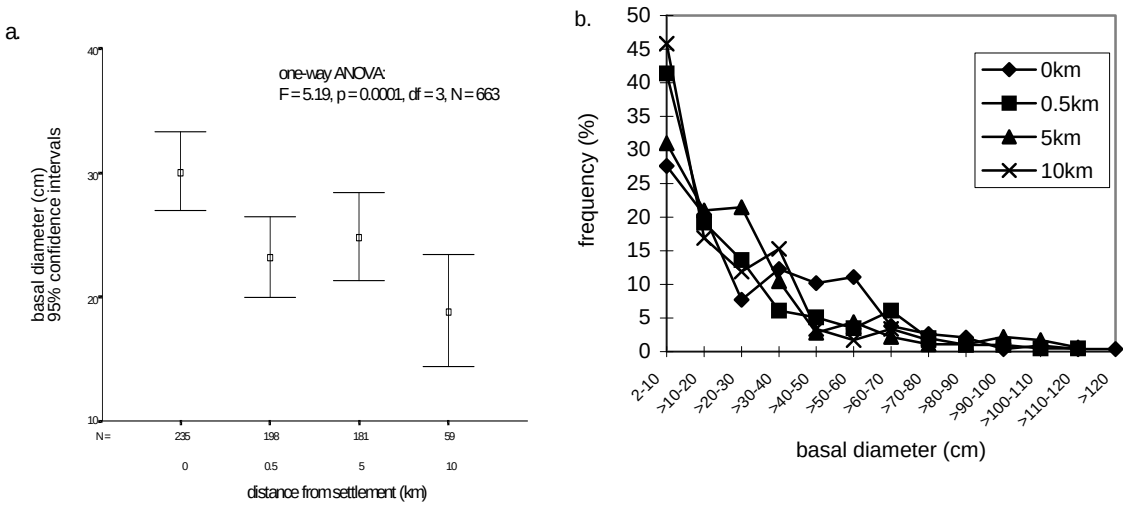

Fig. 3. Explanatory notes

As detailed in section 2.1, propositional statements exist regarding the population structure of woody species around specific settlements in northern Khorixas District. For example, the assertions that '[t]here are no young trees nor can any raise its head owing to the intensive browsing of the numerous cattle, goats and donkeys', and that '… as the large trees die off one by one and no others take their place it seems that all vegetation must disappear …' (Van Warmelo, 1962: 39), can be tested fairly explicitly using standard ecology or forestry survey tools. Given that perceptions of vegetation degradation inform policies and projects designed to reduce numbers of livestock and otherwise control resource-use activities, I would suggest that some 'data-gathering' might be useful for either the affirmation or discrediting of these views: if the latter, then it stands to reason that the findings of such research might be employed in support of local herding economies, and even in the contestation of nationally- or internationally-driven agendas.

In this analysis, and as Fig. 2a indicates, distance from settlement was significantly related to the size of basal diameter of *Acacia tortilis*, the most common species[¥] occurring on the western alluvial plains of the Hoanib River and a tree important locally in the provision of browse, building poles, firewood, medicine and food. The height of individuals of this tree also follows the same pattern (Sullivan, 1999), namely that the largest individuals occurred within settlements while the smallest individuals occurred in samples furthest from settlement. Direct measures of woody plant utilisation, namely branch removal and browsing by livestock were negatively correlated with distance from settlement (r = -0.49

[¥] As defined by both formal and folk taxonomies.

and -0.48 for cutting and browsing respectively, $p = 0.0001$, $N = 663$), suggesting that distance from settlement was indeed useful as a surrogate measure of resource impact.

Interpretation of these results in accordance with the degradation paradigm would suggest that recruitment of juveniles, i.e. of smaller individuals, is adversely affected by settlement pressure, with possibly long-term consequences for the viability of the population. Analysis of the size class distributions of these measures, however, suggests a rather different picture. Fig. 2b demonstrate that basal diameter sizes actually, conform well to the reverse J-shaped distribution associated with healthy tree populations that display high recruitment potential. This is true for all distances from settlement, for which the frequencies of individuals in the smaller regeneration size classes were comparable. Fig. 2b further shows that the reason for the relatively high mean heights measured for *A. tortilis* within settlements was the greater frequency of extremely tall individuals recorded for these samples; this had the effect of pulling the mean disproportionately upwards and contributing to the significant results produced in the ANOVA. Again, the degradation paradigm might suggest that this is due to the effects of branch cutting in reducing the size of otherwise large individuals. As would be expected from a 'healthy' population, however, height and basal diameter had a strong positive association ($r = 0.8$, $p = 0.0001$, $n = 507$), indicating that levels of cutting are not high enough to reduce the expected relationship between these size measures. This relationship remained significant and positive even when only individuals from within settlements were tested, i.e. those subject to the greatest intensities of utilisation ($r = 0.82$, $p = 0.0001$, $n = 135$).