Rapid Assessment Method for Renosterveld

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from discussions at the Renosterveld Assessment Workshop

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Summary

- This report presents a method for assessing the biodiversity and grazing value of Renosterveld, and to identify drivers of vegetation change;
- The method is based on understanding of Renosterveld vegetation dynamics;
- Abiotic, plant and animal indicators are combined in conditional assessment;
- The method generates data that can be used to identify thresholds of potential concern for triggering management actions to address grazing and biodiversity concerns;
- Application of the assessment and monitoring method should promote adaptive management;
- Use of standard data collection proformas and visual presentation of data as sunray charts will facilitate communication between landowner and researcher, conservator and agriculturalist.
- A follow-up workshop will be required to evaluate and improve the method.

Contents

Introduction: Renosterveld assessment needs and challenges

Renosterveld is vegetation type that grows on fine textured, shale-derived soils on undulating topography in the Western Cape. It usually occurs on the ecotone between Fynbos and Succulent Karoo, and comprises varying proportions of, perennial grasses, geophytes, succulents and reseeding and resprouting evergreen shrubs (Rebelo et al. 2006). Fire-protected habitats within Renosterveld (such as drainage lines and termitaria) includes plant species associated with sub-tropical thicket. The dominant families are Asteraceae, Fabaceae, Malvaceae, Poaceae and Iridaceae. Levels of endemism are high, particularly in the Aizoaceae, Asteraceae, Fabaceae and Iridaceae (Von Hase et al 2003). The vegetation type is renowned for a high diversity of spring-flowering geophytes.

The conservation status of Renosterveld, particularly in the higher rainfall part of its distribution, is very poor and over 95% of the lowland Renosterveld has been transformed for development of field crops, vineyards and orchards (Kemper et al. 1999; Von Hase et al 2003). Remaining Renosterveld occurs as fragments in transformed agricultural landscapes (Newton 2006). Fragmentation, nutrient enrichment from the surrounding landscape, and dispersal of seeds in herbivore dung have facilitated invasion by alien plants (van Rooyen 2004, Shiponeni & Milton 2006), particularly European winter-growing annual grasses (Milton 2004) and evergreen woody plants (*Acacia, Eucalyptus, Pinus*) from winter-rainfall climates worldwide (Boucher 1995). Fragments are frequently used as supplementary grazing land for livestock (sheep, goats, cattle, ostrich) and game (Cowling et al. 1986; Scott 1986; MacGregor 1990; Low & Jones 1995; Cupido 2005, Raitt 2006). Changes in fire regimes (such as exclusion of fire, use of fire in the wet season), invasions by alien plants, nutrient enrichment and overgrazing appear to be changing or reducing the value of Renosterveld for both grazing and conservation (Rebelo et al. 2006).

Renosterveld is probably the least-clearly defined vegetation type in South Africa. Because of its geographical position in the Western Cape, its accessibility and arable quality, and was also among the first vegetation types to be changed by grazing and transformed for crop production in the C17th and C18th (Rebelo et al. 2006; Newton 2006). For this reason there are no baseline vegetation data describing the condition of renosterveld in pre-colonial times. There is also considerable variation in Renosterveld composition across a gradient of rainfall quantity and seasonality. Moll et al. (1984) distinguished four renosterveld type, namely west coast lowland, south coast lowlands, inland mountains and eastern. The west-coast type has the highest diversity of geophytes, south coast lowland Renosterveld tends to be more grassy and the Renosterveld on the Succulent Karoo and Subtropical Thicket ecotones tends to include more succulents that Renosterveld types abutting Fynbos (Rebelo et al. 2006).

History and geographical variability thus make it difficult to define the ideal structure and composition of Renosterveld. Moreover, good condition for grazing does not necessarily imply high biodiversity value and vice versa. Despite these challenges, it is in the interest of both biodiversity conservation and sustainable agriculture to document the condition and composition of Renosterveld fragments, and to understand how management affects the vegetation, so as to suggest management interventions that could prevent or revert degradation and sustain biodiversity (viz. Cape Nature Fire Fact Sheet). The method presented here was developed by range ecologists and conservation biologists at a workshop funded by the Table Mountain Fund through WWF. It is intended primarily for use by researchers who collect information in a quantified and structured way using the data forms appended to this report. However the method can be applied in a non-quantitative way by land users who wish to make decisions about the management actions needed to improve grazing value or conserve biodiversity.

Objectives

This document outlines a method for assessing Renosterveld vegetation fragments on private or public land in the Western Cape in order to

1. assess grazing and conservation value of particular areas,
2. document the effects of management (including grazing, burning, cutting, resting) and site factors on the structure and composition
3. produce data that can be used for making ecological management decision.

Conceptual framework for assessment

This section describes the philosophy behind the condition assessment approach. The condition assessment approach is based on (1) understanding drivers of Renosterveld vegetation and habitat attribute change, (2) knowledge of how graziers and conservators value Renosterveld habitat characteristics and vegetation attributes, (3) conceptualising condition as a particular mixture of attribute rankings, and (4) deciding on attribute thresholds that should trigger conservation decisions or management action. Each of these four concepts underlying the condition assessment approach is now discussed in more detail.

Drivers of Renosterveld vegetation and habitat change

The intermediate disturbance hypothesis would predict that biodiversity tends to be greatest when vegetation is subjected to intermediate frequencies or spatial scales of disturbance – or when vegetation is in the process of moving from dominance by one life form to another. **Figure 1** shows three extreme composition states in Renosterveld – grass, thicket and shrub. Whereas grassy Renosterveld is likely to benefit grazing animals, thicket would benefit browsers, and dense shrubland would promote fire, biodiversity is most likely to peak in some intermediate state that is moderately influenced by grazing, fire and the period of freedom from disturbance **(Figure 1).**

Conceptual models synthesise our understanding of vegetation dynamics and provide a basis for making the predictions upon which management decisions are usually based. Because they are fundamental for management decision making, conceptual models should continually be improved as information is gained by practical experience. This is the basis of adaptive management – observe, predict, act, observe and refine the prediction. A number of conceptual models have proposed ways in which various drivers (usually types and seasons of disturbance) will interact to bring about changes in the composition of Renosterveld.

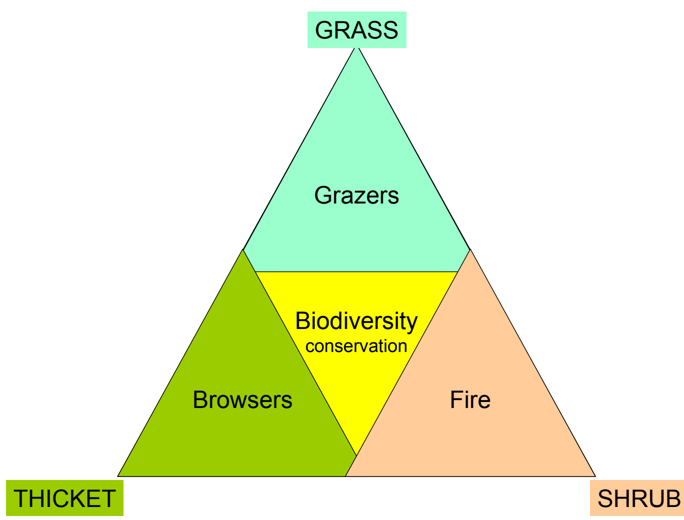

Figure 1. *Extreme states of Renosterveld and their beneficiaries*

The model, developed by Cowling et al. (1986) for south coast Renosterveld **(Figure 2),** on the basis of his own observations and experiments of Levyns (1935), suggests that a combination of spring burning with grazing prevents grasses setting seed and propagating.

This benefits winter-seeding shrubs which are largely unpalatable and ignored by livestock and game, and therefore leads to increasing dominance of the vegetation by shrubs such as *Elytropappus rhinocerotis, Athanasia* and *Relhania*. Autumn burning, during the flowering season of shrubs but following seed set by grasses such as *Themeda triandra,* would reduce shrub cover by killing shrubs before they seeded, but favour grass recruitment. *Elytropappus rhinocerotis* seeds germinate in response to fire and persist seven years in the seed bank (Levyns 1926, 1929). The plants take three years to mature, so fires should be repeated at three years intervals to exhaust the seed bank (Cowling et al 1986).The thesis by Raitt (2005) present further empirical evidence that frequent burning of Renosterveld promotes *Themeda triandra* in the Overberg region.

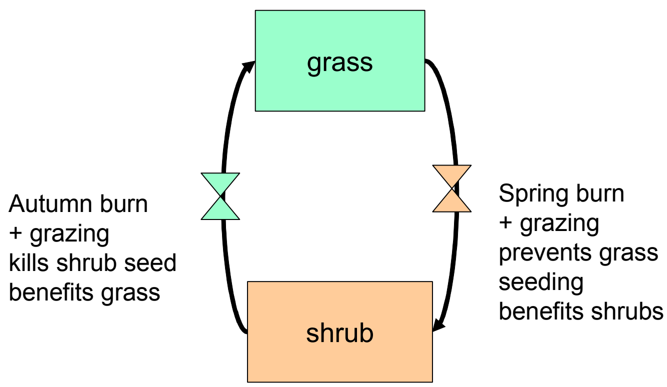

Figure 2. *Conceptual model (from Cowling et al. 1986) showing how season of burn may change Renosterveld from a shrubby to a grassy state and vice versa.*

A model developed by Rebelo (1995) suggested that heavy grazing immediately after burning would convert grassy Renosterveld to a shrubland strongly dominated by *Elytropappus rhinocerotis* (renosterbos), whereas exclusion of fire would tend to result in conversion of Renosterveld to Subtropical thicket. Burning of thicket, combined with light grazing, would produce a grassland once more. Evidence for these transitions in Renosterveld composition is taken from Acocks (1955) and Levyns (1926, 1929) combined with his own observations. They are further supported by Teague's (1999) state-and-transition model for Baviaanskloof, and by empirical data from Britton & Jackleman (1995), McDowell (1995), and Raitt (2005).

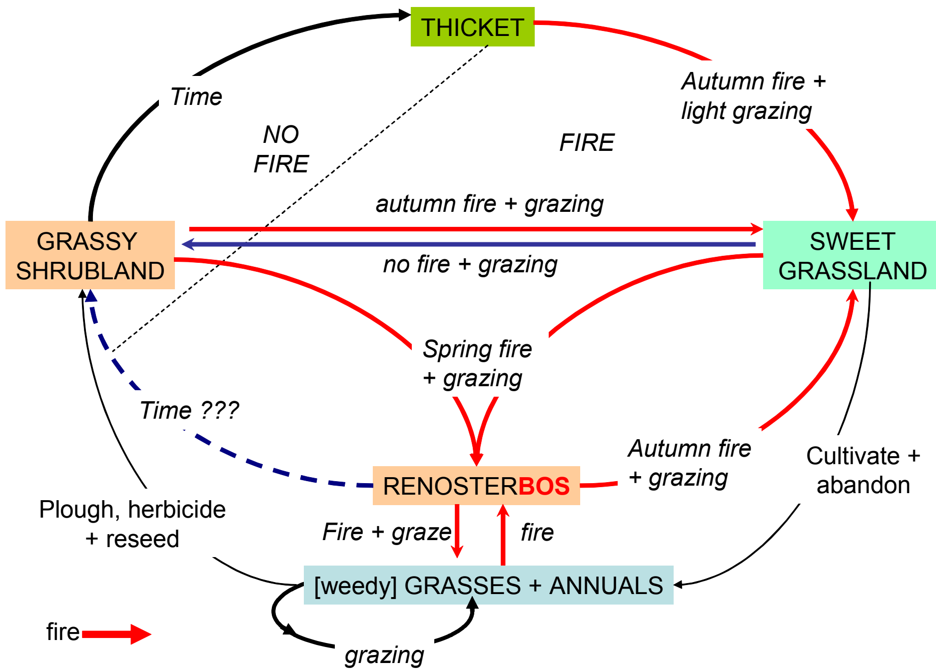

Figure 3. *Conceptual model showing how fire and grazing may interact to change the composition of Renosterveld to species poor "renosterbos" dominated by Elytropappus rhinocerotis or weedy annuals. The structural changes can be reversed with autumn fire and grazing. Once ploughed, former Renosterveld may be maintained as weedy grassland indefinitely by grazing and exclusion of fire. Ploughing and grazing lead to species losses that may be partly mitigated by reseeding.*

Rebelo's (1995) model, has been elaborated, in **Figure 3**, to include the effects of burn season (Cowling et al. 1986) and transitions that occur following ploughing. Old fields that were formerly Renosterveld are initially colonised by annual forbs and grasses. Grazing tends to maintain old fields under a cover of *Cynodon dactylon* lawngrass and weedy winter-growing annuals (McDowell 1995, Walton 2005), which in turn exclude indigenous perennial grass and shrub establishment (Iponga et al. 2005). Burning and clearing of weeds facilitates return to a more species-rich state through improved growth and flowering of residual indigenous bulb species (Musil et al. 2005), and through germination of indigenous Asteraceae that may be dispersed up to 80 m from adjacent intact Renosterveld by wind (Shiponeni 2002). The composition of the returning vegetation can be further manipulated by reseeding (Holmes 2005).

Some disturbances or management effects could not be incorporated in the conceptual model, but are indicated in **Table 1** which attempts to capture many disturbances or management actions that might influence Renosterveld – for example the effects of brush-cutting, fragmentation and nutrient enrichment. Acocks (1955) and Boucher (1995) said that selective removal of Renosterveld by hand clearing or brush cutting would make decreaser species more vulnerable to over-grazing and thus to reduce diversity. Exclusion of fire combined with grazing or brushcutting may reduce diversity in Renosterveld (Boucher 1995), although Walton (2006) reported that moderate grazing increased diversity and cover of grasses and geophytes on Renosterveld old fields over a period exceeding 30 years in the absence of fire. Fragmentation and fertilizer runoff into fragments from surrounding fields have been shown to promote invasion of Renosterveld by alien weedy grasses (Kemper et al. 1999; Van Rooyen 2004).

Table 1 *Likely effects of disturbance or management actions on Renosterveld cover composition and species richness by plant functional type*

Management	Frequency	Grass	Geophyte	Succulent	Seeder	Sprouter	Weed
				Canopy cover			
Succession time	>10 year	-	-	+	-	+	-
Fire alone	5-10 yearly	0	0	0	+	0	0
Fire alone	3-5 yearly	+	+	-	0	-	+
Herbivory alone	low	+	+	0	0	0	0
Herbivory alone	high	+	+	0	+	-	+
Fire + spring herbivory	5-10 yearly	-	-	-	+	-	+
Fire + autumn herbivory	5-10 yearly	+	+	-	-	-	+
Brush cutting	>10 yearly	+	+	-	-	-	+
Fragmentation		0	0	0	0	0	+
Nitrogen		+	-	-	0	0	+
				Species richness			
Succession time	>10 years	-	-	+	-	+	-
Fire alone	5-10 yearly	0	+	0	+	0	0
Fire alone	3-5 yearly	+	0	-	-	-	+
Herbivory alone	low	+	+	0	0	0	0
Herbivory alone	high	-	-	0	-	-	+
Fire + spring herbivory	5-10 yearly	-	-	-	+	-	0
Fire + autumn herbivory	5-10 yearly	+	+	-	-	-	+
Brush cutting	>10 yearly	+	+	-	-	-	0
Fragmentation		-	0	-	0	0	+
Nitrogen		-	-	-	-	0	+

Ploughing, nutrient enrichment and very small fragment size can reduce the species richness of Renosterveld fragments. However, counts for unploughed Renosterveld in plots ranging from 0.001ha to 0.1 ha suggest that species area curves flatten off at about 0.01 ha (100 m^2) and that 60-80 species can be expected in healthy Renosterveld at this scale. Kemper et al. (1999) concluded that high species richness can persist in Renosterveld fragments as small as 0.01 ha.

In summary, it is apparent that overgrazing and fire exclusion can reduce the indigenous perennial grass component of Renosterveld and give rise to species poor shrubland dominated by shrubs that are unpalatable to herbivores. Dominance by such "increaser" shrubs is a sign of poor condition for grazing and biodiversity. High disturbance levels (including ploughing, very frequent burning, leaching of nitrogen from surrounding fields) favour alien annual grasses, which can prevent recruitment of indigenous perennials, and are therefore indicators of poor condition for biodiversity conservation.

How attributes of Renosterveld are valued for grazing and conservation

Renosterveld habitat and vegetation can be described by measurable attributes that may differ in the way in which they are valued for biodiversity conservation and for grazing. The attributes of vegetation that are relevant to grazing use and conservation, and can be quantified, are habitat area, status of the soil surface (in terms of erosion and biological activity), vegetation height, cover, species richness, and the identity of component plant species. Plant identity can be linked to additional attribute information such as palatability, endemicity, rarity and weed status.

Discussions at the TMF-funded Renosterveld assessment workshop suggested that attributes that have high information value as indicators for graziers are:

- perennial grass cover
- ratio of increaser to decreaser shrubs
- vegetation height
- soil erosion

Attributes with potential to indicate conservation value are:

- species richness per 0.1 ha
- invasive alien weed cover
- fragment size and surrounding landuse type.

In general, small vegetation fragments on highly eroded soils and dominated by a few species of weedy plants have low value for all landusers, be they graziers, conservators or tourists.

Graziers would tend to place high value on stable soils, large fragment size, and on low-growing perennial grasses and shrubs that can be accessed and eaten by livestock or game. Because summers are hot and dry, and winters cold and wet, graziers are also likely to value phenological diversity among plant species or habitats that would ensure that fresh green material is produced by some of the species in winter and by others in summer. Graziers would place low value on unpalatable tall shrubs that tend to increase with grazing or succession **(Table 2).** Additional data on the chemical composition of some Renosterveld plant are given in (Stindt & Joubert 1979, and Joubert & Stindt 1979).

Table 2. *Plant species that decrease (usually palatable) or increase (usually unpalatable) in response to grazing. Data are from (1) McDowell 1995 (Eenzaamheid) and (2) Walton 2006 (Elandsberg), (3) Iponga 2005.*

Palatable OR decrease with heavy grazing	**Source of info**	**Unpalatable or increase with heavy grazing**	**Source of info**
Shrubs			
Anthospermum galioides	*2*	*Athanasia trifurcata*	1,2
Anthospermum spathulatum	*2*	*Elytropappus rhinocerotis*	1,2
Hermannia alnifolia	2	*Eriocephalus paniculatus*	1,2
Hermannia scabra	2	*Bobartia filiformis*	1
Aspalathus spinosa	2		
Thesium funale	2		
Leucadendron verticillatum	2		
Lobostemon argenteus	2		
Salvia chamelaeagnea	2		
Proteaceae	1	Asteraceae	1
Rutaceae	1		
Olea europaea ssp africana	3		
Graminoids			
Ficinia indica	2		
Poaceae	1		
Digitaria eriantha,	2	*Cynodon dactylon* (palatable but increases)	2
Ehrharta calycina,	2		
Ehrharta capensis,	2	*Ehrharta capensis*	1
Eragrostis capensis	2		
Heteropogon contortus,	2		
Pentaschistis pallida	1		
Pentaschistis densifolia	2		
Themeda triandra	2		
Tribolium hispidum	2		
Tribolium uniolae	2		

Biodiversity conservators would value stable soils, high diversity and connectivity in habitat types within Renosterveld patches, high structural and species diversity, and endemic species. They may be neutral as to the value they place on the palatability and above-ground persistence of species, but would place low values on alien weeds.

Any given patch of Renosterveld may therefore be assessed differently for its biodiversity and commodity values as indicated in **Figure 4**. For example, a grazier might place a high value, and a conservator a low value, on Renosterveld habitat that was once used for cropping but is now dominated by an almost mono-specific cover of a lawn grass such as *Cynodon dactylon* that provides good soil cover and good grazing. On the other hand, road verges might have higher conservation than grazing value, whereas fragments C,D,E,& G may be of moderate value for both conservation and grazing.

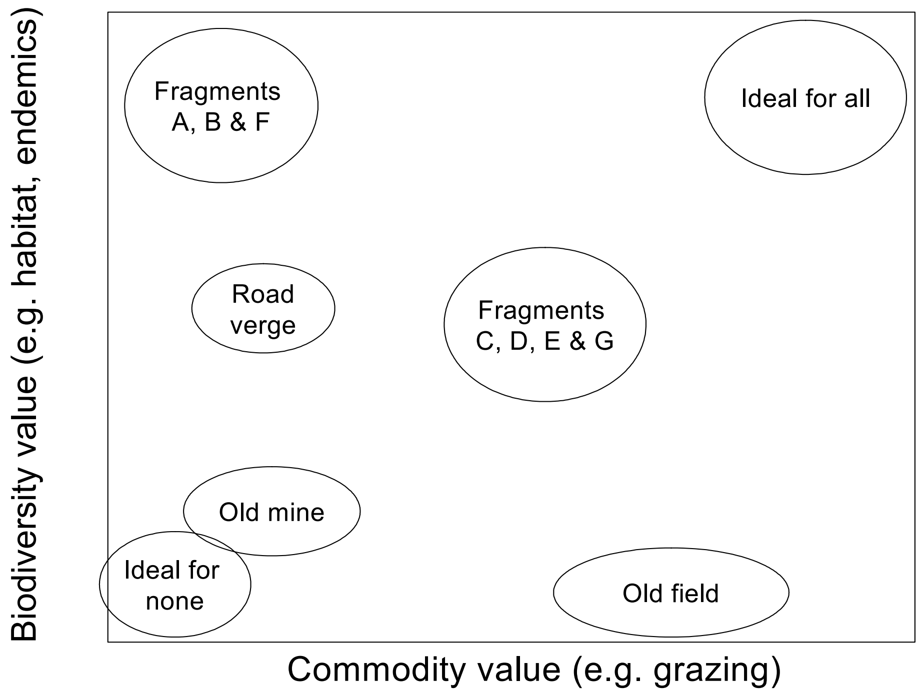

***Figure 4**. Scatter plot to illustrate that biodiversity and commodity values of Renosterveld fragments are not necessarily correlated.*

Conceptualising condition as a combination of multiple attributes

The challenge for assessment is how measured attributes can be combined to give a single index that can be used to communicate the grazing or conservation condition of a Renosterveld fragment, or to make decisions about management action to improve or maintain the condition of the vegetation. A linear degradation gradient (classification of condition from poor to excellent on a scale of 1 to 10 for example), may not be the appropriate way to describe condition states in Renosterveld where both biodiversity and grazing values are of interest. For example, biodiversity may be greatest at an intermediate level of decreaser shrubs, or grazing might be best when biodiversity level was moderate.

For this reason, the approach suggested is the use of a multi-criterion assessment where a fixed number of relevant attributes are quantified in the field, entered into a data base, and analysed statistically to generate numerical or graphical comparisons of the sample sites with ideal conditions for grazing or biodiversity conservation. Ranks or quantities for 3 to 8 measured attributes can also be plotted on a sunray chart, such as **Figure 5**.

Joining the plotted points forms a polygon (**Figures 6a and 6b**). By visually comparing the shapes and sizes of polygons drawn in this way, one can get a general impression of the differences, similarities and trends among various patches of vegetation sampled, and assess the relative merits of the vegetation for grazing and biodiversity conservation.

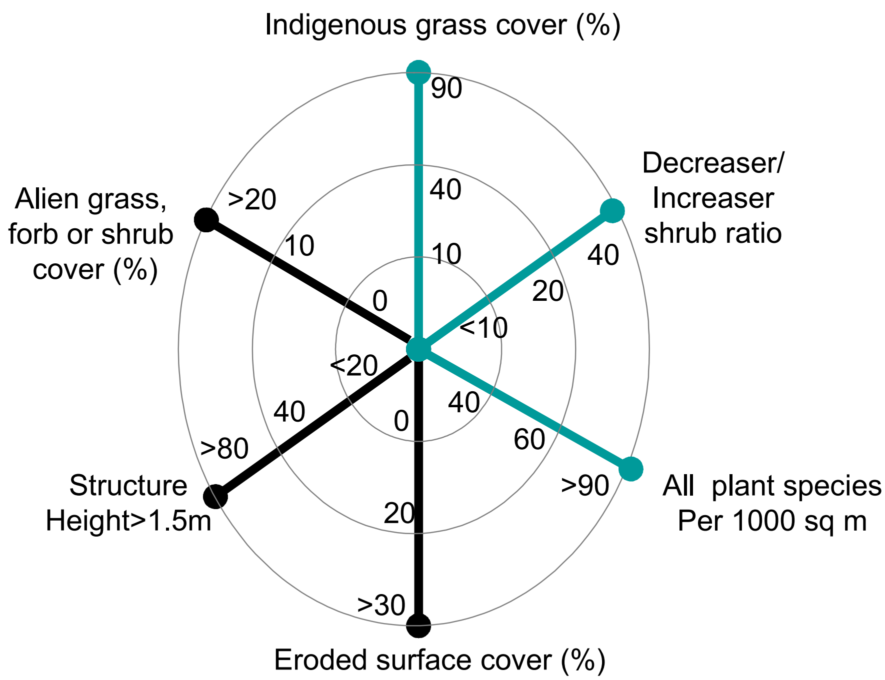

Figure 5. *Sunray plot with axes for six measurable attributes of relevance to biodiversity conservation and/or grazing.*

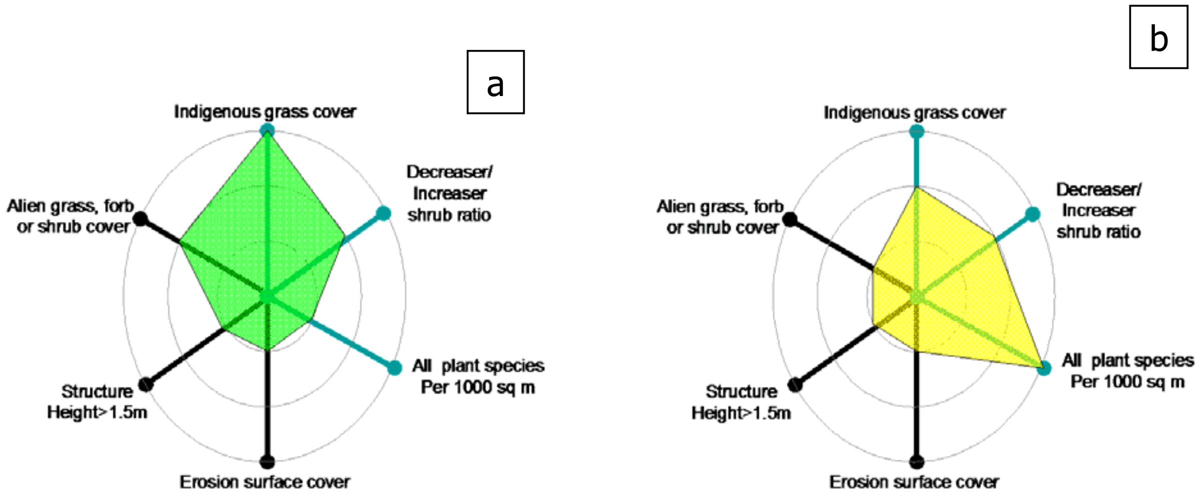

Figure 6*.Polygons formed by plotting data for six attributes of Renosterveld in (a) good condition for grazing and (b) in good condition for conservation.*

Using condition to trigger management decisions

Adaptive management involves using the best available conceptual model to make a management decision, observing the response of a system to the management action, and revising then revising the conceptual model to incorporate new information. Biggs & Rogers (2003) proposed setting Thresholds of Potential Concern (TPCs) that define the upper and lower levels along a continuum of change in selected environmental indicators or attributes. The levels are set using the best available information. When monitoring or assessment indicates that the TPC has been reached, this prompts an assessment of the causes, which in turn may be is the basis for making a management decision or revising the conceptual model on which the TPCs were based. The TPC approach is used to advise environmental decision making in SANParks.

Once the selected attributes of a Renosterveld patch have been quantified, the concept of TPCs can be used to describe the condition of the area relative to grazing or conservation ideals, and to make decisions on management actions to bring about a preferred condition. **Table 3**. gives examples of indicators of condition, and of thresholds that could be set for alerting managers to the need to respond by applying some form of management in order to change the state of renosterveld to one more suitable for the intended form of landuse (here grazing vs biodiversity conservation).

***Table 3**. Indicators of change (or condition) and thresholds of potential concern (TPC)*

Indicator	Measurable variable	Grazing threshold values	Biodiversity threshold values	Response
Soil erosion	% Cover of eroded surface	>20	>10	Control, rest, rehabilitate
Increaser (unpalatable) shrubs	% Canopy cover	>40	>60	Change burn season, change grazing
Alien weeds	% Canopy cover	>20	>5	Reduce disturbances and fertilizer input, control weeds
Indigenous perennial grass	% Canopy cover	<40	<10	Change grazing, burn autumn
Decreaser shrubs	% Canopy cover	<10	<20	Reduce grazing animals
Plant species diversity	Plant species per 100 m^2 (August)	<40	<60	Check for endemics, rest, reseed
Structure	% in Max height >1.5m	<20%	20-80	If >80 % over 1.5m then vegetation needs burn
Fragment size	hectares	>10	>0.1	Avoid grazing very small patches; attempt to link smaller patches using corridors

Threshold values should be set separately for landuse objectives as well as for west and south coast, mountain and eastern forms of Rensoterveld. At this stage, insufficient information is available to set such thresholds. Available data should be supplemented by expert opinion to set preliminary thresholds which would be refined by adaptive management

Methods for quantifying attribute data in the field

Assessment of the condition of Renosterveld and its responses to management should be done in such a way that the method is repeatable and the data can be shared among researchers and interpreted beyond the lifespan of the project or researcher. For these reasons it is necessary to collect and archive thre types of data for every Renosterveld fragment, namely metadata, management data and vegetation data.

Metadata (Data sheet 1)

For a data base to have long term value and to be shared among users it is essential to record metadata. A metadata sheet should be the first of any set of Excel or hard copy spreadsheets for a particular site. It includes

- GPS reference and map for the sampling site, district and farm name;
- contact details for the farm owner and researcher;
- details of sampling method used, including the position of the plots or transects in the landscape in relation to landmarks, the size and orientation of sample lines or plots, and a clear description of how vegetation and other environmental attributes were quantified. Options are (1) visual estimates of cover in a plot (20m x 5m), (2) continuous intercept records on a line transect of specified length, or (3) cover records taken at 1 m intervals along a line using a descending point.

Management data (Data sheet 2)

Literature reviews and conceptual models suggest that the major drivers of Renosterveld condition are ploughing, grazing, burning, brush-cutting, fragmentation, use of the surrounding landscape, and successional time (time protected from any disturbance). For these reasons it is necessary to record as much of this information as it is possible to obtain from the land owner of from air photographs. Only with good records of landuse history, will our understanding of factors causing species losses or grazing deterioration be improved. Patch size is also important to record as fragments tend to shrink over time.

Theory predicts that the negative effects of disturbance on persistence of plants and animals in isolated habitat patches increase with edge to area ratio. Narrow fragments would therefore be expected to contain more alien species and lose more indigenous species than circular patches. For this reason it would be useful to GPS the boundaries or at least to record the area and maximum and minimum diameters of the fragment.

Vegetation sampling (Data sheet 3)

At the Renosterveld Assessment workshop it was agreed that the assessments should be based on the following sampling protocol:

1. Select a homogeneous site (cover, habitat types, e.g. slope, edaphic factors)
2. Site should be >50m from disturbed lands and water points if possible
3. Orientate long axis of plot or transect along contour (not up-down slope)
4. Record physical attributes of site that could influence vegetation composition and condition assessment (slope, aspect, topographic position, soil texture, rockiness)
5. Record indicators of biological activity in the soil (termites, porcupine, moles) and estimate soil cover by biological crust (moss, lichen, fungi, algae)
6. Estimate percentage of landscape affected by active soil erosion (dongas, sheet was indicated by exposed roots)
7. Record invasive alien woody weed cover in fragment
8. Count all plant species within an elongated plot (20 x 5m)
9. Estimate cover data for increaser and decreaser species groups
10. If time allows, measure cover by species using a descending point method along a 50 m transect.

Communicating information about Renosterveld condition

Among scientists and managers

Communication about veld condition between farmers and conservators, or researchers and managers may fail if the two parties are not able to clearly describe the criteria that they use to define good, intermediate or poor condition for veld in terms of their management goals. Using simple iconic graphs such as sunray plots can improve communication because both parties can use the same data and picture as a basis for discussion about the condition of the veld in relation to management objectives such as biodiversity conservation or grazing. For example, in **Figure 7,** the yellow envelope shows a scenario that would be excellent for biodiversity conservation, and acceptable (but not ideal) for grazing, where as the pink envelope delimits species poor shrubland on degraded soil that has little value for grazing or conservation. However, as pointed out by Donovan Kirskwood of Cape Nature assessment of veld as being in “poor condition for conservation” should NEVER be used to justify further degradation of a site until backed by a detailed specialist survey.

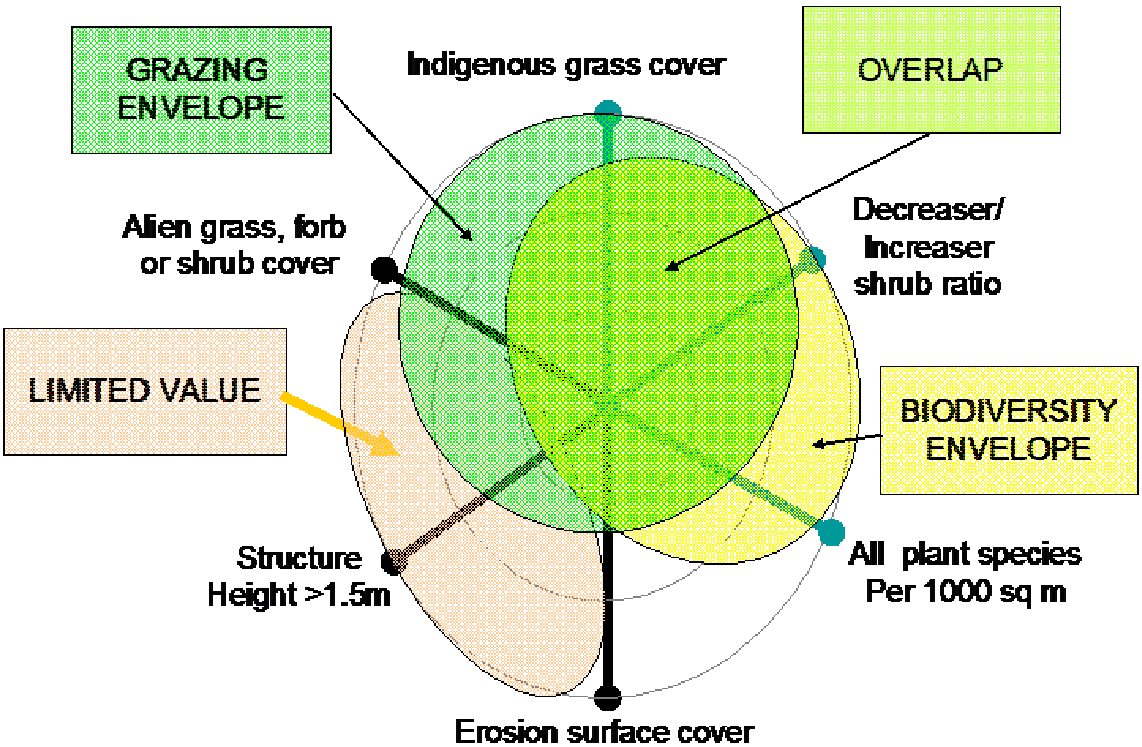

Figure 7. *Renosterveld patches with levels of measured attributes that indicate good condition of grazing (green), or biodiversity conservation (yellow). The overlap (light green) shows that there is considerable agreement between areas suitable for conservation and grazing. The pink envelope indicates eroded shrubby areas with low diversity.*

Among agricultural and conservation researchers

Use of the same proformas for data collection greatly improves communication between sectors and makes it possible to share data. This in turn builds a larger data bank and should facilitate more rapid adaptive learning, improvement of assessment methods and better management. The TMF workshop resulted in the development of an approach to data collection, selection of veld condition assessment criteria, and the development of data forms. However, further work will be required to publicise, test, promote and implement the method, and to ensure that data collected in a comparable way and are available to both conservation and agriculture. To achieve this, the following actions are recommended:

- In order to publicise and to obtain critical input to the method, a summary of the method should be included in the book "*Fynbos Ecology and Management*" currently in preparation (Esler et al funded by TMF);

- The method and datasheets should be placed on the websites of Department of Agriculture: Western Cape, SANBI and of WWF/TMF so as to be accessible to others who might wish to assess Renosterveld condition in order to improve their management. Long-term strategy is needed for archiving Renosterveld vegetation and management data and managing assessment outputs;

- At present, there is no formal process for testing the quick assessment method developed through the workshop. It is therefore recommended that the original workshop participants, and all others who have gained field experience in use of the assessment method, meet at another workshop in mid 2009 to review and improve the method. Among the questions that should be addressed at such a workshop are:
  - What characteristics are desired in renosterveld habitats by graziers (grass, palatable plants, accessible height)?
  - Should the six attributes selected for quantification in this draft method (cover of weeds (%), cover of perennial indigenous grass (%), ratio of increaser to decreaser shrubs, species per 0.1ha; vegetation cover >1.5 m high (%), soil erosion cover (%)) be supplemented, reduced or changed?
  - How should thresholds for assessment of veld condition differ between Renosterveld types, sites on north vs south-facing aspects and along a rainfall gradient?
  - Could use of the suggested attributes deliver a false assessment of "good condition" for conservation for veld where damaged in the past?
  - How do grazing, fire season and frequency, brush-cutting, protection from disturbance influence composition and condition in various types of Renosterveld?
  - Does the assessment methods work for agriculture and conservation purposes?
  - Would a key type approach to assessment better than the assessment approach suggested here?
  - Does use of sunray charts facilitate communication between disciplines and between scientists and managers?

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Data Forms for Rapid Assessment of Renosterveld

Based on designed by Simon Todd
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Sheet 1: Metadata

Date:	Researcher Name:
District:	Farm Name:
Farmer:	GPS:
Description of sampling method	
Line transect length	Line transect orientation
Descending point Y or N	Continuous intercept Y or N
Plot size 20x5m OR ________________	Number of plots

Sketch map showing line or plot layout in relation to landscape features (hills, rivers)

Sheet 2: Management history

Patch area:	ha		
Length x width	m x m		
Fragmentation:	Isolated		
	Poorly Connected		
	Well Connected		
Surrounding land use/s:			

Decade/Year last ploughed:

Management Actions:	Alien Clearing	
	Brush Cutting	
Other:		

Fire History:	Age	Season/Month
Last Burn		
Previous Burn		
Older Burns		

Camp Design:

Patch is part of larger camp	
Patch is fenced off	
Other:	

Grazing History:

Years Ago	Date/Time of Year	Period	Details (# stock and spp.)
0-1			
2-3			
4-10			
10+			

Other Comments:

Sheets 3 Vegetation condition

Date: Observer:

GPS:

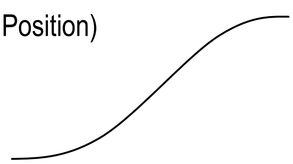
Patch Description:

A general description of the patch in terms of its orientation, relationship to other landscape features

Plot Description:

A description of how the plot is orientated within the patch, how the vegetation within the plot relates to the vegetation of the whole patch

Plot Physical Descriptors:

Slope:
Aspect:
Landform: (Slope Position) 
Rockiness:
Soil Depth:

Biological Indicators:

Porcupine Diggings:			
Termites:			
Harvester Ants:			
Heuweltjies:			
Other:			
Alien Plants:	Infestation in fragment		
	Insig.	Medium	Severe
Woody			
Grasses			
Thistles			

Soil Quality & Condition Estimators:

Biological Soil Crust:
<10% (Unhealthy)
10-60% (Intermediate)
>60% (Healthy)

Pedestal (Exposed Roots):
None (Healthy)
1 – 5 % (Intermediate)
>5% (Unhealthy)

Dongas:	**Other:**
Present/Absent	
Density/km^2	
Active/Stabilised	

Sheetwash in plot (%)

Species List of all plants in 5x20m plot (0.01 ha):		
1	26	51
2	27	52
3	28	53
4	29	54
5	30	55
6	31	56
7	32	57
8	33	58
9	34	59
10	35	60
11	36	61
12	37	62
13	38	63
14	39	64
15	40	65
16	41	66
17	42	67
18	43	68
19	44	69
20	45	70
21	46	71
22	47	72
23	48	73
24	49	74
25	50	75

Grazing increasers/Decreasers:					
			Cover		
Type:	**< 5%**	**5 – 10%**	**10 – 25%**	**25 – 50%**	**> 50%**
Elytropappus rhinocerotis					
Athanasia trifurcata					
Bobartia filiformis					
Galenia africana					
1					
2					
3					
Annual Grasses					
Alien perennial grass					
Cynodon dactylon					
Invasive alien woody weeds					
INCREASER TOTAL					
Other Asteraceous Shrubs					
Non-Asteraceous Shrubs					
Trees/fleshy-fruited shrubs					
Themeda triandra					
Other perennial grass					
Herbs					
Geophytes					
DECREASER TOTAL					

1,2,3 Any other increasers identified by discussions with farmers