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A Case Study of Landholder Attitudes and Behaviour Toward the Conservation of Renosterveld, a Critically Endangered Vegetation Type in Cape Floral Kingdom, South Africa

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Abstract The attitudes and behaviours of private landholders toward the conservation of a highly transformed and critically endangered habitat, Overberg Coastal Renosterveld (OCR) (a grassy shrubland of the Cape Floral Region, South Africa) are described. Personal, semistructured interviews were conducted with landholders, representing 40 properties in the Overberg region, on topics such as management and utilisation of OCR, the depth of their knowledge of its conservation importance, what they perceive its value to be, and the extent of their willingness to conserve it. General attitudes toward conservation incentives and provincial conservation authorities were also investigated. Farmers more willing to conserve were younger, did not necessarily have a better education, and owned larger farms (>500 ha) with a greater amount of remnant renosterveld (>300 ha) than those less willing to conserve. Attitudes toward the OCR were largely negative, related to associated problem plants and animals and the fact that it is believed not to be economically advantageous to retain it. However, farmers are of the opinion that provision of incentives and increased extension support will provide practical positive inducements for conservation. Landholder education is paramount to prevent further transformation of critically endangered habitats. The success of private-conservation programs depends on the attitudes of landowners toward (1) the particular habitat or species to be conserved (which can vary depending on the type of land use practised and the associated benefits and disadvantages of that habitat type); (2) the conservation agency or extension officers responsible for that area; and (3) willingness of landowners to participate in a conservation program, which is influenced by landowner age, farm size, and the amount of natural habitat left to conserve.

Keywords Extension · Incentives · Overberg Coastal Renosterveld · Survey · Willingness to conserve

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Introduction

In the past decade, conservation efforts in South Africa have begun to shift toward private land initiatives to effectively preserve the country's biodiversity. This has been prompted by factors that limit expansion of the formal conservation reserve network, such as shrinking budgets, lack of capacity, and competing socioeconomic priorities (Botha 2001a). Conservation of land beyond reserves can effectively expand the existing reserve system (Milton and Davies 1994). The agricultural community privately owns approximately 80% (by area) of the most scarce and threatened vegetation types in South Africa (Botha 2001b). Therefore, the future conservation or destruction of threatened ecosystems lies predominantly in the hands of farmers and private landholders. Conservation planners and authorities must work with farmers to understand their values and goals because these

qualities underpin most decisions made and actions taken (Fell 2000).

It is therefore unfortunate that in South Africa, of all the facets of environmental conservation, the human attitudinal and behavioural components are the least understood and researched (Ferrar 1983). A review of the international literature shows this research gap is not restricted to South Africa but appears to be a common phenomenon in several countries (see Pyrovetsi and Daoutopoulos 1997; Plieninger and others 2004).

Empirical information on factors determining farmers' conservation practices is highly skewed toward the North American region (Amsalu and De Graaff 2007; Knowler and Bradshaw 2007). This is important because the relative significance of factors influencing farmers' environmental practices may differ under varying agroecological and socioeconomic conditions (Bekele and Drake 2003; Amsalu and De Graaff 2007). ''Locational specificity'' of such factors (Wandel and Smithers 2000) means that few, if any, universal variables regularly explain adoption of conservation agriculture (Lockeretz 1990; Wilson 1992; Knowler and Bradshaw 2007). This study addresses a call by Knowler and Bradshaw (2007) to produce results meaningful for local management rather than for universal understanding. In the light of the failure of existing theoretical perspectives to predict the adoption of conservation practices, the inductive exploratory approach advocated by Lockeretz (1990) and Napier (2001) features strongly in this study in that farmers were simply asked why they do, or do not, conserve a threatened vegetation type on their farms.

The majority of empirical studies concern the adoption of soil- and/or water-conservation practices or farmers' attitudes to the environment in general; we rather focused on farmers' willingness to conserve natural habitat on their farms. A small proportion of studies outside of South Africa are explicitly concerned with this issue: Kreutzwiser and Pietraszko (1986) on wetlands; Wilson (1992) on native forests; Kingsbury and Boggess (1999) on riparian habitats; Curtis and Robertson (2003) on river frontages; Jacobson and others (2003) on birds; and Plieninger and others (2004) on Spanish holm oak savannas. Studies conducted by Pyrovetsi and Daoutopoulos (1999), Macdonald and Johnson (2000), and Genghini and others (2002) focused on wildlife habitat or natural ecosystems in general. The situation has not improved substantially since McDowell and Sparks (1989a) commented that in-depth analyses of the behaviour of landowners toward natural or seminatural ecosystems on their lands are scarce.

Although explanations for the relative importance of factors determining land users' conservation decisions vary, there is some consistency in the pattern of influence on the adoption of conservation practices once study-specific factors are controlled (Knowler and Bradshaw 2007). In this regard, the international literature provides a framework for the South African context. Four sets of factors are hypothesized to be influential: farmer characteristics (socio-demographic as well as attitudinal), farm biophysical characteristics (''farm-structure''), business characteristics of the farm, and institutional or social environment factors (*e.g.*, communication and information networks) (see Petrzelka and Korsching 1996; McCann and others 1997; Beedell and Rehman 1999, 2000; Bekele and Drake 2003; Jacobson and others 2003; Knowler and Bradshaw 2007).

Renosterveld (Acocks ''veld-type 46,'' Acocks 1988) is a distinctive grassy shrubland that occurs on fertile soils highly favourable for agriculture. This is why only 5% to 6% of the lowland form of this vegetation type (*i.e.*, Coastal Renosterveld) remains (Von Hase and others 2003). Coastal Renosterveld is one of the most poorly protected veld types in the Cape Floristic Region (CFR) and the most transformed habitat type in South Africa (Von Hase and others 2003). Less than 1% of Coastal Renosterveld is formally conserved in statutory reserves (Von Hase and others 2003), making conservation of this vegetation type on private land a high priority. The remaining areas of Coastal Renosterveld are small fragments scattered throughout agricultural lands that exist in varied levels of degradation and are under constant threat of being cleared for new agricultural lands or other developments. Disturbances that have degraded many remnants include overgrazing, alien plant invasion, crop spraying, frequent fires, and edge effects, which often cause alien grass invasion (Kemper and others 2000).

McDowell (1986a, 1986b, 1988) and McDowell and others (1989a, 1989b) explored factors affecting the conservation of renosterveld on the West Coast of South Africa. This is the only work that investigated attitudes toward renosterveld specifically; however, it was restricted to West Coast landowners and did not consider landowners in the Overberg, the other main region of renosterveld's distribution. The Overberg differs markedly from the West Coast in terms of land use (sheep and fruit farming versus cereal and wine), climate, and topography, all of which could affect landowners' attitudes toward renosterveld.

Only two other local studies have focused on issues pertaining to conservation on private land in the CFR in particular, namely, Botha (1991) and Van Zyl (1999). Work in other South African provinces, by Benson (1988), Infield (1988), and Brand (1994), focused on attitudes toward various conservation aspects, whereas Savy (2003) focused specifically on private land–conservation behaviour.

To address the landowner attitude gap in the conservation literature, particularly but not exclusively in the South African context, the purpose of the present study was threefold. First, it was primarily aimed at describing the attitudes of landholders toward the conservation of

Overberg Coastal Renosterveld (OCR), a critically endangered habitat type, still remnant on their land. The following aspects were investigated in relation to landholder attitudes: (1) landholder knowledge and awareness levels of the conservation importance of the OCR and (2) the value landholders attach to the OCR in both economic and intrinsic terms and (3) the willingness of landholders to conserve the OCR.

Although this mainly exploratory study was not aimed at testing hypotheses per se, willingness was investigated in more detail by identifying possible factors influencing a farmer's willingness to conserve OCR on the farms: age, highest level of education, farm size, and area of OCR on the farm. A second objective of the study was to describe landholder behaviour relevant to the retention of an endangered vegetation type on their property, particularly what the OCR is currently used for, how it is managed, and the future likelihood of it being transformed. Finally, farmers' attitudes toward what might incentivise them, as well as what might prevent them from conserving more renosterveld, were explored. However, the relationship between farmers' attitudes and behaviours lied beyond the scope of this study. A related set of landholder attitudes, namely, those toward provincial conservation authorities, were also investigated. Where relevant, findings were compared with similar research in other parts of the world, but it must be taken into account that such research has usually been undertaken in agricultural landscapes that differ considerably from the landscape presented here.

Empiric data collected in this study on the factors limiting landholders to conserve renosterveld should greatly assist conservation-extension personnel in their negotiations with landholders about formally conserving or participating in a particular conservation project. Knowing the limitations faced by landholders in their farming operations is also extremely important for conservation agencies to understand because the application of conservation practices is influenced by farmer's perceptions of the compatibility of such practices with their needs and production goals (Botha 1991). It is hoped that a deeper insight into these landholders' attitudes and behaviours as a whole will inform strategies for fostering greater cooperation between landholders and authorities regarding the preservation of critical ecosystems on private land.

Methods

Study Area and Sample Selection

Within the Western Cape of South Africa, Coastal Renosterveld occurs naturally in two regions, namely the West Coast and the Overberg. West Coast Renosterveld has been subject to more research than Overberg Coastal Renosterveld (OCR), which has been identified as one of the seven most threatened broad habitat units in the CFR (Cowling and others 2003; Fig. 1). A fine-scale conservation plan for Coastal Renosterveld (Von Hase and others 2003) was underway in this area at the time of study initiation. For these reasons, the Overberg was selected as the broad study area for this investigation.

Within the Overberg, two areas were selected for study: one area is located between the towns of Bot River and Caledon (referred to as ''Bot River'' in the study), and another area lies between the towns of Bredasdorp and Swellendam (referred to as ''Suikerkankop''). Selection of the areas was made with the input of the Cape Conservation Unit (CCU) of the Botanical Society of South Africa, who undertook extensive botanical field work in the coastal renosterveld areas of the Overberg for the Cape Lowlands Project (Von Hase and others 2003). The Cape Lowlands project was seeking to add information on landholder characteristics, personalities, attitudes, and behaviours toward the conservation of coastal renosterveld fragments to a global information systems (GIS) database of mapped remnant patches. It was hoped that such information could be used to identify some of the human dimension opportunities and constraints to implementing a conservation plan for the Cape Lowlands. The study areas contain some of the largest and most ecologically important Coastal Renosterveld fragments in the Overberg region, and are target areas for the implementation of various conservation plans and projects (Von Hase and others 2003; Winter 2004).

A sample of 36 landowners, representing 40 properties (some farmers owned >1 property) and an area of 39 000 ha, was drawn randomly from a population consisting all farms in the Overberg on which pristine Coastal Renosterveld still occurred (compared with disturbed renosterveld, which might have been previously ploughed). Individual properties, and not landholders, were selected as the sampling unit because no sampling frame was available of all landholders that owned Coastal Renosterveld in the Overberg. However, landholders became the observational unit.

Electronic, spatial coverage was obtained of all property cadastrals in the Western Cape (courtesy of the Department of Water Affairs). The database, amenable for analysis with a GIS, contained information on farm number, farm name, and farm size. Spatial data of all remaining coastal renosterveld fragments in the Western Cape lowlands was obtained as a work in progress from the CCU and overlaid on top of the property cadastrals using ArcView (version 33, ESRI ©2002, Esler, University of Stellenbosch). A list was then compiled of all property cadastrals with Coastal Renosterveld in the two sample areas of Bot River and Sui-

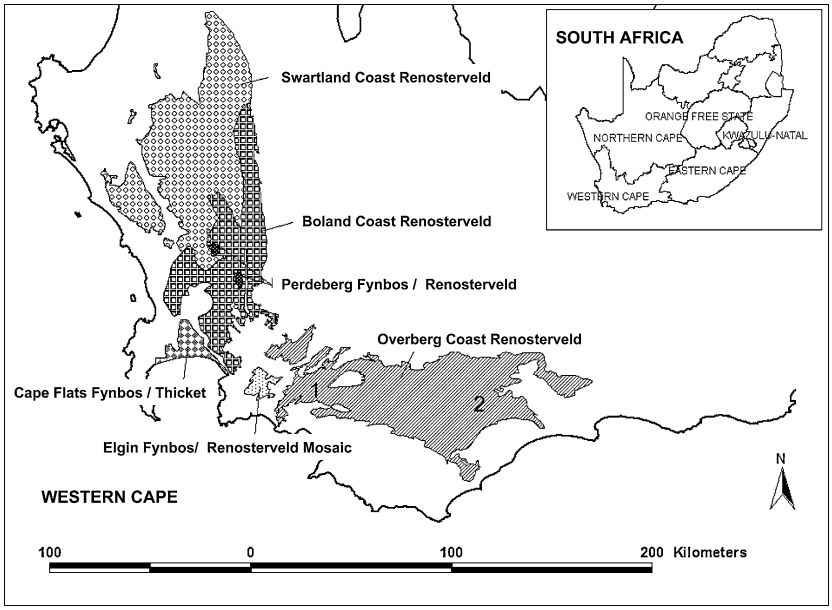

Fig. 1 The seven most threatened secondary broad habitat units in the Fynbos Biome, South Africa, as identified in the CAPE study (Cowling and Heijnis 2001) showing the location of OCR selected as the vegetation type for this study (courtesy of the CCU) as well as the location of the Bot River (1) and Suikerkankop (2), the study areas within the Overberg in the Western Cape, South Africa

kerkankop. Properties were randomly selected from the list to yield a total study sample of 40 properties. Additional properties were selected in the event that a landholder declined to be interviewed. Landholder contact details for each sample property were obtained from the Provincial Department of Agriculture for the Western Cape.

Although the sample was drawn randomly, the study is limited in terms of the extent to which research results may be generalised to a larger population than that of landholders in areas in the Western Cape where Coastal Renosterveld occurs (see McDowell and Sparks 1989a). Results should also be interpreted cautiously because of the relatively small size of the sample.

Because notifying people about a survey beforehand normally increases cooperation (Benson 1988), a letter of introduction was sent to the sample of farms to familiarise landholders with the study aims and to invite their participation in the interviews. Landholders were notified that the data would be published but were assured of confidentiality. No information was given to the landholders that might have altered their knowledge levels or attitudes toward coastal renosterveld until after the interview was completed.

Data Collection

Semistructured, face-to-face interviews were conducted with 36 landholders, representing 40 farms. Nineteen farms were located in Bot River and 21 in Suikerkankop. Mailed questionnaires were not used to collect data because these ususally have low return rates (<35%) (Brand 1994; Van Zyl 1999). Personal interviews tend to elicit landholders' attitudes and perceptions more accurately than posted questionnaires, telephone surveys, or electronic surveys (McDowell 1988, 1989b). An interviewer questioning respondents face-to-face can make important observations aside from responses to questions asked in the interview (Babbie and Mouton 2001). For example, an attempt was made to view OCR belonging to the landholder or manager because this often enabled meaningful discussions as well as provided data on background on management history. The advantages of ''walking the land'' (Koontz 2001) in terms of, for example, facilitating discussions, were considered to outweigh the possible disadvantages accorded to reactivity. Approximately half of the interviews were conducted between June and July 2002, whereas the other half was conducted in late August and September of the same year. No interviews were planned before June or after September because these are harvesting seasons.

Measuring Tools

The interview schedule (available on request) was subjected to peer review by experts in several conservation organisations. It was also tested in three pilot interviews conducted with landholders not included in the sample. These interviews served to refine the interview schedule and to ensure that all items were appropriate for OCR landholders. Based on the pilot interviews, questions probing affluence, income, and the value of the property were deemed too sensitive and therefore excluded.

The interview schedule used in the semistructured interviews combined questions of a more quantitative, closed-ended nature with more qualitatively oriented, open-ended questions. The closed-ended questions provided a greater uniformity of responses, which were more amenable for quantitative analysis, whereas the open-ended questions allowed the interviewer to probe certain issues in more depth. The latter allowed a focus on the decision-making

context of the farmers, suggested by Jones (2002) to be more value than simplistic and deterministic explanations that rely excessively on economic determinants in explaining, for example, environmental degradation on farms. The closed-ended questions included Likert-statements, one ranking scale, and a variety of demographic questions.

Interview duration varied from .75 hour to 3 hours depending on the amount of discussion the interview schedule generated and the amount of time the farmer was willing to spend on the interview. In some cases, certain questions were omitted for the sake of brevity, especially if the body language of the interviewee indicated that he or she preferred to end. A rationale for the inclusion of sets of questions and the way in which key variables were measured is provided below.

Section A: Background Information on Landholders and Farming Activities

To describe the study population, a range of demographic and farm-related questions was selected on the basis of previous research findings, in particular those of McDowell (1988) (Table 1). We noted that many explanatory variables explored for conservation decision making, such as age, have shown contradictory findings (*e.g.*, Cary 2001; Amsalu and De Graaff 2007; Knowler and Bradshaw 2007). Farmers' education has, however, proven to be one of the strongest variables determining conservation behaviour, generating the hypothesis that more education leads to a better understanding and/or awareness of, and more access to, information on conservation issues (McDowell and Sparks 1989a; Wilson 1992).

In the seven cases in which the interviewees were not landholders but farm managers, farm-related questions were modified to elicit information about the owner (*e.g.*,''Does the owner, to your knowledge, have any intention of selling the property in the next 5 years?'). The rationale was that it is normally the owner, not the manager, who will make important decisions on the property, such as future land use changes that might impact the future transformation of OCR.

Section B: Renosterveld Use and Management

The aim of this set of questions was to collect data on what OCR is currently used for, how it is managed, and the future likelihood of it being transformed. Current uses were gauged by presenting a list of possible renosterveld uses, such as grazing, shelter for livestock, wildflower picking, and bee keeping. Those landholders who used renosterveld for grazing were further probed on whether grazing had any noticeable benefit or disadvantage to livestock because the application of conservation practices is influenced by the farmer's perception of the relative advantages and disadvantages of conservation practices (Botha 1991). Landholders were then asked whether they actively managed their renosterveld areas or not, and, if so, which management tools they used. Finally, the future likelihood of OCR being transformed was determined by probing the interviewees on their plans for the management or use of their renosterveld in the next 5 years. The likelihood of OCR remaining untransformed in the future was also indirectly measured by asking interviewees the primary reason why OCR had been retained on the property. Responses to two farm-related questions regarding the slope and fertility of renosterveld areas could also indirectly indicate the likelihood of it being ploughed (*e.g.*, if the land was flat or gently sloping and extremely fertile, it would probably be highly suitable for agricultural purposes).

Table 1 Description of the study population ($N = 40$)

Demographic characteristic		
Sex (*n*)	Male (39)	Female (1)
Language (*n*)	English (3)	Afrikaans (37)
Bilingual ability (*n*)	Poor to Average (10)	Average to Excellent (30)
Length of tenure (*n*)	<11 years (10)	>11 years (30)
Farming experience (*n*)	<20 y (20)	>20 y (20)
Size of farm (*n*)	<500 ha (8)	>500 ha 32
Amount of renosterveld (*n*)	51 to 300 ha (22)	<51 to >300 ha (18)

Section C: Knowledge of Renosterveld and Its Value

According to Morris and Potter (1995), a behavioural approach, which focuses on the motives, values, and attitudes that determine the decision-making processes of individual farmers, has much to recommend it. Thus, the third set of questions was aimed at collecting data on the respondents' knowledge and awareness of the conservation value and protected status of OCR, their knowledge about renosterveld in general, and the value they themselves attached to it. Within the broader sociologic framework of structuration theory, Jones (2002) argued that decision makers will maintain or improve the land if they have a perception of the problem. According to Knowler and Bradshaw (2007), farmers' awareness of environmental threats demonstrates a consistent impact on adoption of conservation practices. We therefore hypothesised that farmers with an awareness of renosterveld and its value would be more likely to want to protect it.

In addition to closed-ended questions on these issues (Table 2), respondents were also probed on any knowl-

Table 2 Landholder responses pertaining to knowledge, use and management of OCR ($N = 40$)

Question	Yes (%)	No (%)	Other/unsure (%)
Were you aware that renosterveld is an endangered vegetation type?	47.5	52.5	–
Did you know that a permit is required to plough renosterveld?	52.5	47.5	–
The reasons why renosterveld should be conserved are clear to me	82.5	10.0	7.5
Do you think people in this area are becoming more aware of the scarcity and conservation importance of renosterveld?	25.0	72.5	2.5
Has the grazing livestock on renosterveld had any noticeable benefit to the livestock?	37.5	55.0	7.5
Has grazing livestock on renosterveld had any noticeable disadvantage to the livestock?	20.0	75.0	5.0
Do you actively manage the renosterveld areas?	80.0	20.0	–

edge they had about renosterveld and its fauna and flora (Table 3). Landholder attitudes concerning the utilitarian and intrinsic value of OCR were measured by means of a ranking scale consisting a list of 15 items (Table 4), from which the interviewees were asked to choose the 3 most important forms of renosterveld use to them in descending order of importance. Likert statements were also developed to measure landholder attitudes toward particular aspects of renosterveld value (Table 5). Two dimensions of the value a landholder may attach to renosterveld were further investigated: its economic value and its intrinsic value. Economic value was determined by asking respondents to give their estimation of the commercial value of renosterveld (in rands). Intrinsic value was investigated by probing the level of landholder interest in the renosterveld on his or her property and the associated plants and animals. Finally, farmers' opinions were gauged on why there may sometimes be a negative perception amongst certain landholders toward renosterveld.

Section D: Willingness to Conserve

Respondents' willingness to conserve renosterveld on their property was first measured indirectly by asking their opinions on the compatibility of conservation with agriculture or other land use productivity. Landholders were then asked directly how willing they would be to conserve renosterveld areas on their property in the future, even if a more profitable crop could be planted where renosterveld is currently found (Table 5). This touched on the aspect of sacrificial conservation, *i.e.*, leaving natural areas untransformed that are suitable for agriculture could mean that the landholder must forfeit income from production that could be earned from the undeveloped land.

Section F: Factors Incentivising and Limiting Conservation

Landholders' attitudes toward incentives for promoting conservation were investigated by asking their opinions about its efficacy in general as a way of promoting conservation on private land (Table 5). Thereafter, a list of 14 possible incentives (ranging from assistance with clearing alien trees and tax deductions to free access to nature parks and reserves) was presented to respondents to determine which of those incentives were attractive to them (Table 6).

To determine what may prevent landholders from conserving more renosterveld, respondents were asked whether they experience limitations of, for example, a financial, management, resource, equipment, or other nature. An issue related to conservation incentives concerns landholders' perceptions of their role and responsibility as custodians of biodiversity. In this regard, respondents were asked if they agree that the protection of biodiversity outside of protected reserves should be the responsibility of private landholders and whether CapeNature (the provincial conservation authority) or a government organisation should bear the costs for the conservation and management of renosterveld on the property. Respondents were also asked questions pertaining to the administration of incentives on private land. Assuming that certain incentives can only be delivered if audited, respondents were asked if they would be willing to have their OCR monitored by an expert or authority. Second, respondents were asked if they would like a representative from CapeNature to visit them in the future should the implementation of incentive schemes become a reality. It was believed that the response to the latter question would indicate the sincerity of a landholder's interest in negotiating incentive and stewardship options for their property. To conclude the section on incentives, respondents were asked, in an open-ended question, if they had any general comments or concerns about incentives in general. To conclude the survey, respondents were asked if they were interested in hearing the results of the survey.

Data Analysis

Statistical Package for Social Sciences version 11.0 (SPSS), Microsoft Excel 97, and STATISTICA (StatSoft 2005) were used to analyse data. Descriptive, univariate

Table 3 Negative and beneficial aspects associated with OCR as reported by landholders interviewed[a]

Disadvantages
Elytropappus rhinocerotis, a shrub that often dominates renosterveld, is costly to keep under control and decreases the grazing value of pasture.
Renosterveld is a source of unwanted plants (termed ''weeds'' by some farmers) that often invade surrounding cultivated lands.
No income can be generated from land that is not worked.
Caracul (*Felis caracal*) are problem animals that live and breed in renosterveld areas and can cause substantial stock losses.
The wool of sheep is damaged by walking through renosterveld shrubs.
Unploughed natural vegetation is regarded as ''messy.'' Many landholders like to keep their farms ''clean'' and so plough up everything.
Advantages
Renosterveld offers a valuable source of natural grazing and is especially valuable during winter or drought conditions, when planted pastures are unable to meet all of the dietary requirements of the livestock.
Renosterveld grazing also provides a form of natural medicine for livestock as well as an important source of roughage. This improves livestock resistance to disease and sickness.
Renosterveld protects steep slopes from erosion and therefore serves the important function of soil erosion control. This is particularly relevant when a drinking water dam is situated at the bottom of a hill. If that land is tilled, water quality will be decreased by the large quantities of silt that will runoff into the dam.
Renosterveld also offers ecosystem services such as soil carbon sequestration. Natural vegetation is able to bind carbon into the soil and maintain soil fertility.
Certain renosterveld plants even have human medicinal value, such as cancerbush and wormwood. Products from such plants are now being marketed for their healing properties.
Renosterveld is also a source of easily cultivated garden plants (particularly beautiful bulbs), which are well adapted to the cape's climate and growing conditions.
Renosterveld is home to a wide variety of birds and animals as well. Enjoy bird-watching and even controlled game bird hunting on your own property! Grey-wing francolin (*Francolinus africanus*) are sought-after game birds that feed on bulbs and plants that grow in renosterveld.

[a] Responses are ranked in order of most to least frequently mentioned

Table 4 Three most important forms of OCR use to landholders in the Overberg in decreasing order of importance ($N = 40$)

Renosterveld use	No. 1 (%)	No. 2 (%)	No. 3 (%)
Pasturage	60.0	2.5	7.5
Shelter for livestock	0.0	32.5	5.0
Nature conservation	12.5	10.0	7.5
Soil erosion control	7.5	10.0	25.0
Wild flowers (aesthetic value)	5.0	12.5	20.0
Wild animals (aesthetic value)	5.0	17.5	7.5
Recreation	2.5	2.5	12.5
Medicinal plants	5.0	5.0	7.5
Future agricultural fields	0.0	2.5	0.0
Wild flowers (commercial value)	0.0	0.0	0.0
Wild animals (commercial value)	0.0	0.0	0.0
Firewood	0.0	0.0	0.0
Beekeeping	0.0	0.0	0.0
Garden plants	0.0	0.0	0.0
Future periurban expansion	0.0	0.0	0.0

analysis was conducted with most quantitative and qualitative data collected during the interviews. On a more explanatory level, several bivariate analyses were performed on a number of background variables and landholders' willingness to conserve.

Results

Background Information

Most (75%) of the interviewees were landholders, whereas the rest were mainly property managers or, in three instances, property trustees. Only 1 of the 40 landholders interviewed was female. Just more than half of the landholders were between the ages of 36 and 55 years, and almost half possessed some form of tertiary qualification. By far, the majority (93%) were Afrikaans speaking, although 75% regarded themselves as having an average or excellent English/Afrikaans bilingual ability. Almost three quarters of the landholders had owned their properties for >11 years, and half had >20 years of farming experience. Most (80%) landholders had comparatively large farms (>500 ha), and just more than half had a medium quantity of renosterveld (51 to 300 ha) on the farms. The primary land use on the respondents' farms was grazing (cattle and/or sheep), with the cultivation of cereals and dairy farming, respectively, representing the second and third most prevalent farming practices.

Renosterved Use and Management

Most farmers (80%) actively managed their renosterveld, mainly with rotational grazing (Table 2). The majority of

Table 5 Landholder responses to Likert statements (N = 40) on (1) the utilitarian and intrinsic value of OCR (2) willingness to conserve, and (3) attitudes toward incentives for conservation

	Likert Statement	Agree (%)	Unsure (%)	Disagree (%)
	Fynbos has more value than renosterveld	60.0	20.0	20.0
1.	The renosterveld areas on my property are nonproductive, wasted pieces of land	57.5	12.5	30.0
	Agricultural productivity is more important than the conservation value of my property	27.5	17.5	55.0
	Currently, conserving renosterveld offers no advantages or benefits to me or to the business	30.0	7.5	62.5
	Conservation of land is incompatible with running an agricultural business	30.0	0.0	70.0
2.	Realistically, I can only consider conserving renosterveld on land that I cannot productively use	65.0	7.5	27.5
	Offering landholders incentives is a good idea for promoting conservation on private land	92.5	2.5	5.0
	Protection of plants and animals outside of reserves should be the responsibility of private landholders	87.50	5.0	7.5
3.	CapeNature or another government organization should bear the costs for the conservation of renosterveld on the property	57.5	7.5	35.0

Table 6 Attractiveness of incentives to landholders in the Overberg in descending order of attractiveness ($N = 39$)

Incentive	Respondents (%)	Frequency
Assistance with fencing and land management	72.5	29
Assistance with alien vegetation clearing	67.5	27
Rates relief for land conserved	67.5	27
Grants or subsidies for conservation	65.0	26
Tax deductions	47.5	19
Access to scientific advice	45.0	18
Tourism incentives	40.0	16
Law enforcement	32.5	13
Access to farm planning and management support	32.5	13
Assistance with fire management	30.0	12
Free access to all CapeNature parks and reserves	27.5	11
Discounts for accommodation at CapeNature resorts	27.5	11
Advice on legal compliance procedures	17.5	7
Public/community recognition	15.0	6

active renosterveld managers (68%) also implemented controlled burns with the use of firebreaks. Very few (28%) of these same landholders used brush cutting to decrease the fuel load or improve grazing because burning is a more popular and cheaper tool for achieving the same effect. Only a small proportion of landholders actively controlled soil erosion.

Knowledge of Renosterveld and Its Value

Just less than half of the landholders were aware that OCR is an endangered vegetation type (Table 2), and most believed that awareness of the scarcity and conservation importance of OCR was not common among other farmers in the area. Fewer than half of the landholders were able to provide any information on renosterveld. Information provided by the 17 landholders that responded was related to the use of renosterveld for a variety of medicinal and other utilitarian purposes.

Amongst the landholders who had grazing livestock on their farms, approximately half regarded renosterveld as providing a noticeable benefit to their livestock. Other than the benefit of livestock grazing mentioned by 55% of respondents (Table 2), other advantages are associated with renosterveld (Table 3), such as natural medicine and roughage for livestock. The three most important forms of OCR use selected by landholders included pasturage (selected by 60% of landholders), shelter for livestock (33%), and soil erosion control (25%) (Table 4).

Twenty percent of landholders regarded renosterveld as causing a noticeable disadvantage to their livestock in particular (Table 2). Most disadvantages related to unwanted plants (*e.g.*, renosterbos, *Elytropappus rhinocerotis*) and animals (*e.g.*, caracal) that are associated with renosterveld habitats and interfere with farming activities and incur costs to control. The two most common reasons why landowners themselves think there is a general negative perception of renosterveld include ignorance (because many people are not aware of the scarcity and conservation importance of renosterveld) and because no income can be generated from unworked lands where renosterveld naturally grows (Table 3).

In general, approximately one third of respondents did not see the potential for a conservancy in their area mainly because of the perception that ''there is nothing to conserve'' on the farmlands because very little natural vegetation remains in the area. Similar to the farmers in a study conducted by Carr and Tait (1991), who tended to reserve

the term ''wildlife'' for species beneficial to farming, many landholders in the present study only regarded land that holds large game as conservation worthy. Compared with fynbos, 60% of the landholders thought that renosterveld had less value, although 20% were unsure (Table 5). Most respondents regarded renosterveld areas as nonproductive, wasted pieces of land, whereas 13% were undecided.

McHenry (1996) stated that farmers had little sense of any intrinsic value in wildlife, whereas Kreutzwiser and Pietraszko (1986) report a narrow appreciation of wetland values on the part of many of the landowners they studied. In the present study, the economic value landholders attached to OCR, defined as the estimated retail value of the land presently occupied by renosterveld, varied from a maximum of R3 500/ha to a minimum of R100/ha, with a mean value of R631/ha ± 153.155 (SE) and a median value of R400/ha. However, 20% of the respondents believed that OCR had no value whatsoever and therefore did not report a value. At the other extreme, one respondent, who had a deep appreciation for renosterveld, said that such land was ''priceless'' and that he could not provide a monetary estimate for a commodity of such high intrinsic value to him. The value of workable land at the time of writing was between R3500 and R4000/ ha. At the time of writing in March 2007, 1 South Africa rand = 0.070 United Kingdom pound, 0.139 United States dollar, and 0.104 euro.

Willingness to Conserve

A large proportion of landholders (70%) were of the opinion that conservation is compatible with running an agricultural business (Table 5). However, these environmentally conscious attitudes may reflect social desirability bias because they were not reflected in some of the other responses. In particular, only 28% of landholders may have been regarded as ''sacrificial conservators'' or what Davies and Hodge (2007) referred to as ''progressive environmentalists,'' *i.e.*, willing to forgo potential income from land that is set aside for conservation purposes.

Considering the negative attitudes landowners expressed toward renosterveld and the disadvantages associated with it, it was expected that the landowners' willingness to conserve renosterveld on their property in the future, even if a more profitable crop could be planted, would be low. However, similar to the farmers in a study conducted by MacDonald and Johnson (2000), of whom almost two thirds said they would be willing to create wildlife refuges on their land if subsidies were available, 65% of farmers in the present study expressed a willingness to conserve renosterveld, either without reservation (33%) or in principle (30%). Only 10% of farmers considered conservation as a non-viable option, 15% believed they were not in a position to conserve renosterveld now but possibly could do so in the future, and 12.5% of respondents were unsure about the issue. In dealing at least partly with reported attitudes, we must bear in mind the possibility that there will be inconsistencies between what is said and what is done (Mcdonald and Johnson 2000), but these findings are consistent with other studies suggesting that most landholders hold positive attitudes toward conservation (Curtis and Roberston 2003). Qualitative data have shown that a number of landholders may be classified as ''commodity conservationists'' (see Davies and Hodge 2007), who tend to qualify their willingness to conserve renosterveld with economic considerations, as illustrated by the following responses: ''Yes, I am willing to conserve, but then you must come and put up the fence and help manage it'' or ''Yes, I am willing to conserve, but I cannot do so without financial assistance.'' One landholder emphasised the importance of understanding a farmers' economic dependence on his or her land: ''Land is money,'' he said, and therefore it is difficult to ''give up'' land for conservation.

Bivariate analyses were performed to investigate if and how willingness to conserve is influenced by certain attributes of the land (farm size, size of OCR area) and of the landholders (age, highest level of education). A greater percentage of farmers on large farms expressed a willingness to conserve OCR sacrificially than those on smaller farms. Also, a greater percentage of landholders with a large amount of renosterveld on their properties were willing to conserve their renosterveld than landholders with smaller amounts of renosterveld. Landholders' willingness to conserve tended to decrease with age: 71% of landowners willing to conserve their renosterveld were between 18 and 35 years old, whereas 50% of farmers >50 years of age were as willing to conserve. A slightly larger percentage of those landholders without a qualification after finishing school (67%) were willing to conserve than landowners without a formal education after high school (60%).

Factors Incentivising and Limiting Conservation

Ninety-three percent of landholders were of the opinion that incentives are a good idea for promoting conservation on private land. 88% also regarded the protection of biodiversity outside of reserves as their responsibility; although only 35% were prepared to bear the costs for that responsibility (Table 5).

From the list of incentives presented to interviewees, assistance with fencing and land management was deemed most attractive (Table 6). Several of landholders expressed the desire to fence off renosterveld areas to prevent overgrazing, but the high costs of fencing prevented them from doing so. Assistance with clearing alien vegetation was considered the second most attractive incentive. Direct financial incentives in the form of rates relief, grants, subsidies, and tax deductions were also attractive to 66% of

landholders. The least attractive incentive was public or community recognition (Table 6).

Considering that 33 of the landholders interviewed indicated they would like to make use of incentives or any other form of assistance from the local conservation authority, the need for incentives was strongly supported (Table 6). Very few landholders expressed any reservation about having their renosterveld audited or monitored for the property to be regarded as legible for an incentive. On the contrary, all but two of the landholders indicated that they would like a provincial conservation authority representative to visit them in the future should the implementation of incentives become a reality.

When questioned about what prevents them from conserving more land on their property, most landholders cited financial constraints, including lack of resources and/or equipment, whereas only 5% considered limitations to be management related. A number of interesting, distinctive constraints were also mentioned. For example, conserving more land is in direct opposition to the need to maximise potential land that may be used in the case of a drought or a weak economy. Riparian landowners in Oregon provided a similar reason for their nonparticipation in a conservation reserve–enhancement programme, *i.e.*, decreased flexibility to change land use as economic conditions warrant (Kingsbury and Boggess 1999). Another landholder who had recently had an unpleasant experience in trying to obtain a permit to cultivate new fields blamed the ''red tape, rules, and bureaucracy of environmental authority departments.'' The lack of cooperation he experienced in his dealings with these authorities was the reason why he was not interested in cooperating with conservationists to alter his land use activities to achieve ''their goals on my land.'' Yet another respondent believed the reason was simply ''ignorance'' and that this was the only valid excuse for not conserving conservation-worthy habitats. This last comment supports the finding that landholders believed that ignorance was the reason for the negative attitudes of many farmers toward OCR.

When respondents were asked for further comments about incentives in general, only one landholder expressed a clear dislike and distrust of the idea, saying that he was not in favour of any development restrictions and did not want people to ''tell him what to do on his land.'' He believed that by signing some form of legal contract for receiving an incentive, ''the agreeing party becomes the boss, and you are no longer able to make decisions at your own discretion.'' One respondent mentioned that the notion of incentives for conservation is not so novel an idea because farming practices normally do not operate without some form of government assistance or subsidy. Therefore, the same principle should apply to farming practices that benefit conservation. He questioned why it has taken so long for regulatory authorities to realise the need for conservation incentives within enabling legislation. When presented with the list of possible incentives, another landholder said that his first choice would not necessarily be tax deductions, because conservation should ''not be about the money'' but about the need to protect our land and natural resources for future generations. This ''environmentalist'' (Fairweather and Keating 1994) view was shared with another respondent who reiterated that people should not be motivated to conserve purely due to a promised financial incentive because this would not effect a lasting change in their values, attitudes, or behaviours. He suggested that an attempt should rather be made to instil amongst landholders a sense of pride and personal responsibility for the stewardship of natural resources and habitats on their own property.

Discussion

Use, Value, and Perceived Benefit of Renosterveld to Landowners

Considering the relatively low level of knowledge and awareness of OCR, its scarcity, and its endangerment, there is clearly a need for more education and extension support to spread the message amongst landholders about the conservation importance of OCR. It follows that the actual adoption of conservation measures will be influenced by the extent to which landowners perceive renosterveld transformation to be an issue of concern. This positive correlation between farmers' perceptions of an environmental problem and their adoption of other conservation practices is well documented in the literature (see, for example, Amsalu and De Graaff 2007; Knowler and Bradshaw 2007). In the case of OCR, landowners will only be concerned if they are aware that they have a critically endangered vegetation type on their property and that renosterveld conservation is important.

Landholders also tended to list the disadvantages and problems they experienced with renosterveld far more readily than the advantages. The most important reason for landholders' negative regards toward renosterveld is their frequent association of the vegetation with *Elytropappus rhinocerotis* (renosterbos), which often dominates renosterveld. *E. rhinocerotis* is a pioneer, indigenous species, but it causes a suite of management challenges to the farmer because it rigorously invades planted fields and becomes costly to control by hand removal. Furthermore, *E. rhinocerotis* has poor grazing value compared with planted pastures. The name ''renosterveld'' is similar to the word ''renosterbos,'' and therefore many of the misperceptions regarding renosterveld can be traced to negative

connotations with this species. Promoting the benefits of renosterveld while countering such misconceptions is probably one of the best means of changing the way landholders value their renosterveld. Previous research on species in need for regeneration on farms has also showed the importance of the species' utilitarian value. For example, farmers using oaks for firewood, charcoal production, fattening pigs showed higher oak appreciation (Plieninger and others 2004). Further research needs to be undertaken to add to the known ''list'' of renosterveld advantages.

An assessment of the most popular uses of OCR (namely pasturage, shelter for livestock, and soil erosion control) revealed that renosterveld holds a predominantly utilitarian benefit for landholders. This suggests that the aesthetic value of OCR (including its conservation value and habitat value for wild flowers and wild animals) is not as valuable to landholders as its economic value. This replicates the findings of McDowell and Sparks's (1989a) study of attitudes of landholders toward natural ecosystems on farms in South Africa. They concluded that for owners who have to make a living from the land, the economic role of that land tends to take precedence over its aethestic values. The findings are also in line with the stronger ''utilitarian'' attitude of farmers to the natural environment found, according to Pyrovetsi and Daoutopoulos (1999), by most other studies on the issue. The present study showed, however, that the value farmers attach to OCR is not always consistently positive or negative. This is apparent in farmers' seemingly contradictory views on certain issues. For instance, although a larger proportion of landholders agreed that the renosterveld on their property does offer some form of advantage or benefit to the business or to themselves, more than half regarded renosterveld as unproductive, wasted land. Although Macdonald and Johnson (2000) found that many farmers possessed positive attitudes toward the wildlife value of habitats on their farms, it seemed that more negative attitudes were not limited to the farmers in this study alone becasue at least two other studies have reported similar findings. In Carr and Tait's (1991) research, farmers often described unfarmed, wildlife areas on their farms ''in terms which implied they were bad: derelict, wasted land . . .'', whereas Young and others (1995; cited in Macdonald and Johnson 2000) found that tidiness was a reason frequently mentioned among farmers removing hedgerow because farmers may not always have a good idea of what constitutes a ''good'' habitat and tend to believe believe that a neat clean agricultural landscape is a sign of a ''good'' farmer.

The overall negative perception farmers have of OCR was further reflected by the low median estimated commercial value that landholders attached to a hectare of OCR (in $R.ha^{-1}$), which was approximately 10% of the commercial value of cleared, workable ground. As was found by MacDowell and Sparks (1989a), most remaining renosterveld is located on marginal land that is too steep, rocky, or wet to plough. Such natural constraints, similar to those found to make wooded areas and native forest more difficult for farming elsewhere (Wilson 1992; Erickson and others 2002), makes the agricultural potential of OCR very low and further explains the sentiment that renosterveld is an ''unproductive, wasted piece of land.'' These findings explain the overall negative perception of renosterveld, particularly in an agricultural context, irrespective of its general advantages or benefits.

What Affects Willingness to Conserve?

Conservationists can be tentatively optimistic about the future of OCR because most landholders are indeed willing to conserve it in the future. However, a much smaller percentage of landholders are ''progressive conservationists,'' willing to consider conserving OCR on land that can be used productively. The generally sympathetic sentiments toward conservation should again be interpreted within the context of economic pressures that often force landholders to use every hectare of land productively. As such, the results of this survey support previous studies suggesting that most landowners consider protection of wildlife habitat as important, although economic pressure often prevents the implementation of these objectives (see Plieninger and others 2004). This observation is further supported by the study's finding that landholders on larger farms were more likely to consider conserving renosterveld on land that they can still productively use because they are more likely to have additional hectares to spare than smaller farms. Thus, without practical and financial incentives, improved education is unlikely to dramatically change landholder actions.

From a demographic perspective, this study indicated that younger farmers appear more willing to conserve than middle- or older-aged farmers. The reasons for this could be varied because age may function as a proxy for higher educational attainment (Pyrovetsi and Daoutopoulos 1999, but not in this study) or historic education context. Younger farmers were socialised during the decades of environmental concern, whereas older farmers learned farm management skills at a time when natural habitats on farms were perceived as a liability (Napier and Camboni 1993; Napier and others 1995).

Although comparisons with other conservation-attitude studies might reveal interesting differences around the world, an assessment of overall landowner attitude is different from investigating willingness to conserve. Winter and others (2005) discovered, through the construction of

an index, that conservation attitude comprised two factors: (1) the willingness to conserve and (2) the perceived value that landowners attach to retaintion of natural habitats. Therefore, conservation attitude could reflect different relationships with demographic variables than when willingness to conserve is considered alone.

The finding that landholders without a tertiary education are more willing to conserve is surprising and, at first glance, seems counterintuitive. Although education is clearly linked with knowledge and awareness, there is not necessarily a link between willingness to conserve and level of education simply because willingness to conserve, conservation attitude, and actual adoption of conservation behaviour are not synonymous. Each area and type of natural habitat under discussion is likely to produce a different attitudinal profile within a particular farming community.

Attitudes Toward Incentives

Shepherd (1996) maintains that because of the various commitments landholders have in running a farm as a business, many do actively seek further information on funding programmes and financial incentives for on-farm conservation. This is consistent with our finding that most landholders would like to make use of incentives or assistance from the provincial conservation authority to maintain natural areas on their land. Incentives that are considered attractive by most landholders included assistance with fencing and land management, assistance with alien vegetation clearing, and direct financial incentives. Given the high cost of fencing, as well as that of alien plant clearing (combined with the fire hazard that alien vegetation poses), the attractiveness of these incentives to landholders is easily understood. It is also not surprising that direct financial incentives are also popular.

However, as one respondent noted, as long as the dominant values of most of the farming community remain at variance with wildlife and landscape conservation, any improvements encouraged by grants or persuasive messages are likely to be minimal or unstable. Carr and Tait (1991) hold a similar view: According to them, legislation and regulation may be the only effective means of ensuring stable long-term change if this proves to be the case. However, this latter view is not shared by these investigators or by Botha (2001a), who stated that providing the correct incentives to modify behaviour may be far cheaper than enforcing regulations and more effective than elaborating on bureaucratic administrative requirements. McDowell (1998) found no indication that restrictive legislation has any decisive influence on conservation behaviour. The ''big stick'' approach might have merits in particular situations, but in general what is needed amongst landholders of threatened ecosystems is a change in mindset from one of consumerism to responsible stewardship of the natural heritage entrusted to them. To shift mindset, personal communication with landholders through direct extension is needed.

McDowell (1986b) suggested that the selective provision of subsidies has certain advantages over tax-based incentives because subsidies provide the most direct means of financial support. The results of this study concur with McDowell's observation, that 66% of the landholders interviewed preferred the notion of grants and subsidies, whereas 48% identified tax deductions as the most attractive incentive.

If incentives are associated with government regulation, negative connotations could develop regarding red tape and bureaucracy or fines and prosecution, a concern voiced by several landholders in this study. Therefore, among farmers the positive aspects and advantages of adopting a stewardship option should be carefully marketed and fears allayed wherever possible. Many landholders were pessimistic about the likelihood of financial incentives ever being realised in South Africa. Apart from financial incentives, advanced extension services are considered essential and cost-effective incentives for improving landholder cooperation and conservation behaviour. An impression was gained through the interviews that landholders could be motivated to conserve if extension officers provided a committed level of advice, (nonmonetary) support, and follow-up on their individual management problems and queries. However, conservation extension services in South Africa require much improvement for these kinds of motivational incentives to be realized.

Attitude Change Versus Behavioural Compliance

For conservationists, it becomes important to know how one can change the negative attitudes of those people who are not sympathetic toward conservation. Perhaps the most common way to changing attitudes is to present a person with a message containing information about the attitude object, which is called persuasion (Petty and Krosnick 1995). Forcing a change in behaviour by relying on force or threatened punishment is called ''behavioural compliance.'' The advantage of persuasion over behavioural compliance is that when people's internalised attitudes are changed, they will presumably choose to engage in consistent behaviour, even if the person who brought about the attitude change is not present (Kelman 1958). This has become the rationale for introducing incentives for conservation rather than enforcing compliance with legislation.

Implications for Conservation Agencies

Conservation authorities must understand the attitudes, management approaches, needs, and limitations of the private sector that own large areas of threatened ecosystems around the world. As Mossman (1985) aptly emphasised, one cannot expect conservation to be undertaken at levels beyond the interests and abilities of the landholders who own such priority conservation land. Research tools outside those of the biological sciences, such those provided by the social sciences, are therefore necessary to properly understand the lies and worlds of the private landholder and how they think.

Provision should be made for landholder relationship building and attitude surveys in the strategic plans of conservation authority business units and more attention paid to improving public relations with landholders and stakeholders that own property bordering statutory reserves. Furthermore, sociologists or social-ecologists should be employed within conservation authority personnel structures to provide these skills. McDowell (1989) provided a code of conduct for extension agents to induce positive conservation attitudes in landholders. More training is needed for extension officers that specifically focuses on improving landholder interactions through effective communication, impression management, and effective decision steering.

General Lessons

Any landholder survey or needs-analysis should be kept as brief as possible, without jeopardizing the collection of adequately detailed data for analysis. In retrospect, and considering the constant demands on a farmer's time, the questionnaire used in this study was too lengthy as evidenced by some questions being omitted during the interview.

Based on the general impressions gathered during the interviews with landholders, there is clearly a lack of understanding and respect between farmers and conservationists. Conservationists often are not sympathetic to a farmers' economic dependence on their land. Furthermore, many farmers are negatively stereotyped by conservationists as uncooperative. Such views do not bode well for enlisting landowner support for conservation programs and therefore must be addressed by considering the viewpoints of the other party and by attempting to understand their lives, worlds, and underlying reasons for their behaviour. Apart from educating landowners about the conservation importance of certain ecosystems, education and lobbying efforts must be directed toward key decision makers to enable legislation and incentive schemes to be introduced.

A new approach to conservation extension is needed whereby there is a shift from reactive extension (*i.e.*, law enforcement) to proactive extension (*i.e.*, building relationship with landowners, addressing their information needs, making regular courtesy calls.). For this to take place, extension training must place a larger emphasis on equipping conservation agency staff with communication and people skills and on developing the best protocol for dealing with landowners and winning their trust. Conservation agencies themselves must keep relevant to the current needs in a particular farming community, and therefore landowner needs and attitudes should be regularly reassessed and understood. It is also recommended that extension staff that have been newly appointed to an area and who are unfamiliar with that region should start by conducting a landowner attitude survey as an excellent means to understand perceptions and attitudes prevalent in the community.

An example of a common perception amongst South African landowners is that only land that supports large game is conservation worthy. However, many endangered vegetation types do not typically support much large game and are therefore regarded as ''dull, boring, or uncharismatic'' by the landowners. Furthermore, the fragmented nature of highly transformed ecosystems gives landowners the impression that there is ''nothing left to conserve.'' Therefore, such misconceptions should be addressed before landowners are likely to become willing to conserve.

Finally, the most important lesson gained from this study is that the success of a private-conservation program depends on the following: (1) the attitudes of landowners toward (a) the particular habitat or species to be conserved (which can vary depending on the type of land use practised,and the associated benefits and disadvantages of that habitat type) and (b) the conservation agency or extension officers responsible for that area; and (2) the willingness of landowners to participate in a conservation program, and this participation is influenced by landowner age, farm size, and amount of natural habitat left to conserve.

Conclusions

Although this research focuses largely on the South African experience, and in particular on OCR, it is set in the general context of farm-level conservation. The literature suggests that convergence toward a universal explanation of landholder attitudes and behaviour regarding conservation is unlikely, but although our findings are context specific, they are not necessarily unique. The problems that threaten the survival of threatened vegetation types, such as OCR, are complex and uncertain. The solutions required do not only imply adjusting current land use and agricultural

practices but also call for relational and attitudinal adjustments to be made between conservation authorities and the landholders themselves. As stressed by McDowell and others (1989b), personal interaction has a far greater potential than any other method for persuading landholders who own and control threatened ecosystems to modify their land use practices. To assist with conservation and management of priority ecosystems on private land in South Africa, conservation authorities must understand the attitudes, management approaches, needs, and limitations of the private sector, which owns nearly 80% of this priority land.

The present study represents one of the first attempts in the Overberg area of the Western Cape to developing such an understanding in the South African agricultural context. The sample size of 40 farms was admittedly small, and it is recommended that future studies should make use of a larger sample size to improve the representivity of the sample. However, the study does provide a much-needed in-depth perspective on the conservation attitudes and behaviour of private landholders in relation to an endangered habitat. The findings highlight the tenuousness of the existence of remaining renosterveld in the hands of landholders who presently exhibit a relatively low level of knowledge and awareness of OCR, its scarcity, and its endangerment. Thus, education and extension efforts must be urgently increased. For these landholders, the disadvantages associated with renosterveld, often related to misconceptions about the habitat, outweigh the advantages, which are conceptualised in predominantly utilitarian, economic terms. On a positive note, landholders, particularly those who are younger and own relatively large farms, are not averse to becoming involved in future efforts aimed at conserving the renosterveld on their land. However, very few could be termed ''sacrificial conservationists,'' which emphasises the importance of introducing incentives of a particularly practical and financial nature for the conservation of renosterveld. A similar conclusion was made by Plieninger and others (2004), *i.e.*, that economic incentives are a major determinant of the conservation mentality of landowners in Spain and that innovative incentive tools, such as relief from property rates, should be considered.

The findings strongly support the recommendation that before designing or implementing a conservation strategy for a targeted area, conservationists should consider whether an adequate assessment has been made of the attitudes, opinions, and general feelings of private landholders in the intended area of operation. As Mossman (1985) aptly emphasised, one cannot expect conservation to be undertaken at levels beyond the interests and abilities of the landholders who own land on which these priority ecosystems are located. Tools of research outside those of the biological sciences are therefore necessary to better understand the lives and worlds of private landholders. Although this would appear to be common sense, many conservation projects have been launched without such considerations. Taking them into account will ensure maximum effectiveness for any conservation work and the best return for resources that are invested.

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References

Acocks JPH (1988) Veld types of South Africa. Memoirs of the Botanical Society of South Africa 57:1–146

Amsalu A, De Graaff J (2007) Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. Ecological Economics 61:294–302

Babbie E, Mouton J (2001) The Practice of Social Research (South African Edition). Oxford University Press Southern Africa, Cape Town, Africa

Beedell JDC, Rehman T (1999) Explaining farmers' conservation behaviour: why do farmers behave the way they do? Journal of Environmental Management 57:165–176

Beedell JDC, Rehman T (2000) Using social psychology models to understand farmers' conservation behaviour. Journal of Rural Studies 16:117–127

Bekele W, Drake L (2003) Soil and water conservation decision behavior of subsistence farmers in the Eastern Highlands of Ethiopia: a case study of the Hunde-Lafto area. Ecological Economics 46:437–451

Benson DE (1988) Successful methods for human dimension surveys: 1985 RSA game farmers survey example. South African Journal of Wildlife Research 18:61–64

Botha AJ, Van Der S (1991) Die gedrag en percepsie van boere ten opsigte van omgewingsbewaring. MinstAgrar thesis, Department of Agrarian Extension, University of Pretoria

Botha M (2001a) Incentives for conservation on private land: options and opportunities. Summary report. Cape Conservation Unit, Botanical Society of South Africa. Report No. 01/2001

Botha M (2001b) Conservation options for farmers and private landholders. Summary report. Cape Conservation Unit, Botanical Society of South Africa. Report No. 01/2001

Carr S, Tait J (1991) Farmers attitudes to conservation. Built Environment 16:218–231

Cary J (2001) Environmental policy implementation challenged by some land management realities. Connections 1:9–13

Cowling RM, Heijnis CE (2001) The identification of broad habitat units as biodiversity entities for systematic conservation planning in the Cape Floristic Region. South African Journal of Botany 67:15–38

Cowling RM, Pressey RL, Rouget M, Lombard AT (2003) A conservation plan for a global biodiversity hotspot—the Cape Floristic Region, South Africa. Biologic Conservation 112:191–216

Curtis A, Robertson A (2003) Understanding landholder management of river frontages: the Goulburn Broken. Ecological Management and Restoration 4:45–54

Davies BB, Hodge ID (2007) Exploring environmental perspectives in lowland agriculture: a Q methodology study in East Anglia, UK. Ecological Economics 61:323–333

Erasmus DJBH, Potgieter HR (1994) A landholder opinion survey on the hunting season and status of kudu in the Northern Cape Province. Bontebok 9:39–42

Erickson DL, Ryan RL, De Young R (2002) Woodlots in the rural landscape: landowner motivations and management attitudes in a Michigan (United States) case study. Landscape and Urban Planning 58:101–112

Fairweather JR, Keating NC (1994) Goals and management styles of New Zealand farmers. Agricultural Systems 44:181–200

Featherstone MA, Goodwin BK (1993) Factors influencing a farmer's decision to invest in long-term conservation improvements. Land Economics 69:67–81

Fell LR (2000) Time to converse: the importance of language, conversation and electronic media in agricultural extension. Australian Journal of Experimental Agriculture 40:503–509

Ferrar AA (ed.) (1983) A South African perspective on conservation behaviour—a programme description. South African Scientific Programmes Report 76. Foundation for Scientific and Industrial Research, Pretoria

Genghini M, Spalatro F, Gellini S (2002) Farmers' attitudes toward the carrying wildlife habitat improvement actions (WHIA) in intensive agricultural areas of Northern Italy. Zeitschrift Fuer Jagdwissenschaft 48:309–319

Infield M (1988) Attitudes of a rural community toward conservation and a local conservation area in Natal, South Africa. Biological Conservation 45:21–46

Jacobson SK, Sieving KE, Jones GA, Van Doorn A (2003) Assessment of farmer attitudes and behavioral intentions toward bird conservation on organic and conventional Florida farms. Conservation Biology 17:595–606

Jones S (2002) A framework for understanding on-farm environmental degradation and constraints to the adoption of soil conservation measures: case studies from Highland Tanzania and Thailand. World Development 30:1607–1620

Kelman HC (1958) Compliance, identification, and internalization: three processes of attitude change. Journal of Conflict Resolution 2:51–60

Kemper J, Cowling RM, Richardson DM, Forsyth GG, McKelly DH (2000) Landscape fragmentation in South Coast Renosterveld, South Africa, in relation to rainfall and topography. Austral Ecology 25:179–186

Kingsbury L, Boggess W (1999) An economic analysis of riparian landowners' willingness to participate in Oregon's Conservation Reserve Enhancement Program. Selected article for the Annual Meeting the Agricultural Economics Association, August 8 to 11, Nashville, Tennessee

Knowler D, Bradshaw B (2007) Farmers' adoption of conservation agriculture: a review and synthesis of recent research. Food Policy 32:25–48

Koontz TM (2001) Money talks—but to whom? Financial versus nonmonetary motivations in land use decisions. Society and Natural Resources 14:51–65

Kreutzwiser RD, Pietraszko LJ (1986) Wetland values and protection strategies: a study of landowner attitudes in southern Ontario. Journal of Environmental Management 22:13–23

Lockeretz W (1990) What have we learned about who conserves soil? Journal of Soil and Water Conservation 45:517–523.

Macdonald DW, Johnson PJ (2000) Farmers and the custody of the countryside: trends in loss and conservation of nonproductive habitats 1981–1998. Biological Conservation 94:221–234

Matthews S, Pease SM, Gordon AM, Williams PA (1993) Landowner perceptions and the adoption of agroforestry practices in southern Ontario, Canada. Agroforestry Systems 21:159–168

McCann E, Sullivan S, Erickson D, De Young R (1997) Environmental awareness, economic orientation, and farming practices: a comparison of organic and conventional farmers. Environmental Management 21:747–758

McDowell C (1986a) Legal strategies to optimise conservation of natural ecosystems by private landholders: restrictive legislation. The Comparative and International Law Journal of South Africa 19:450–460

McDowell C (1986b) Legal strategies to optimise conservation of natural ecosystems by private landholders: economic incentives. The Comparative and International Law Journal of South Africa 19:461–474

McDowell C (1988) Factors affecting the conservation of renosterveld by private landholders. Doctoral thesis, Department of Botany, University of Cape Town

McDowell C, Sparks R (1989a) The multivariate modelling and prediction of farmers' conservation behaviour toward natural ecosystems. Journal of Environmental Management 28:185–210

McDowell C, Sparks R, Grindley J, Moll E (1989b) Persuading the landholder to conserve natural ecosystems through effective communication. Journal of Environmental Management 28:211–225

McHenry H (1996) Understanding farmers perceptions of changing agriculture: some implications for agro-environment schemes. In: Changing Rural Policy in Britain: Planning Administration, Agriculture and the Environment. Countryside Community Press

Milton M, Davies G (1994) Urban conservancies. Natal Parks Board Report

Morris C, Potter C (1995) Recruiting the new conservationists: farmers' adoption of agri-environmental schemes in the Journal U.K. Journal of Rural Studies 11:51–63

Mossman AS (1985) Appropriate technology for game ranching. Fourth International Theriological Congress, Alberta, Canada. Abstract No. 0444

Napier TL (2001) Soil and water conservation behaviors within the upper Mississippi River Basin. Journal of Soil and Water Conservation 56:279–286

Napier TL, Camboni S (1993) Use of conventional and conservation practices among farmers in the Scioto River Basin of Ohio. Journal of Soil and Water Conservation 48:231–237

Napier TL, McCarter SE, McCarter JR (1995) Willingness of Ohio land owner-operators to participate in a wetlands trading system. Journal of Soil and Water Conservation 50:648–656

Petrzelka P, Korsching PF (1996) Farmers' attitudes and behavior toward sustainable agriculture. Journal of Environmental Education 28:38–45

Petty RE, Krosnick JA (eds) (1995) Attitude strength: antecedents and consequences. Lawrence Erlbaum Associates, New York. NY

Plieninger T, Modolell J, Mainou Y, Konold W (2004) Land manager attitudes toward management, regeneration and conservation of Spanish holm oak savannas (dehesas). Landscape and Urban Planning 66:185–198

Potter C, Lobley M (1992) The conservation status and potential of elderly farmers: results from a survey in England and Wales. Journal of Rural Studies 8:133–143

Pyrovetsi M, Dautopoulos G (1997) Contrasts in conservation attitudes and agricultural practices between farmers operating in wetlands and a plain in Macedonia, Greece. Environmental Conservation 24:76–82

Pyrovetsi M, Daoutopoulos G (1999) Farmers' needs for nature conservation education in Greece. Journal of Environmental Management 56:147–157

Savy C (2003) Conserving wattled crane (*Grus canrunclulatus*) on private land in KwaZulu-Natal, South Africa: attitudes, economics and potential incentives. Master's thesis, Percy Fitzpatrick Institute, University of Cape Town

Shepherd DP (1996) Survey of farmer attitudes to long-term protection and management of remnant vegetation of high nature conservation value. Report to Department of Conservation and Land Management, Western Australia

Traore N, Landry R, Amara N (1998) On-farm adoption of conservation practices: the role of farm and farmer characteristics, perceptions and health hazards. Land Economics 74:114–127

Uliczka H, Angelstam P, Jansson G, Bro A (2004) Nonindustrial private forest owners' knowledge of and attitudes toward nature conservation. Scandinavian Journal of Forest Research 19:274–288

Van Zyl WJ (1999) Conservation on private lands: the situation within the three cape provinces. Master's thesis, University of Stellenbosch, Department of Conservation Ecology

Von Hase A, Rouget M, Maze K, Helme N (2003) a fine-scale conservation plan for the Cape Lowlands Renosterveld: Technical Report. Cape Conservation Unit, Botanical Society, Cape Town

Wandel J, Smithers J (2000) Factors affecting the adoption of conservation tillage on clay soils in Southwestern Ontario, Canada. American Journal of Alternative Agriculture 15:181–188

Wilson GA (1992) A survey on attitudes of landholders to native forest on farmland. Journal of Environmental Management 34:117–136

Winter SJ, Esler KJ, Kidd M (2005) An index to measure the conservation attitudes of landowners toward Overberg Coastal Renosterveld, a critically endangered vegetation type in the Cape Floral Kingdom, South Africa. Biological Conservation 126:383–394

Winter SJ (2004) Conservation stewardship: a new approach to conservation on private land. Veld and Flora 90:46–47

Young C, Morris C, Andrews C (1995) Agriculture and the environment in the UK: toward an understanding ''farming culture.'' Greener Environment International 12:63–80