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Conservation, commercialisation and confusion: harvesting of *Ischyrolepis* in a coastal forest, South Africa

Charlie M. Shackleton · Fiona Parkin · Maphambe I. Chauke · Linda Downsborough · Ashleigh Olsen · Gregg Brill · Craig Weideman

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Abstract Harvesting of non-timber forest products is an integral component of rural livelihoods throughout the developing world. At times this is at odds with conservation objectives. Reconciliation of the two requires examination of local level contexts and needs. This paper reports on the harvesting needs for *Ischyrolepis* by a rural community in South Africa, against the setting that they had recently been prohibited from harvesting by the local conservation officials. Interviews were conducted with conservation officials to understand the reasoning for the prohibition. Local demand for *Ischyrolepis* was assessed by household surveys, as well as in-depth interviews with traders. The density and size class distribution of *Ischyrolepis* was determined using transects. The total annual demand for *Ischyrolepis* was determined to be approximately only 2.7% of the standing crop. The bulk of the annual demand was for small-scale trade, the income from which was a primary source of income for the few harvesters. Very little evidence could be found indicating that harvesting was damaging the resource or its habitat, and local knowledge suggested that the abundance of the species was stimulated by harvesting. Even if market demand were to increase, the size of the shoots required means that less than 20% of the standing crop could be harvested annually. Current regulations around harvesting are in a state of revision, and hence confusion prevails regarding if harvesting is permissible, and if so, under what conditions, which is detrimental to both conservation and livelihoods.

Keywords Demand · Harvesting · Income · *Ischyrolepis* · Regulations · Supply · Sustainability

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C. M. Shackleton (✉) · F. Parkin · M. I. Chauke · L. Downsborough · A. Olsen · G. Brill · C. Weideman
Department of Environmental Science, Rhodes University, Grahamstown 6140, South Africa
e-mail: c.Shackleton@ru.ac.za

1 Introduction

The use and commercialisation of natural resources, specifically non-timber forest products (NTFPs), by rural households is an important livelihood strategy throughout the developing world (Kusters and Belcher 2004; Sunderland and Ndoye 2004), especially in underdeveloped areas where people are economically vulnerable and governments have been unable to provide even the most basic services. Consequently, the primary actors in the production and trade of NTFPs are frequently women and the most vulnerable sectors of rural society, who may have little or no alternatives for income generation (Shackleton and Shackleton 2004). From this perspective, NTFPs represent an important point of entry into the cash economy for the most marginalized (Rogerson 2000; Arnold and Ruiz Perez 2001).

Whilst the benefits of NTFP extraction have been found to be considerable for many rural households, the extraction of NTFPs poses numerous conservation challenges, not least of which being that there is minimal information on sustainable harvest levels for the vast majority of species (Cunningham 2001; Ticktin 2004; Emanuel et al. 2005). On the one hand governments and development agencies seek to stimulate the use of and markets for NTFPs as a means of economic upliftment in poor, remote areas. This frequently parallels the efforts being made to promote initiatives to decentralize management and authority over resources to local communities rather than State officials, as was the case in the past (Fabricius 2004). On the other hand, forestry and conservation agencies seek to limit extraction rates, often using prescriptive, preservationist approaches (Fabricius 2004), to minimize the negative impacts to the species in question as well as the natural systems from which many such species are harvested. Finding the middle ground, which allows for both subsistence and commercial use of NTFPs without undermining conservation needs, is a subject that has spawned much research and management models (Crook and Clapp 1998; Magome and Fabricius 2004). It is also argued that capturing the direct economic benefits gained through the use of NTFPs may be a contributory incentive for communities to conserve the species and/or habitats in question (Shackleton 2001). However, it seems there are few generalities, and therefore sustainable harvesting incentives and practices within a commercialisation paradigm are both resource specific as well as spatially and temporally variable (Shackleton 2001). Consequently, considerable local level contextual information is required.

The interplay between conservation needs and natural resource use is most acute when dealing with the commercial use of a resource, especially by poor, rural communities (Emanuel et al. 2005; Shackleton and Shackleton 2005). Large changes in resource supply, demand or external contexts can have severe impacts on local livelihoods, as they are extremely vulnerable to shocks and changes (Glewwe and Hall 1998; Campbell et al. 2002). Typical dynamics might be alterations in the economic sphere through changes in market demand, prices or competition. Fluctuations in the macro context, such as currency devaluation, increases in the price of staple foods, or increasing unemployment may all drive more people to trading in NTFPs (Campbell et al. 2002; Shackleton 2005). On the resource supply side, significant changes may be a decline in a specific NTFP due to overharvesting, unfavourable climatic or disease conditions, or restrictions on access or quotas on amounts harvested. Because such changes can undermine already vulnerable livelihoods, it is necessary that they be implemented, as far as is possible, in consultation with local communities and with sensitivity to local livelihood needs.

Within the context of the above, this study sought to examine the role and potential sustainability of the harvesting of a locally traded NTFP species in the Eastern Cape, South

Africa. The Eastern Cape is the poorest of South Africa's nine provinces (StatsSA 2005) characterized by high unemployment and economic stagnation, especially in the rural areas. As such, the use and commercialisation of NTFPs is especially significant to rural livelihoods in the region (Shackleton et al. 2002; Cocks and Wiersum 2003). Fibre based NTFPs are particularly attractive as marketed goods (Guillarmod 1980; Cocks and Dold 2004; Gyan and Shackleton 2005; Pereira et al. 2006) because they fulfill several purposes (utilitarian, cultural and decorative) and so have a broader client base. More specifically, this case study was investigated because the local community had been restricted from harvesting the NTFP in question. A local Cape reed, *Ischyrolepis eleocharis* (locally called umtshayelo) has been harvested for decades by residents of the village Tharfield to make hand brooms. These brooms are used by the local villagers in their own homesteads, are sold in a nearby town and have also been found to have a cultural significance and are commonly presented as wedding gifts (Cocks and Dold 2004).

Ischyrolepis eleocharis is a perennial rush or sedge-like herb of the family Restionaceae (Leistner 2000). It constitutes one of 49 species of *Ischyrolepis*, which occur largely in the Western Cape and Northern Cape (Namaqualand), with some reaching the Eastern Cape, Lesotho, KwaZulu- Natal and Mpumalanga (Low and Rebelo 1996). Within the study area it occurs commonly on the coastal dunes running parallel to the coast. It has a rhizomatous habit, with rhizomes occurring at depths of between 5 cm and 20 cm under the sand and with a single, narrow (1–3 mm), branched vertical shoot every several centimeters. These shoots can reach to up to 80 cm tall, but most are less than 50 cm. These shoots carry florets for sexual propagation. The distance between vertical shoots is a lot less in open areas than in areas under the forest canopy (see Results).

In light of the above, this paper examines the extent to which residents of an Eastern Cape rural community, Tharfield, depend on *Ischyrolepis eleocharis* (Mast.) H.P. Linder (specimen lodged at Selmar Schonland Herbarium) for the production and sale of brooms as a livelihood strategy. It seeks to clarify the perceptions of sustainability of resource use and dependence and the actual ecological sustainability of the resource. The issue of sustainability has been raised by conservation officials who recently halted the harvesting of *I. eleocharis*, on the assumption that the harvesting of this species for the local broom industry is unsustainable and causing ecological damage to the dune environment. This opinion contradicts that of the resource harvesters who feel that their actions are beneficial to the species and its growth, whilst simultaneously contributing to their livelihoods. Current legislation (National Environmental Management Act 1998; Biodiversity Act 2004) in South Africa for conservation of indigenous species is strong, but simultaneously makes provision for harvesting and sustainable use of species (Government of SA 1998, 2004).

2 Study area

The study site was Tharfield village (27°16′ E; 33°23.2′ S) and the coastal forest to the east. Originally designated for farm labourers on white-owned farms under the former apartheid government, the village of Tharfield fell under the control of the Ciskei government with the formation of the Ciskei homeland in the 1970s. These lands were taken over by the Ciskei 'government' and allocated to black African families. After the demise of the apartheid regime in the early 1990s the area was reincorporated into South Africa. Currently there are approximately 95 households. Local residents engage in a diverse range of livelihood strategies to make ends meet, including migrant labour to nearby and regional

urban centres, arable and livestock agriculture and natural resource harvesting from the adjacent coastal forest. Households also rely on State grants such as old-age pensions, welfare, child-care and disability grants. The majority of the households have cash incomes well below the national poverty line. There is a primary school and a clinic in the village as well as potable, piped water and electricity.

Residents collect numerous resources from the surrounding areas, including medicinal plants, fodder for livestock, fuelwood, edible herbs and fruits, and the like. The landscape immediately adjacent to the village is an agrarian one with open fields and grazing lands. Approximately 5 km to the east lies the Bathurst State Forest. This coastal forest on the hind dunes parallel to the Indian Ocean covers an area approximately 5 km long (between the Mgwalana and Bira estuaries) and 0.6 km wide, i.e. 300 ha. It is associated with established coastal dunes, intergrading into grasslands and savanna on the leeward side. The area falls under the Coastal Forest vegetation type defined by Low and Rebelo (1996). Dominant tree species are *Mimusops caffra*, *Euclea natalensis*, *Pterocelastrus tricuspidatus*, *Mystroxylon aethiopica*, *Apodytes dimidiata*, *Scutia myrtina*, and a variety of *Rhus* species. The mean canopy height is between five and seven metres. Mean annual rainfall is approximately 750 mm, with about 60% received in the summer months between October and April. Temperatures are mild due to the proximity of the Indian Ocean.

3 Methods

Data collection comprised three components; namely (i) interviews with officials regarding harvesting regulations, (ii) the estimation of demand for *I. eleocharis*, and (iii) an inventory of its local abundance. With respect to harvesting regulations, interviews were undertaken with relevant officials regarding local regulations and the reasons for preventing the harvesting of *I. eleocharis*. Three interviews were conducted, one with the local field rangers responsible for enforcing harvesting bans on the ground, another with the area manager in the district office, and thirdly one with the provincial policy unit advising government departments. Each interview was unstructured and open-ended, with the intention of capturing perspectives and interpretations of local regulations and reasons why the ban on harvesting had been introduced.

Demand was assessed through a series of interviews conducted with specific stakeholders. Firstly, a survey of the general use of *I. eleocharis* was conducted with 23 randomly selected households within Tharfield village. The survey was conducted in the local language, isiXhosa, and captured details of whether or not the household used *I. eleocharis* brooms, if so where they obtained the material and how many brooms they use per month. Secondly, all people in the village who made and sold *I. eleocharis* brooms for income (9) were identified and interviewed. These interviews inquired about the source of their material, local knowledge of its distribution and response to harvesting, how many brooms the traders sold per month, the costs and time associated with making the brooms, and the importance of that income in relation to their overall livelihood incomes.

With respect to resource abundance, harvesters were accompanied to the collection sites where they demonstrated the overall area of collection, the type of material collected and their harvesting techniques. Thereafter, 35 randomly located line transects were sampled to estimate the density of *I. eleocharis* within the forest. Each line transect comprised 10 quadrats of 1 m^2, placed 10 m apart. Within each 1 m^2 quadrat the number of *I. eleocharis* shoots were counted and the height of the shoot closest to the bottom left-hand corner of the quadrat was measured (for those quadrats with shoots present (n = 168)). Additional

measurements included (i) a visual estimation of the proportion (%) of the ground area of each quadrat covered by grass, plant litter or bare ground, (ii) the number of paths encountered along the transect as an index of disturbance, and (iii) whether or not the quadrat was in the shade or the open. This last measure was included because during the pilot visit with harvesters it was apparent that *I. eleocharis* was more abundant in open patches than in forest shade, and secondly the harvesters said that they preferred to harvest in the shade of the forest as the shoots were too short in the open patches. These open patches were a regular feature of the landscape, especially towards the crests of the dunes, ranging in size from less than 10 m^2 to perhaps 150 m^2. They were associated with relatively few trees, higher grass cover and more exposed sand than in the forest itself. The origin of these gaps was not investigated, but in some instances they were clearly associated with the death of a large canopy dominant tree. Examination of aerial photographs of the area indicated these patches to be a common feature along the coast even in areas not prone to harvesting.

Five brooms were purchased from traders within the village and then disaggregated to count the number of *I. eleocharis* shoots per broom. Forty shoots were randomly selected from the five brooms and the length of each was measured. For many of the shoots it was evident that when harvested they had been broken off from the underground rhizome. The bottom end of the shoot was a dark brown as opposed to the pale green of the above ground portion. In this situation we measured only the aboveground length of the shoot so that the measurements could be compared to those obtained in the forest quadrats. Estimating the number of shoots per broom allowed comparison of supply and demand using number of shoots as the common unit.

Each data set was collated into a spreadsheet and then imported for statistical analysis. Differences in plant attributes and density were tested using a parametric *T*-test or a Kruskal–Wallis non-parametric test in situations where the data were not normally distributed. The relationship between plant height and density was examined by correlation. The Rand to US dollar exchange rate at the time of the field work was approximately R6.40 = 1 US dollar.

4 Results

4.1 Harvesting regulations

The conservation field rangers confirmed that a ban had been imposed on the harvesting of *I. eleocharis* approximately 14 months ago. This was because they had observed that much of the harvesting was for commercial purposes and felt that the indigenous forest needed protection from over use. They felt that the commercial demand would definitely result in serious damage to both the resource and the forest in general. In particular, the dune system was regarded as sensitive, and once the substrate was exposed through either trampling, paths or over-harvesting, it was prone to wind and water erosion making re-establishment difficult. They considered the open patches on the dunes to be a consequence of this. They stated that they had informed harvesters verbally of the prohibition on harvesting unless a harvester first applied for a permit, and that harvesting was permitted for domestic use only (still requiring the said permit). When asked on the conditions for issuing permits, the price and the location where permits were issued, the field rangers responded that the permits were not yet in force and the system was still being developed, and consequently no harvesting was allowed until the permit system was in place. No data or information was

available to them that indicated that the resource was being over-harvested and negatively affected.

At the regional office, conservation officials were aware of the prohibition, but were not informed of the reasons for the ban and the promulgated regulations under which it had been imposed. Seemingly the provincial legislative Act that should control such harvesting is under revision. Under the old Act (of 1987), which is presumably in force until the new revisions are passed, *I. eleocharis* is not a protected species, and there are no specific regulations governing it being harvested. The National Forests Act (1998) does have such provisions, but the ownership status of the land is unclear, and hence whether or not the National Forest Act (1998) applies. Apparently the whole coastal strip was a recognised State forest, and was conserved as such up until the early 1970s, where after it was incorporated into the then Ciskei homeland. Under the Ciskei government people had access to the resources in the forest however, with the demise of the Ciskei homeland in the early 1990s with the democratic transition in South Africa, the situation changed. Some regulations remain in force whilst others have been replaced by new provincial legislation. In light of all this uncertainty, the regional officials felt that it was unlikely that the ban on harvesting was backed by any formal regulations, until the new Eastern Cape Environmental Conservation Act come into being, as well as a new conservation body, the Eastern Cape Parks Board. They anticipated that the new Act will differentiate between commercial and subsistence use. The department has developed a set of operational guidelines on the commercial use of indigenous plants, which favour the discouragement or prohibition of harvesting for commercial purposes, however these are not enforceable by law. The national legislation covers protection of species but allows harvesting from State lands with an approved permit (Government of SA 199 2004). In some areas traditional leaders have a strong role to play in issuing permits for harvesting of some resource, but this does not apply at Tharfield

The advisors in the project management unit supported the statements made by the regional conservation officials and confirmed that provincial legislative provisions were in a state of change. Furthermore they indicated that conservation authorities were keen to use the powers that they assumed were going to be conferred upon them in the spirit of conserving the biological resources of the province. It was anticipated that the harvesting of biological resources for commercial purposes would require a full environmental impact assessment before a permit would be granted. In terms of the expected revisions the permit requirements and policing of domestic harvesting was unclear, as was perhaps the role of commercial harvesting by small-scale enterprises of one or two individuals earning relatively meager incomes from local markets.

4.2 Demand for and value of *I. eleocharis*

All households interviewed made use of *I. eleocharis* brooms with several households having more than one broom at a time. The longevity of the brooms was reported to be 8.2 ± 0.9 months, meaning each household used, on average, 1.5 brooms per year. All households reported using the brooms for sweeping inside the house, and one reported using brooms for cultural purposes. Other reported uses in the village as a whole included offering the brooms as wedding gifts, and using them to spread traditional medicine for charms around the homestead. Two-thirds of the households purchased their brooms from traders within Tharfield village itself, and the other one-third made their own. Of those that purchased their brooms, 70% said that the price per broom was R6.00, the rest said the

price was R5.00. Thus, the mean price was taken as R5.69 ± 0.13 per broom. The mean number of shoots per broom was 220.4 ± 21.8, ranging between 174 and 286. The mean length per shoot in the brooms was 45.0 ± 1.84 cm, ranging between 30 cm and 69 cm. When extrapolating to the village level, the domestic requirements for *I.eleocharis* brooms are approximately 143 brooms per year, with a direct use value of R814. This requires approximately 31,517 shoots per year, or a maximum of 40,900 shoots if the maximum number of shoots per broom is used.

The local demand for brooms was supplied by nine traders, some of whom also sold brooms at the closest small town of Peddie, approximately 40 km away. All the traders were women of middle age; the youngest being 43 years old and the oldest, 65 years. Most had learnt to make brooms from their mothers, but a few had learnt from a neighbour. On average, the traders had been selling brooms for 17 years (16.6 ± 5.3), although a few members have been trading for as long as 35 years. Two-thirds of the traders were heads of their households. Mean household size was 4.4 ± 0.4 people. Despite most of them being the household head, four of the nine had no schooling. Across all nine, the mean number of years schooling was 3.1 ± 1.1. Only one trader was employed (as a domestic helper), whilst the rest relied upon State grants and income from the sale of crafts such as brooms and reed mats. Overall, three of the trading households received a wage income from at least one family member, two received State old-age pensions and six received State child grants. Three of the nine reported that the cash earned from brooms and other NTFP products was the primary source of income for the household, and two reported such incomes as of equal importance with other income sources.

In terms of harvesting, *I. eleocharis* is harvested on almost a weekly basis (4.2 ± 0.8 times per month), although some traders harvest twice weekly. The average head-load weighs 30–45 kg (fresh mass), and each trader would collect one head-load per trip. Each trip took most of the day (9.0 ± 0.8 h), including walking to and from the forest. Respondents stated that one head-load was sufficient to make 10.7 ± 1.9 brooms. Only 85% of the brooms made were sold, as some were used at home, or given away to family and friends. The gross annual income per trader was calculated as R2,418 ± 481, ranging between R1,152 and R5,184. The total number of brooms made by the nine traders was 4,863 per year, representing between 1.07 million and 1.39 million *I. eleocharis* shoots, for the mean and maximum number of shoots per broom, respectively.

The direct costs (other than labour) associated with broom making were small, although they did influence the profit made by the traders. No equipment was required to harvest the *I. eleocharis* shoots, as they were pulled by hand. Twine for the brooms was sourced locally or in town and represented a cost of R0.61 ± 0.20 per broom. Only two of the traders sold brooms outside the village, so most had no transport costs. For the two who traded in town, the cost of getting the brooms to market averaged R13.00 per trip. The selling price was not better in the local towns, but these two traders combined their trips with their personal shopping (and often also visited relatives), thus saving themselves the costs of a trip for ordinary household shopping. Consequently, only half the transport cost is attributable to the costs of trading. Based on this, direct costs were about 15% of gross income.

The time taken to make a broom varied considerably depending upon how it was tied at the top and the degree of decoration. Thus, a basic, functional broom could be produced in less than 30 min if required. The average time required was two hours, but could be as long as 8 h if accompanied with extensive decoration and trimming. The time for marketing was negligible for those who sold in the village as customers came to them, rather than the other way round. Even those who sold brooms in the local town said that they generally

sold all their stock the same day and had time for shopping. They also sold in their own village. Thus, excluding marketing time, the direct time associated with broom production (harvesting and manufacture) was 1.9 ± 0.5 h. With a mean price of R5.69, less 15% direct costs, the returns to labour were in the order of R2.55 per hour, the equivalent of R20.40 per 8 hour day.

4.3 Abundance of *I. eleocharis*

Across the 350 quadrats sampled, there was a mean density of 20.8 ± 2.1 shoots m^{-2}, the equivalent of approximately 62.4 million for the entire 300 ha forest. The highest density was 305 shoots m^{-2}. Just over half (51.4%) of the quadrats had no *I. eleocharis*. Density was significantly greater (H = 8.7; $p < 0.0001$) in the open quadrats (50.1 ± 4.9 shoots m^{-2}) than the shaded ones (5.8 ± 1.0 shoots m^{-2}). The opposite applied to mean shoot height (T = 6.9; $p < 0.001$), with those in the shade (41.5 ± 1.8 cm) being 48.7% taller than those in the open (27.9 ± 0.8 cm). The mean height across all quadrats was 33.4 ± 0.9 cm. There was a negative correlation between shoot density and shoot height (r = −0.347; $p < 0.0001$), but whether this reflects a largely competitive effect or the influence of canopy shading is unknown.

The effect of canopy shading was also clear with respect to the proportions of grass, litter and bare ground in the sample quadrats (Table 1). The proportion of grass (T = 5.6; $p < 0.001$) and bare ground (T = 13.4; $p < 0.0001$) were significantly lower in shaded areas than open ones, whereas litter was the opposite, i.e. significantly higher (T = 18.7; $p < 0.0001$) in the shaded areas of the forest. The proportion of quadrats categorized as shaded was 66%, and 34% as unshaded or open. In terms of disturbance most of the sample transects (62.9%) had no paths at all. The mean number was 0.5 ± 0.1 paths crossed per 110 m transect. It was not possible to differentiate between paths made by humans and those made by game, as once created a path was potentially used by both.

The proportion of shoots in the forest that was equal to or greater than the mean length in the brooms (45.0 ± 1.8 cm) was 17.2%, or the equivalent of 3.6 shoots m^{-2}. The proportion that was equal to or greater than the minimum length (30 cm) was 57.1% or approximately 11.9 shoots m^{-2}. Thus, with a conservative estimate, of the 62.4 million *I. eleocharis* shoots in the entire forest, approximately 10.7 million were of the mean length or longer, representing the potential standing crop of harvestable material.

In terms of abundance and changes in resource availability, only one of the nine traders felt that the abundance of *I. eleocharis* had declined over the last 5–10 years. She attributed this to under-use since the conservation officials had banned harvesting. All the respondents independently stressed that *I. eleocharis* was denser in areas where it was harvested. They were of the unanimous opinion that if it was not harvested the abundance decreased. Three of the traders said they did not know how long it took the reeds to re-grow after an area was harvested, whilst the rest said new shoots were visible within a month of harvesting. Additionally, all felt that there was considerably more than enough resource in

Table 1 Ground cover (%) in open and shaded areas

	Grass (%)	Litter (%)	Bare (%)
Open	16.7 ± 1.6	26.3 ± 2.3	56.7 ± 2.6
Shaded	6.6 ± 0.8	77.3 ± 1.5	16.2 ± 1.3
Combined	10.0 ± 0.7	59.9 ± 1.3	29.9 ± 1.6

the forest to meet both the domestic and commercial demand. When asked why the conservation officers had halted harvesting, more than half of the traders said that they had not been informed of the ban. The remainder said that the conservation officials had stated that their harvesting methods were unsustainable, that they destabilized the dunes on which *I. eleocharis* grows, and lastly, that they were using the harvesting of *I. eleocharis* as an excuse to illegally harvest shellfish from the coast. In contradiction to the conservation officials, the harvesters felt that harvesting had a stimulatory effect on the plant, and that they were not the cause of the open patches on the dunes, as they preferred to harvest in the shaded areas where *I. eleocharis* shoots were longer. The short shoots found in the open areas were unsuitable for making brooms. They stated that the open patches had always been there (most of the respondents had either been born there or married and moved there in their 20s), and suggested that the open patches were caused by many factors, such as fires, animals and trees blowing over.

5 Discussion

The interplay of the historical use of a resource, in a time of evolving regulations, with both a domestic and small-scale commercial demand, makes for an intriguing dynamic with respect to the current situation as well as future policy options and interventions. The conservation authorities have prohibited harvesting with the good intentions of protecting the specific resource as well as to limit damage to the forest system and coastal dunes. However, this action was clearly not founded on appropriate information or data on the size of the demand and supply (and hence the potential threat), the relative degree of commercial or subsistence use, the importance of the resource and its trade to local livelihoods, actual damage to the forest, or provincial current regulations. As such, local livelihoods have been undermined in terms of direct use of a local resource, and income-generation opportunities lost, largely on the basis of preservationist generalisations, however well intended they may be. This has also undermined conservation efforts since the local community is now distrustful of the intentions and rationale of conservation officials.

It is clear from the data presented that over and above the small domestic demand, the broom traders in Tharfield village harvest only a small proportion (a *maximum* of 13%) of the suitably sized resource on an annual basis, and only 2.3% of the total resource. This result is robust as we have factored in the length/height requirement of harvestable fronds, and used a maximum number of shoots per broom rather than the mean, and so actual annual demand is closer to 10% of suitably sized standing crop. Thus, in essence, there is a self-imposed size limit on harvesting as the brooms require long fronds (a mean of 45 cm), but only 17.2% of the available resource is of this size or longer. It is conceivable that if market demand increased markedly, that smaller shoots might be harvested, but only to a limited extent, as if the shoots are too shoot, then the product is no longer functional as a broom. Additionally, in the open areas, which are of concern to the conservation authorities, nearly all the available resource is too short (a mean of 27 cm tall) and hence not harvested. Whilst currently there is no formal information on regrowth rates after harvesting, it is noteworthy that local harvesters were unanimous in their perception that harvesting actually stimulated the growth of *I. eleocharis*. This is consistent with its rhizomatous growth habit, which is well regarded as being tolerant of heavy harvesting or grazing (van den Wyngaert et al. 2003). Thus, if only 2.3% of the total standing crop is harvested on an annual basis it is quite probable that this is currently within sustainable

harvesting limits. Given the high litter cover in the primary harvesting areas (shaded sites), the removal of nutrients by harvesting is probably only a small proportion of the total pool, but nonetheless would need to be considered (Ticktin 2004).

With respect to damage to the forest system, we found relatively few paths crossing the thirty-five 110 m transects that we sampled. The majority of transects had no paths crossing them. Furthermore, not all the paths encountered would be attributable to harvesters of *I. eleocharis*, as other agents included wild game species and people accessing the beach for recreation and harvesting of shellfish. The harvesters stated that the open patches in the forest were a persistent feature of the landscape, a fact supported by direct examination of aerial photographs, and the existence of such patches throughout the forest both up- and down-coast of the study area, well away from rural villages and possible harvesters. It is also noteworthy that some of the harvesters have been engaging in trade as long as 35 years. The mean number of years harvesting was 17 years, with no obvious ill effects to the species noticed by either the harvesters or the conservation officials.

Against this is the small domestic demand by all households in the village, and the contributions to the livelihoods of nine small-scale traders. The domestic use is negligible, relative to both the commercial demand and as a proportion of the total standing crop (<0.01%). The contribution to the livelihood of the traders is small, albeit significant. All are middle-aged, poorly educated women with few formal skills to enter the job market. Most are heads of their households, with husbands that have either died or left, and they have several dependents to support. Five of the nine reported that the cash earned from brooms and other craft products was the primary, or joint primary, source of income for their household. The high prominence placed on the broom trade to their total livelihoods, and the regularity with which they engage indicates that this is more than simply a safety-net role (Shackleton and Shackleton 2004). Mean net annual incomes were approximately R2,055, or R2.55 per hour. Whilst not large, it is not insignificant in an area of high unemployment and low formal skills. The standard unit cost of labour in the agricultural sector in South Africa is currently R4.03 per hour (South African Department of Labour 2005). Thus, the traders are experiencing a negative opportunity cost and would be economically better off seeking wage labour in the local agricultural sector. However, this is not possible for most of them for two reasons. Firstly, there are very few wage labour opportunities even in the agricultural sector, and secondly, most of them have several dependents and hence have to be available in and around the homestead. Additionally, many workers in the NTFP sector prefer being independent, working for themselves and from home (Shackleton and Shackleton 2004). It is these intangible benefits that require more exposure and consideration when opportunity costs are used (Gram 2001; Shackleton et al. 2002).

Whilst this study has shown that only a small proportion of the natural resource base is harvested to meet current domestic and commercial demand, sustainable use is not solely a function of abundance, but also the growth rate and regeneration of the species, as well as disturbance to the broader habitat and nutrient removal. These various determinants need further investigation. Nonetheless, rhizomatous species are relatively tolerant to the removal of above ground parts, and indeed, growth may well be stimulated through accelerated lateral spread (Ellery and Walker 1986; van den Wyngaert et al. 2003), as perceived by the harvesters. Classification of species forms into guilds of varying susceptibility to harvesting is a useful strategy (Dzerefos and Witkowski 2001; Shackleton 2001), rather than assuming impacts are always negative. Even where direct impacts may be deemed negative the promotion or maintenance of diversity at a larger spatial scale also needs to be considered (Brown 1997; Shackleton 2000), along with the ecosystem level negative impacts (Ticktin 2004).

The fines and fences approach towards species and habitat conservation has been thoroughly debated, and in many instances found wanting (Fabricius 2004). This is particularly the case when the excluded communities are poor rural communities with limited livelihood opportunities, voice and political influence (Brown 1997) and have been denied access to resources. This is even more so when there is no unequivocal evidence of negative impacts on the resource and the local habitats. Arnold and Ruiz Perez (2001) comment how government policies often assert State control over resources such as forests, or override local rights, thereby undermining the authority and effectiveness of community level institutions to control and manage forests and their use. Government policies can also hinder local efforts to realize the potential that NTFPs can contribute to household livelihoods. Because governments give high priority to conservation objectives, many have set in place forest and environmental policies and regulations designed to limit, rather than encourage the collection, production and sale of NTFPs in support of livelihoods and income generation (Arnold and Ruiz Perez 2001). In the case of *I. eleocharis* harvesting by Tharfield residents, we recommend a more consultative approach, combined with (i) widespread communication of concerns over dune destabilization on the bare patches, (ii) a spatially delineated rotational harvest, and (iii) research on the growth and regeneration rates of the species. The can be done in a participative manner, in which the actual users are involved in participatory monitoring. This is currently being discussed with conservation officials.

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References

Arnold, J. E. M., & Ruiz Perez, M. (2001). Can non-timber forest products match tropical forest conservation and development objectives? *Ecological Economics, 39*, 437–447.

Brown, K. (1997). Plain tales from the grasslands: extraction, value and utilization of biomass in Royal Bardia National Park, Nepal. *Biodiversity and Conservation, 6*, 59–74.

Campbell, B. M., Jeffrey, S., Kozanayi, W., Luckert, M., Mutamba, M., & Zindi, C. (2002). *Household livelihoods in semi-arid regions: Options and constraints* (p. 153). Bogor: CIFOR.

Cocks, M. L., & Wiersum, K. F. (2003). The significance of biodiversity to rural households in the Eastern Cape province of South Africa. *Forests, Trees & Livelihoods, 13*, 39–58.

Cocks, M. L., & Dold, A. P. (2004). A new broom sweeps clean: the economic and cultural value of grass brooms in the Eastern Cape province, South Africa. *Forests, Trees & Livelihoods, 14*, 33–42.

Crook, C., & Clapp, R. A. (1998). Is market-orientated forest conservation a contradiction in terms? *Environmental Conservation, 25*, 131–145.

Cunningham, A. B. (2001). *Applied ethnobotany: People, wild plant use and conservation*. London: Earthscan.

Dzerefos, C. M., & Witkowski, E. T. F. (2001). Density and potential utilization of medicinal grassland plants from Abe Bailey Nature Reserve, South Africa. *Biodiversity and Conservation, 10*, 1875–1896.

Ellery, W. N., & Walker, B. H. (1986). The distribution and dynamics of *Elephantorrhiza elephantina* on the farm Maccauvlei. *South African Journal of Botany, 52*, 100–104.

Emanuel, P. L., Shackleton, C. M., & Baxter, J. S. (2005). Modelling the sustainable harvest of *Sclerocarya birrea* subsp. *caffra* fruits in the South African lowveld. *Forest Ecology and Management, 214*, 91–103.

Fabricius, C. (2004). The fundamentals of community-based natural resource management. In C. Fabricius, E. Koch, H. Magome, & S. Turner (Eds.), *Rights, resources and rural development: community-based natural resource management in southern Africa* (pp. 3–43). London: Earthscan.

Glewwe, P., & Hall, G. (1998). Are some groups more vulnerable to macroeconomic shocks than others? Hypothesis testing based on panel testing in Peru. *Journal of Development Economics, 56*, 181–206.

Government of South Africa (1998). National Environmental Management Act, no. 107 of 1998. Government Gazette 401. Pretoria.
Government of South Africa (2004). National Biodiversity Act, no10 of 2004. Government Gazette 467. Pretoria.
Gram, S. (2001). Economic valuation of special forest products: an assessment of methodological shortcomings. *Ecological Economics, 36*, 109–117.
Guillarmod, J. A. (1980). Something from almost nothing. *The Eastern Cape Naturalist, 24*, 30–31.
Gyan, C. A., & Shackleton, C. M. (2005). Abundance and commercialization of *Phoenix reclinata* in the King Williamstown area, South Africa. *Journal of Tropical Forest Science, 17*, 325–336.
Kusters, K., & Belcher, B. (Eds.). (2004). *Forest products, livelihoods and conservation: Case studies of non-timber forest product systems. Vol 1: Asia* (p. 365). Bogor: CIFOR.
Leistner, O. A. (Ed.). (2000). *Seed plants of Southern Africa: Families and genera. Strelitzia 10*. Pretoria: National Botanical Institute.
Low, A. B., & Rebelo, A. G. (Eds.). (1996). *Vegetation of South Africa, Lesotho and Swaziland* (p. 85). Pretoria: Department of Environmental Affairs and Tourism.
Magome, H., & Fabricius, C. (2004). Reconciling biodiversity conservation with rural development: The Holy Grail of CBNRM? In C. Fabricius, E. Koch, H. Magome, & S. Turner (Eds.), *Rights, resources and rural development: community-based natural resource management in southern Africa* (pp. 93–114). London: Earthscan.
Pereira, T., Shackleton, C. M., & Shackleton, S. E. (2006). Opportunities and constraints to trade in reed-based craft products in rural villages in the Eastern Cape, South Africa. *Development southern Africa, 23*, 477–496.
Rogerson, C. M. (2000). Rural handicraft production in the developing world: policy issues for South Africa. *Agrekon, 39*, 193–217.
Shackleton, C. M. (2000). Comparison of plant diversity in protected and communal lands in the Bushbuckridge lowveld savanna, South Africa. *Biological Conservation, 94*, 273–285.
Shackleton, C. M. (2001). Re-examining local and market-oriented use of wild species for the conservation of biodiversity. *Environmental Conservation, 28*, 270–278.
Shackleton, C. M., & Shackleton, S. E. (2004). The importance of non-timber forest products in rural livelihood security and as safety-nets: evidence from South Africa. *South African Journal of Science, 100*, 658–664.
Shackleton, C. M., Shackleton, S. E., Ntshudu, M., & Ntzebeza, J. (2002). The role and value of savanna non-timber forest products to rural households in the Kat River valley, South Africa. *Journal of Tropical Forest Products 8*, 45–65.
Shackleton, S. E. (2005). The significance of local level trade in natural resource products for livelihoods and poverty alleviation in South Africa. PhD thesis, Rhodes, University, Grahamstown (pp. 286).
Shackleton, S. E., & Shackleton, C. M. (2005). The contribution of marula fruits and fruit products to rural livelihoods in the Bushbuckridge district, South Africa: balancing domestic needs and commercialisation. *Forests, Trees & Livelihoods, 15*, 3–24.
South African Department of Labour. (2005). Minister of Labour says the minimum wage for agricultural and seasonal workers is effective. Accessed on 29 August 2005 at http://www.labour.gov.za/media/statement.jsp?statementdisplay_id=9834.
South African Department of Statistics. (2005). Eastern Cape Province. Accessed on 10 October 2005 at http://www.statssa.co.za.
Sunderland, T., & Ndoye, O. (Eds.). (2004). *Forest products, livelihoods and conservation: Case studies of non-timber forest product systems. Vol 2: Africa* (p. 333). Bogor: CIFOR.
Ticktin, T. (2004). The ecological implications of harvesting non-timber forest products. *Journal of Applied Ecology, 41*, 11–21.
Van den Wyngaert, I. J., Wienk, L. D., Sollie, D., Bobbink, R., & Verhoeven, J. T. (2003). Long-term effects of yearly grazing by moulting Greylag geese (*Anser anser*) on reed (*Phragmites australis*) growth and nutrient dynamics. *Aquatic Botany, 75*, 229–248.