CHAPTER 4

THE VALUE OF COMMUNITY-BASED CONSERVATION IN A HETEROGENEOUS LANDSCAPE: A CASE STUDY FROM THE MAPUTALAND CENTRE OF PLANT ENDEMISM, SOUTH AFRICA

INTRODUCTION

The Maputaland Centre of Plant Endemism (see Van Wyk 1994 and 1996 for its boundary definitions) is an area that is well known for its conservation importance (Moll 1977; Kirkwood & Midgley 1999; Van Wyk & Smith 2001). One reason most likely responsible for the high levels of biodiversity and endemism associated with the Maputaland Centre is that this area lies at the southern end of the tropics in Africa and many organisms reach the southernmost limit of their range there (Watkeys *et al.* 1993; Hearne & Mckenzie 2000; Matthews *et al.* 2001; Van Wyk & Smith 2001). The region therefore is a biogeographical transitional zone between the tropics to the north and the subtropics to the south, and is characterised by a diverse array of biomes. Consequently, several species pools that cover large parts of continents and are characterised by a variety of vegetation types and climatic conditions, may therefore act as reservoirs to enhance species diversity at the smaller regional scale such as the Maputaland Centre (see e.g. bird richness patterns - Maddock & Benn 2000).

Although several conservation activities have been, and currently still are, taking place in the Maputaland Centre, there are still several conservation concerns within the region. A case in point is the conservation of the Sand Forest habitat type, a distinctive habitat type in southern Africa. The Sand Forest is characterised by a unique combination of plant and animal species and has the highest diversity of woody plant species in the region, with a significant number of these being endemic to the Maputaland Centre (Everard *et al.* 1994; Matthews *et al.* 2001). Quantitative evidence suggests that most of the endemic vertebrate species in the Maputaland Centre are likewise restricted to this habitat type (Van Wyk 1996; Van Rensburg *et al.* 2000). Although Sand Forest is considered the smallest habitat type in South Africa, covering only 0.03% of the region's total land surface area, *circa* 45% of this habitat type has already been transformed due to anthropogenic activities and only small portions of the remainder are currently being formally protected (Low & Rebelo 1996). Even within some of these protected areas, Sand Forest conservation is also under pressure. For example, Tembe Elephant Park contains the largest protected portion of Sand Forest in South Africa (Van Rensburg *et al.* 1999), but although

elephants *Loxodonta africana* prefer plant species from woodland habitats, they are increasingly impacting Sand Forest plant species within the park (Matthews *et al*. 2001). To date no reversion to the original habitat structure has been recorded for disturbed Sand Forest patches even after extensive protection (Van Rensburg *et al.* 1999).

Another facet that conservation strategies have to take into account in order to integrate Sand Forest conservation requirements more carefully into future land-use planning is local scale heterogeneity. Several investigations examining the nature of fine-scale spatial heterogeneity in communities or assemblages have shown a large degree of such heterogeneity between different Sand Forest patches for dung beetles (Van Rensburg *et al.* 1999), birds (Van Rensburg *et al.* 2000) and plants (Matthews *et al.* 2001; Gaugris *et al.* 2004). This heterogeneity is most likely coupled with the biogeographical complexity of the area and indicates that conservation efforts in a variety of habitat patches are necessary to ensure the long-term persistence of its associated biota. This conclusion is particularly important given the increased impact, and hence destruction, of Sand Forest in Tembe (Van Rensburg *et al.* 1999, 2000).

One of the local communities who live adjacent to Tembe recently nominated a part of their ward, namely the Tshanini Community Conservation Area, as a community-based natural resource management project to serve as a possible conservation area in the region. The purpose of the area is to establish a nature reserve in the Manqakulani Ward of the Tembe Tribal Authority. The reserve is to be managed as an economic sustainable wildlife ranching and eco-culture tourism venture through the sustainable utilisation of renewable natural resources, but especially those resources that are associated with Sand Forest ecosystems. The aim of the present study was to describe and compare the Sand Forest bird assemblage that is found in Tshanini, which is characterised by low levels of human utilisation, with those characterised by wildlife utilisation such as in Tembe. This approach is to be used as a point of departure to determine the biological importance of this community area in contributing towards the conservation of the rare Sand Forest habitat type.

METHODS

The field work was done 5 km south of Tembe (27^{o} 01'S; 32^{o} 24'E), in Tshanini, located on the southern Mozambique Coastal Plain of the northern parts of the KwaZulu-Natal province in South Africa (Figure 8).

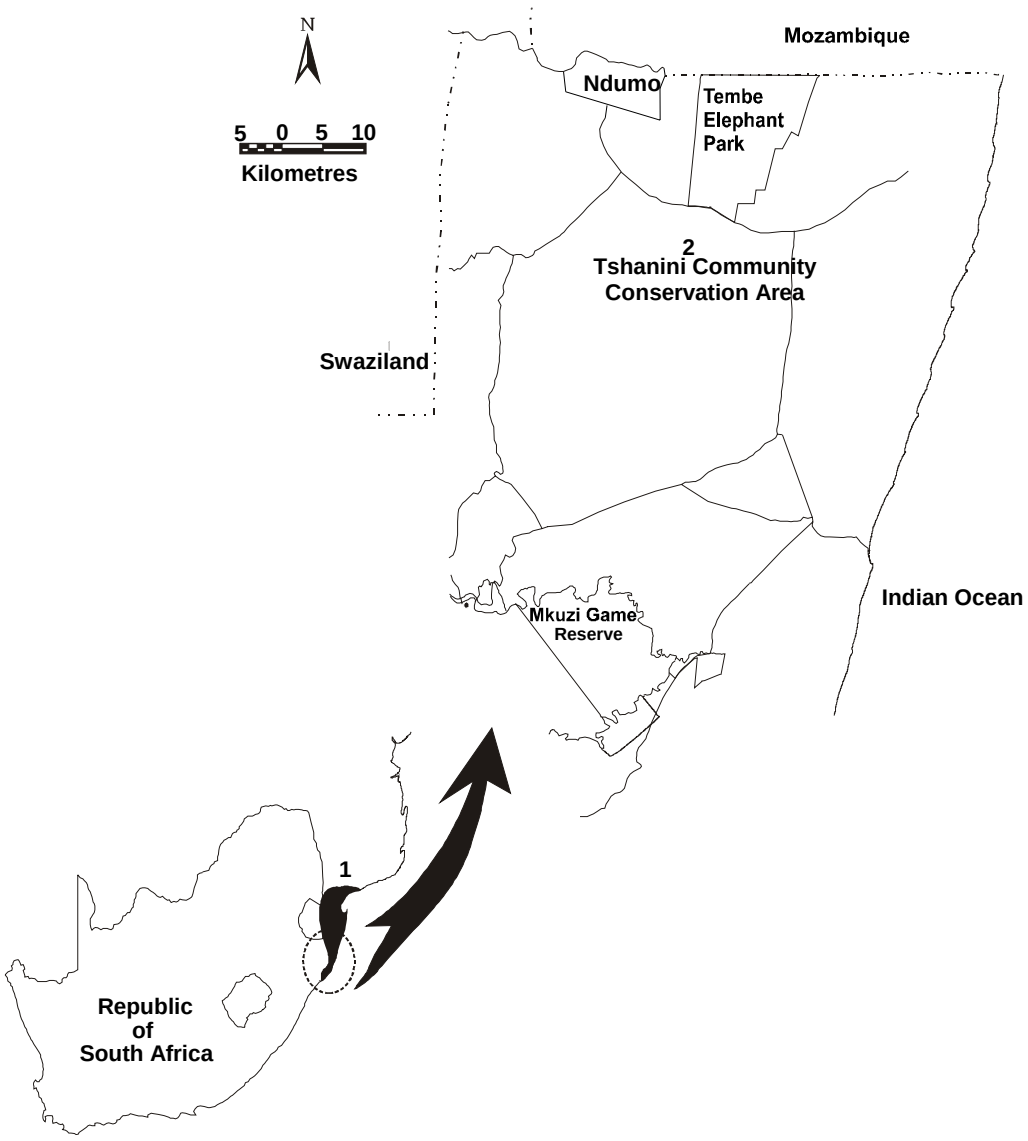


Figure 8. The location of (1) the Maputaland Centre of Plant Endemism and (2) the study area within the Maputaland Centre of Plant Endemism in South Africa.

Similar to Tembe, there are two distinct, clearly bounded habitat types in Tshanini, namely Sand Forest and Mixed Woodland. Visual and auditory bird surveys were done monthly in the Tshanini area between 1 July and 31 December 2002. We followed the same bird surveying protocol as Van Rensburg *et al.* (2000) in Tembe, except that only a single Sand Forest and Mixed Woodland site each were surveyed in Tshanini as opposed to two replicated sites of each habitat type in Tembe. The number of individuals of each species observed over the course of each sampling period in Tembe by Van Rensburg *et al.* (2000) and during the present study was summed for each survey point within each site. Multivariate community analysis of the absolute bird species abundance data was then made by using PRIMER v 5.2 (Clark & Warwick 1994). Cluster analysis, using group averaging and Bray Curtis similarity measures (Bray & Curtis 1957) was used to examine the relationships between habitat types. Analyses of similarity were used to establish the significance of differences in bird assemblages between and within habitats, and Non-metric multi-dimensional scaling was used to display the relationship between the survey sites in a two-dimensional ordination analysis.

To further describe and compare the bird assemblage that is found in Tshanini with those in Tembe, the degree of variation between the bio-indicator species that were identified for the different habitat types was calculated. Characteristic bird species (indicator species) were identified for each habitat type using the Indicator Value Method (Dufrêne & Legendre 1997). The proportion of species method of Gaston (1994), that defines rare species as the 25% least abundant species in a sample area, were used to identify rare bird species for each habitat type and each study area. For a detailed description of the methods, please refer to the general methods in chapter 3.

RESULTS

During the two study periods (1995 to 1996 and 2002) a total of 11 296 observations were made representing 121 bird species (Appendix 1). Significant differences in species richness (*S*) and abundance (*N*) values were found between the unprotected Tshanini area and the protected Tembe area, both values being higher in the former area (Table 1). As for Tembe (Van Rensburg *et al*. 2000), the species accumulation curve for Tshanini reached an asymptote within the sample size used indicating representative bird data for the area of interest (Figure 9).

Analysis of similarity indicated significant differences in bird assemblages between habitat types within and between study areas (Figure 10). This was also true between study areas within a given habitat type. Of all the possible habitat type

Table 1. Species richness and abundance values of birds surveyed in Tembe Elephant Park and the Tshanini Communal Area, South Africa between May 1995 to April 1996, and between July to December 2002 respectively. Significance was calculated at $P \leq 0.05$.

Site	Mean species richness ± Standard error. ($F_{1,62} = 1.294$, $P < 0.01$)	Mean species abundance ± Standard error. ($F_{1,62} = 7.679$, $P < 0.01$)	Number of sampling sites (*n*)	Total species richness (S)	Total species abundance (*N*)
Tshanini	41.06 ± 1.2	260.03 ± 8.9	32	99	8321
Tembe	31.81 ± 1.1	93.0 ± 3.2	32	96	2975

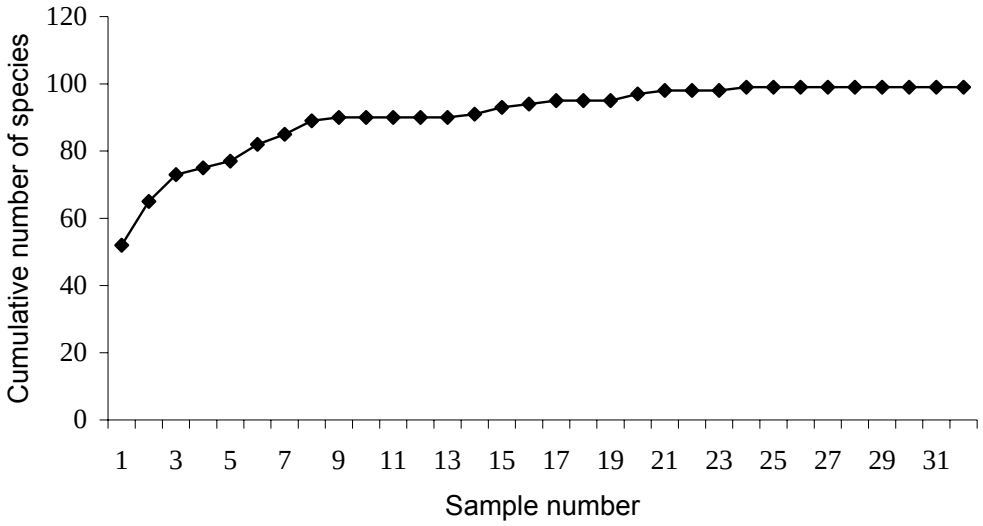
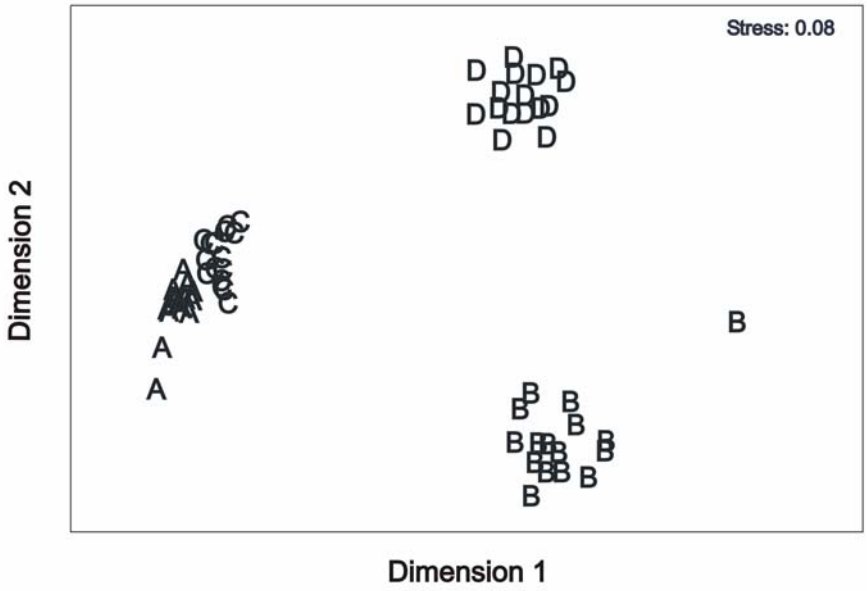


Figure 9. Species accumulation curve for bird assemblages in the Tshanini Community Conservation Area, South Africa from 1 July to 31 December 2002. Each point on the curve represents the mean of five randomly selected survey points from the full data set of survey points.



Tshanini Mixed Woodland	vs	Tembe Mixed Woodland	$R = 0.998$ ($P = 0.001$)
Tshanini Mixed Woodland	vs	Tshanini Sand Forest	$R = 0.782$ ($P = 0.001$)
Tshanini Mixed Woodland	vs	Tembe Sand Forest	$R = 1.000$ ($P = 0.001$)
Tembe Mixed Woodland	vs	Tshanini Sand Forest	$R = 0.995$ ($P = 0.001$)
Tembe Mixed Woodland	vs	Tembe Sand Forest	$R = 0.974$ ($P = 0.001$)
Tshanini Sand Forest	vs	Tembe Sand Forest	$R = 1.000$ ($P = 0.001$)

Figure 10. Non-metric ordination of four habitat sites in the Maputaland Centre of Plant Endemism, South Africa based on multidimensional scaling to indicate the degree of similarity of the abundances of bird species and subspecies in each assemblage where: A = Tshanini Mixed Woodland, B = Tembe Mixed Woodland, C = Tshanini Sand Forest and D = Tembe Sand Forest. The *R* – statistic is a measure of the similarity of assemblages. If *R* is significantly different from zero, then there are significant differences between assemblages. The data were captured between May 1995 and April 1996, and between July and December 2002.

comparisons, the bird assemblages of the Mixed Woodland and Sand Forest habitats in Tshanini showed the lowest degree of dissimilarity. In contrast, bird assemblages showed the highest degree of dissimilarity between Tembe and Tshanini Sand Forest sites and between Tshanini Mixed Woodland and Tembe Sand Forest sites. Clearly, from an avian point of view, these results suggest marked differences between the Tembe and Tshanini avian assemblages, and these differences seem to be more intense within the Sand Forest habitat than in the Mixed Woodland one. The apparent high habitat-associated heterogeneity between the two study areas is also supported by the different levels of habitat specific bird species that occurred consistently within a given habitat type for a particular study area (Table 2). Furthermore, Tshanini had a more even spread of indicator values and more species reaching higher absolute indicator values than Tembe, indicating a larger complex of more characteristic species in Tshanini than in Tembe (Figure 11).

Of the habitat-specific birds, three species and five subspecies are endemic to the Maputaland Centre (Table 2). Of the endemic species, Neergaard's sunbird *Cinnyris neergaardi* (100.0%) and Woodward's batis *Batis fratrum* (84.6%) were indicators of Tembe Sand Forest and the pink-throated twinspot *Hypargos margaritatus* (75.6%) as an indicator of Tembe Mixed Woodland. Neergaard's sunbird was absent from the Tembe Mixed Woodland areas but was relatively abundant in all the other habitat types, reaching its highest densities in the two Sand Forest habitats. Woodward's batis was present in all four of the habitat types but was consistently more abundant in the two Sand Forest ones. The pink-throated twinspot was also present in all four the habitat types but it was more abundant in the Mixed Woodland habitat and rare in the Tshanini Sand Forest (Appendix 1).

Of the endemic subspecies, the brown scrub-robin *Cercotrichas signata tongensis* (96.8%) and southern boubou *Laniarius ferrugineus tongensis* (86.5%) were indicators of the Tembe Sand Forest and the neddicky *Cisticola fulvicapilla lebombo* (87.5%) and white-browed scrub-robin *Cercotrichas leucophrys simulator* (70.0%) of the Tembe Mixed Woodland. The red-fronted tinkerbird *Pogoniulus pusillus niethammeri* (74.0%) was an indicator of the Tshanini Mixed Woodland. The brown scrub-robin was present in all four the habitat types, but it was consistently more abundant in the two Sand Forest ones compared to the Mixed Woodland ones, and it was rare in the Tembe Mixed Woodland. Although present in all four the habitat types, the southern boubou was more abundant in those associated with Tshanini than the Tembe ones. It was not rare in any habitat type but the lowest numbers were found in the Tembe Mixed Woodland.

Table 2. Percentage indicator values (*IndVal* > 70%) of bird species and subspecies for three different study area comparisons in the Maputaland Centre of Plant Endemism, South Africa from 1 July to 31 December 2002. Only significant ($P \leq 0.05$) values were included.

Sand Forest	% IndVal	Mixed Woodland	% IndVal	Combined	% IndVal
TEMBE					
Neergaard's sunbird†	100.0	Blue waxbill	93.8	Black-bellied starling	77.4
Brown scrub-robin‡	96.8	Rattling cisticola	93.8		
Southern boubou‡	86.6	Dark-capped bulbul	91.2		
Woodward's batis†	84.6	Chinspot batis	88.9		
Blue-mantled crested flycatcher	83.7	Southern black tit	88.1		
Eastern nicator	71.1	Neddicky‡	87.5		
		Black-crowned tchagra	78.2		
		Pink-throated twinspot†	75.6		
		Golden-breasted bunting	75.0		
		Brown-crowned tchagra	74.1		
		White-browed scrub-robin‡	70.0		
TSHANINI					
Square-tailed drongo	93.8	Fork-tailed drongo	91.3	Red-eyed dove	99.2
		White-bellied sunbird	85.5	Purple-crested turaco	96.1
		Black-headed oriole	83.7	Orange-breasted bush-shrike	95.5
		Chinspot batis	82.25	Gorgeous bush-shrike	93.9
		Klaas's cuckoo	77.27	Red-chested cuckoo	92.4

Table 2 *continued*

Sand Forest	% IndVal	Mixed Woodland	% IndVal	Combined	% IndVal
		Purple-crested turaco	70.45	African broadbill	83.0
		Yellow-rumped tinkerbird	76.47	Southern boubou	91.8
		Crowned hornbill	74.63	Sombre greenbull	86.0
		Red-fronted tinkerbird‡	74.04	Eastern nicator	84.4
		Cardinal woodpecker	72.79	Barn swallow	84.4
		Crested francolin	71.43	Emerald-spotted wood-dove	83.2
				Black-backed puffback	73.3
				Grey-headed bush-shrike	71.2

† Species and ‡ subspecies endemic to the Maputaland Centre of Plant Endemism.

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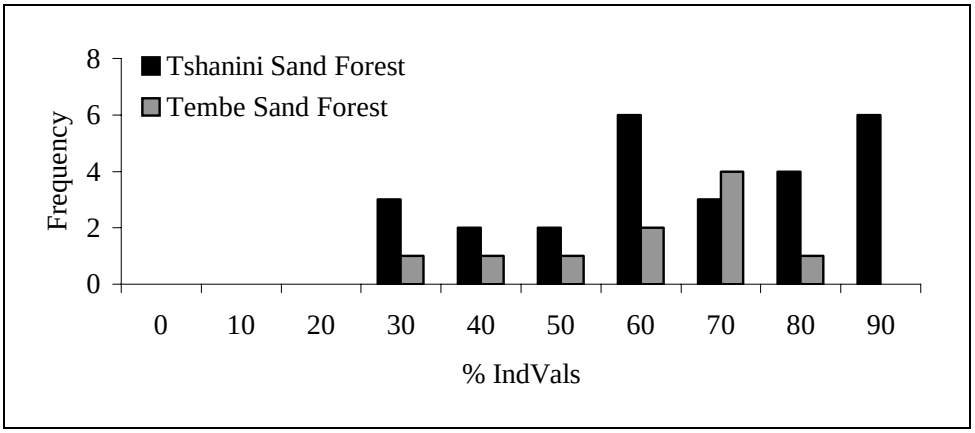

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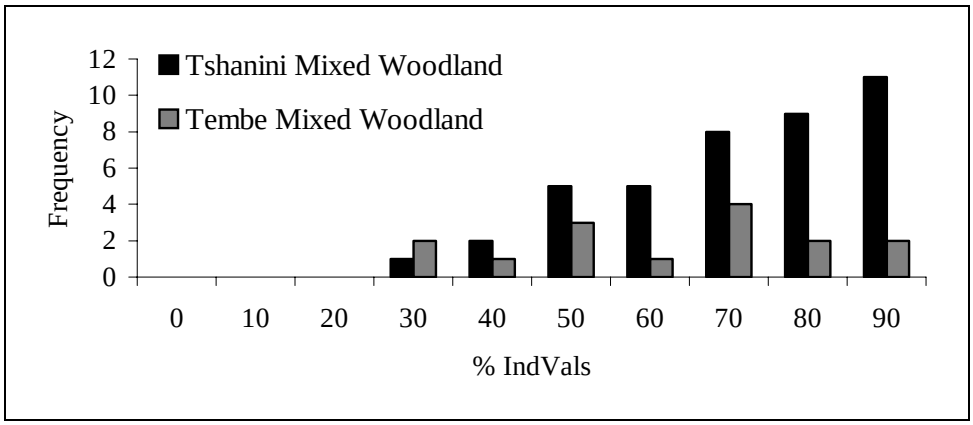

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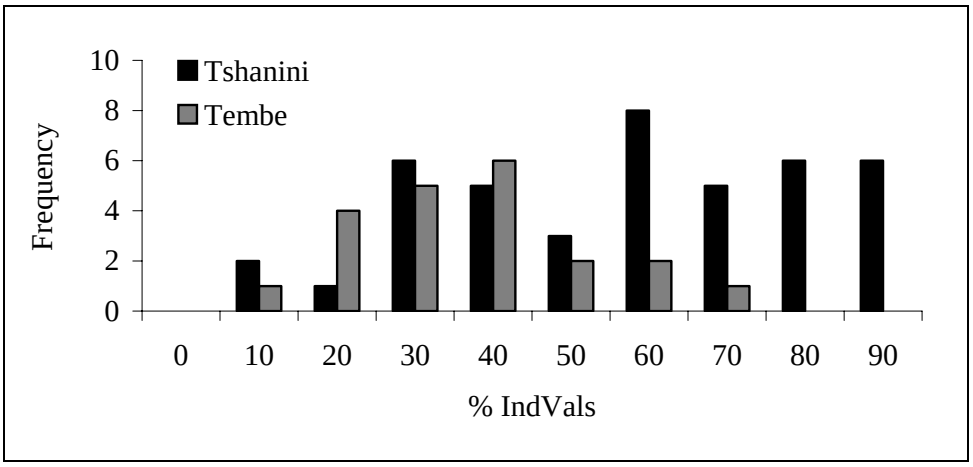

Figure 11. Bird indicator species value distributions for (a) Tshanini Sand Forest versus Tembe Sand Forest, (b) Tshanini Mixed Woodland versus Tembe Mixed Woodland and (c) the entire Tshanini versus the entire Tembe in the Maputaland Centre of Plant Endemism, South Africa. The data were captured between May 1995 and April 1996, and between July and December 2002.

The neddicky was considered rare in the Tshanini Mixed Woodland and was absent from both the Sand Forest habitat types, reaching its highest numbers in the Tembe Mixed Woodland. The white-browed scrub-robin was also present in all four the habitat types and was not considered rare in any one of them. It was, however, consistently more abundant in the Mixed Woodland. The red-fronted tinkerbird was rare in the Tembe Mixed Woodland, was absent from the Tembe Sand Forest, and reached its highest numbers in the Tshanini Mixed Woodland (Appendix 1).

A total of 65 bird species and 5 subspecies were rare in at least one of the habitat types, varying from 17 to 28 species and subspecies per locality (Appendix 1). Of these, 14 species each were restricted to Tshanini and Tembe respectively. None of these rare and restricted species was endemic to the Maputaland Centre, or was identified as an indicator species for any given habitat type within the study area. However, of the 14 species that were considered to be rare and restricted to Tshanini, six were classified as red data species based on Baillie and Groombridge (1996) and Barnes (2000). None of these species was considered rare in South Africa (Harrison *et al*. 1997) and none of the 14 rare and Tembe restricted species was classified as a red data species. The plain-backed sunbird *Anthreptes reichenowi* is, however, rare in South Africa (Harrison *et al.* 1997).

Of the 51 species or subspecies considered to be common in this study area, 11 and 8 of the species were restricted to Tshanini and Tembe, respectively. Of these 51 species or subspecies, none was endemic to the Maputaland Centre or rare in South Africa. The blue waxbill *Uraeginthus angolensis* (93.8% IndVal) was an indicator species for the Tembe Mixed Woodland, the barn swallow *Hirundo rustica* (84.4% IndVal) for the Tshanini habitat as a whole and Klaas's cuckoo *Chrysococcyx klaas* (77.3% IndVal) for the Tshanini Mixed Woodland. Of the species considered common and restricted to Tshanini, only the African goshawk *Accipiter tachiro* was classified as a red data species (Baillie & Groombridge 1996; Barnes 2000). None of the eight common species that were restricted to Tembe was classified as a red data species.

DISCUSSION

This study demonstrated the biological importance of the Tshanini Community Conservation Area to further Sand Forest conservation, especially from an avian perspective. When compared with Tembe, Tshanini contained an unique avian Sand Forest assemblage that is often characterised by more characteristic species and subspecies that shows higher abundance and higher area fidelity values. Moreover, when compared to the different habitat comparisons, reliable indicator species and

subspecies were identified at the study area scale after comparing Tshanini with Tembe as a whole. Because the two study areas were sampled in different years (1995/96 and 2002), a component (albeit probably small) of the differences between study areas may have been due to temporal variation in populations and communities.

Differences in local avian assemblages, especially those in forests, are often a function of the physical structure of a plant community, showing how the foliage is distributed vertically, as opposed to the actual composition of plant species (Rotenberry & Wiens 1980; Van Rensburg *et al.* 2000). In a recent study by Gaugris *et al.* (2004), comparisons were made between the plant communities of Tshanini and similar vegetation units in Tembe. Although their results indicated a high degree of floristic similarity between the two areas, values representing plant physiognomy showed significant differences. For example, within the Sand Forest habitat the vegetation community in Tshanini had a significantly higher mean cover value per species than its equivalent in Tembe. Such structural differences in the vegetation between the two areas most likely contributed most towards the observed differences found in the Sand Forest avian assemblages (see also Van Rensburg *et al.* 2000).

Owing to the high degree of biological heterogeneity in the Maputaland Centre, previous studies recommended that a comprehensive representation of different Sand Forest patches be incorporated into the region's conservation network. Most of these recommendations were based on studies that were done in the region during the late 1990's (e.g.: Van Rensburg *et al.* 1999, 2000; Matthews *et al.* 2001; McGeoch *et al.* 2002). Nevertheless, when comparing the conservation network in South Africa in 1997 (World Conservation Monitoring Centre 1997) with that of 2004 (WDPA Consortium 2004), no additional reserves containing pure Sand Forest plant communities have been added since 1997. This is true regardless of the more than 155 000 ha of land that has been added to the terrestrial protected-area system in South Africa from 1994 to 2002 (Wynberg 2002).

In a complex endemic zone like the Maputaland Centre, one can expect to find a large number of range-restricted species (Poynton 1961). Because these species are part of those most effected by anthropogenic activities, and therefore of most conservation concern (Balmford *et al.* 2001), emphasis should be placed on the extent to which current and future conservation areas within the Maputaland Centre contribute towards conserving endemic species. Indeed, in a recent study on the effectiveness of the global protected area network in representing species diversity, it was indicated that the areas most in need of conservation are often those with high levels of endemism (Rodriques *et al.* 2004). This was true even for endemic areas

where the conservation network already captured a large percentage of the land surface area. This conclusion raises the question of Tshanini's value to enhance the conservation of endemic species. Although the majority of bird species and subspecies that are endemic to the Maputaland Centre achieve their greatest abundance within Tembe when compared with Tshanini, none of these species or subspecies was restricted to Tembe. Moreover, one of these, the red-fronted tinker barbet, was identified as being reliably habitat specific for the Tshanini Mixed Woodland (Table 2). Tshanini can therefore contribute towards the conservation of endemic species and subspecies being represented in as many as possible areas, an important feature for the long-term persistence of wildlife, particularly those with strict habitat requirements (Rodriques *et al.* 2004). Because 43% of the avian species or subspecies that were only recorded in Tshanini are also red data species or subspecies (Baillie & Groombridge 1996; Barnes 2000), Tshanini will further regional conservation efforts and contribute towards national ones.

As is the case in most countries, conservation: human conflicts will likely escalate in southern Africa in the future. Therefore an integrated approach incorporating both conservation and human development needs is required. Such an approach should emphasise the value of existing conservation areas and view parks as a central component of conservation strategies (Bruner *et al.* 2001; McKinney 2002), from which to promote the sustainable development of rural communal areas surrounding these sites (Editorial 2003), while establishing buffer zones around protected areas. Since the eradication of poverty is an indispensable requirement for sustainable development (UNDP 2003), the alleviation of poverty in areas surrounding protected areas will contribute largely towards the required future integrated approach. The present study has shown that the Tshanini Community Conservation Area not only has the potential to contribute significantly towards biodiversity conservation, but that it will also serve as an example for conservation-based community development in South Africa. It is one of the first reserves of its kind to be established in a ward of a tribal area in the northern parts of the KwaZulu-Natal province of South Africa through the initiative taken by the local people themselves. This is a huge step forward for conservation in South Africa, given the current negative attitude of the rural people towards conservation. However, the success of such ventures will require structures to promote initiatives that will support their establishment and maintain their long-term sustainability. We can ill afford to lose any chance to promote conservation in South Africa where the highest known concentration of threatened plants and the highest extinction estimates for any area in the world are found (Wynberg 2002).

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Appendix 1. The total number of individual birds, bird species and subspecies recorded in the Tembe Elephant Park and the Tshanini Community Conservation Area Sand Forest and Mixed Woodland habitats. Bold values denote rare species or subspecies, defined as the 25% least-abundant birds in each of the four habitat types. SUM *r* = sum of the habitat types in which a species or subspecies was classified as rare.

			Mixed Woodland		Sand Forest	
Common name	Scientific name	Sum *r*	Tshanini	Tembe	Tshanini	Tembe
Taxa rare in one or more habitats						
African crowned eagle	*Stephanoaetus coronatus* §	1	1	0	0	0
African dusky flycatcher	*Muscicapa adusta*	2	2	5	1	0
African green-pigeon	*Treron calvus*	1	15	6	1	0
African hoopoe	*Upupa Africana*	1	1	0	0	0
African paradise flycatcher	*Terpsiphone viridis*	3	3	2	0	1
African yellow white-eye	*Zosterops senegalensis*	3	1	2	1	0
Amethyst sunbird	*Chalcomitra amethystine*	2	3	1	0	0
Ashy flycatcher	*Muscicapa caerulescens*	3	2	2	0	1
Bearded scrub-robin	*Cercotrichas quadrivirgata wilsoni* ‡	1	13	3	22	3
Black kite	*Milvus migrans* §	1	0	0	3	0
Black-chested snake-eagle	*Circaetus pectoralis* §	1	1	0	0	0
Black-crowned tchagra	*Tchagra senegalus*	1	4	26	6	1
Blue-mantled crested flycatcher	*Trochocercus cyanomelas*	1	1	6	17	50
Brimstone canary	*Serinus sulphuratus*	1	1	0	0	0
Brown scrub-robin	*Cercotrichas signata tongensis*‡	1	5	3	28	90
Brown-hooded kingfisher	*Halcyon albiventris*	2	2	11	0	1
Brubru	*Nilaus afer*	2	24	1	7	1
Cardinal woodpecker	*Dendropicos fuscescens*	1	43	9	5	1
Collared sunbird	*Hedydipna collaris*	1	5	15	2	5
Crested francolin	*Peliperdix sephaena*	1	60	4	24	1
Crested guineafowl	*Guttera edouardi*	2	2	2	9	7
Diederick cuckoo	*Chrysococcyx caprius*	1	1	0	0	0
Eastern olive sunbird	*Cyanomitra olivacea*	2	2	1	0	0
European bee-eater	*Merops apiaster*	2	2	0	1	0
Fiscal flycatcher	*Sigelus silens*	1	0	2	0	2
Fork-tailed drongo	*Dicrurus adsimilis*	1	136	2	13	0
Golden-breasted bunting	*Emberiza flaviventris*	1	1	21	0	0
Gorgeous bush-shrike	*Telophorus quadricolor*	1	174	3	229	23
Greater honeyguide	*Indicator indicator*	1	1	4	0	0
Green twinspot	*Mandingoa nitidula*	1	0	1	0	0
Green-winged pytilia	*Pytilia melba*	1	0	3	0	0
Grey sunbird	*Cyanomitra veroxii*	2	3	17	3	38
Grey waxbill	*Estrilda perreini*	1	0	0	1	0
Grey-headed bush-shrike	*Malaconotus blanchoti*	1	29	1	22	4
Hadeda ibis	*Bostrychia hagedash*	2	19	0	3	1
Jacobin cuckoo	*Oxylophus jacobinus*	1	1	0	0	0
Kurrichane thrush	*Turdus libonyanus*	1	16	0	1	4
Levaillant's cuckoo	*Oxylophus levaillantii*	1	0	0	0	1

Appendix 1 *continued*

Common name	Scientific name	Sum *r*	Mixed Woodland		Sand Forest	
			Tshanini	Tembe	Tshanini	Tembe
Martial eagle	*Polemaetus bellicosus*§	2	1	0	1	0
Narina trogon	*Apaloderma narina*	1	11	3	24	14
Neddicky	*Cisticola fulvicapilla lebombo* ‡	1	1	29	0	0
Orange-breasted bush-shrike	*Telophorus sulfureopectus*	1	227	16	135	1
Pale flycatcher	*Bradornis pallidus sibilans* ‡	2	6	3	1	0
Pink-throated twinspot	*Hypargos margaritatus* †	1	8	38	2	6
Plain-backed sunbird	*Anthreptes reichenowi*	1	0	0	0	1
Purple-banded sunbird	*Cinnyris bifasciatus*	1	14	18	3	21
Purple-crested turaco	*Musophaga porphyreolopha*	1	174	9	73	1
Red-eyed dove	*Streptopelia semitorquata*	1	285	1	210	3
Red-faced cisticola	*Cisticola erythrops*	1	0	2	0	0
Red-faced mousebird	*Urocolius indicus*	2	3	0	2	0
Red-fronted tinkerbird	*Pogoniulus pusillus niethammeri* ‡	1	33	1	6	0
Retz's helmet-shrike	*Prionops retzii*	2	3	9	1	11
Rudd's apalis	*Apalis ruddi* †	1	6	10	1	2
Rufous-naped lark	*Mirafra Africana*	1	0	3	0	0
Rufous-winged cisticola	*Cisticola galactotes*	1	0	3	0	0
Sabota lark	*Calendulauda sabota*	1	0	9	0	1
Southern black flycatcher	*Melaenornis pammelaina*	2	0	3	1	0
Steppe buzzard	*Buteo vulpinus* §	2	1	0	1	0
Striped kingfisher	*Halcyon chelicuti*	1	0	1	0	0
Tambourine dove	*Turtur tympanistria*	1	0	0	2	15
Tawny-flanked prinia	*Prinia subflava*	1	14	22	0	1
Violet-backed starling	*Cinnyricinclus leucogaster*	1	2	0	5	0
White-starred robin	*Pogonocichla stellata*	2	0	1	0	1
White-throated robin-chat	*Cossypha humeralis*	3	0	2	1	1
Yellow-bellied eremomela	*Eremomela icteropygialis*	1	0	1	0	0
Yellow-fronted canary	*Serinus mozambicus*	2	1	18	1	0
Yellow-rumped tinkerbird	*Pogoniulus bilineatus*	1	48	4	3	2
Zitting cisticola	*Cisticola juncidis*	1	0	5	0	1
Taxa common in all habitats recorded						
African broadbill	*Smithornis capensis*		56	0	76	22
African emerald cuckoo	*Chrysococcyx cupreus*		28	0	23	0
African goshawk	*Accipiter tachiro* §		7	0	7	0
Barn swallow	*Hirundo rustica*		55	0	39	0
Bearded woodpecker	*Dendropicos namaquus*		5	0	0	0
Black cuckoo	*Cuculus clamosus*		31	0	8	0
Black cuckooshrike	*Campephaga flava*		14	0	0	4
Black-backed puffback	*Dryoscopus cubla*		227	80	207	78
Black-bellied starling	*Lamprotornis corruscus*		0	29	10	82
Black-collared barbet	*Lybius torquatus*		17	0	0	0
Black-headed oriole	*Oriolus larvatus*		82	14	16	14
Blue waxbill	*Uraeginthus angolensis*		0	36	0	0
Brown-crowned tchagra	*Tchagra australis*		24	31	14	3
Burchell's coucal	*Centropus burchelli*		37	0	10	0

Appendix 1 *continued*

Common name	Scientific name	Sum *r*	Mixed Woodland		Sand Forest	
			Tshanini	Tembe	Tshanini	Tembe
Cape turtle-dove	*Streptopelia capicola*		16	18	0	21
Cape white-eye	*Zosterops capensis*		0	0	0	2
Chinspot batis	*Batis molitor molitor*		139	55	30	3
Croaking cisticola	*Cisticola natalensis*		0	4	0	0
Crowned hornbill	*Tockus alboterminatus*		50	20	17	14
Dark-backed weaver	*Ploceus bicolor sclateri* ‡		105	35	131	70
Dark-capped bulbul	*Pycnonotus tricolour*		242	83	106	8
Grey tit-flycatcher	*Myioparus plumbeus*		0	7	0	0
Jameson's firefinch	*Lagonosticta rhodopareia*		0	4	0	0
Klaas's cuckoo	*Chrysococcyx klaas*		68	0	20	0
Long-billed crombec	*Sylvietta rufescens*		39	6	4	0
Marico sunbird	*Cinnyris mariquensis*		4	0	0	0
Neergaard's sunbird	*Cinnyris neergaardi* †		23	0	29	82
Rattling cisticola	*Cisticola chiniana*		24	112	4	0
Red-capped robin-chat	*Cossypha natalensis*		17	8	19	11
Red-chested cuckoo	*Cuculus solitarius*		110	5	170	18
Scaly-throated honeyguide	*Indicator variegates*		30	0	20	18
Sombre greenbull	*Andropadus importunes*		369	67	288	40
Southern black tit	*Parus niger*		13	31	6	2
Southern boubou	*Laniarius ferrugineus tongensis* ‡		366	5	365	60
Speckled mousebird	*Colius striatus*		4	0	0	0
Spectacled weaver	*Ploceus ocularis*		7	0	0	0
Square-tailed drongo	*Dicrurus ludwigii*		0	71	101	109
Terrestrial brownbull	*Phyllastrephus terrestris*		30	57	34	62
White-bellied sunbird	*Cinnyris talatala*		134	8	13	0
White-browed robin-chat	*Cossypha heuglini*		0	0	0	3
White-browed scrub-robin	*Cercotrichas leucophrys simulator* ‡		29	32	16	8
White-crested helmet-shrike	*Prionops plumatus*		0	5	0	0
Woodward's batis	*Batis fratrum* †		4	5	10	46
Yellow-bellied greenbull	*Chlorocichla flaviventris*		329	58	286	132
Yellow-breasted apalis	*Apalis flavida*		161	101	167	129
Species richness			**92**	**85**	**76**	**66**
Total number of individuals			**4805**	**1492**	**3516**	**1483**

† Species and ‡ subspecies endemic to the Maputaland Centre of Plant Endemism.

§ Red data species or subspecies restricted to a given study area.