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The influence of livelihood dependency, local ecological knowledge and market proximity on the ecological impacts of harvesting non-timber forest products

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ABSTRACT

It is well established that non-timber forest products make significant contributions to rural incomes throughout most of the developing world. NTFP use frequently raises concerns about the sustainability of, or ecological impacts associated with, NTFP harvesting, as well as local contextual factors which may limit or reduce the impacts. Here we test the conceptual model first advanced by Uma Shaanker et al. (2004) relating to the factors that may limit or exacerbate the ecological impacts associated with NTFP harvesting. These were the extent of local dependence on NTFPs, the degree of marketing and the level of local ecological knowledge. Data were collected via household questionnaires and ecological surveys of woody plants from eight villages throughout South Africa. We found no significant relationships between measures of ecological impact with local ecological knowledge or market proximity and engagement. There was a strong positive relationship between ecological impacts and NTFP dependency as indexed through mean annual direct-use value for NTFPs. This indicates that the higher the dependency and demand for NTFPs, the greater is the possibility of high impacts to the local environment. However, other contextual drivers not included in the original Uma Shaanker et al. (2004) model may also play a role, particularly the strength of local resource governance institutions.

1. Introduction

There is a wealth of case studies from around the world on the contribution of non-timber forest products (NTFPs) to local livelihoods (Vedeld et al., 2007; Shackleton et al., 2007; Saha and Sundriyal, 2012). The precise values and percentages from different regions and studies (Angelsen et al., 2014) are frequently not directly comparable because of the different NTFPs included and the varying methods that were used (Shackleton et al., 2011). Nonetheless, most point to the fact that the proportion of total household incomes provided by NTFPs is significant, with estimates ranging between 10% and 90%, and usually characterised by a higher contribution for poorer households than wealthier ones (e.g. Cavendish, 2000; Davidar et al., 2008; Rijal et al., 2011). This applies for the safety-net function, trade income and for direct consumption. However, whether or not NTFPs are therefore a viable option for poverty alleviation or prevention strategies continues to be debated, and requires more work across a greater range of contexts (Belcher and Schrekenberg, 2007; Shackleton et al., 2007; Ainembabazi et al., 2013).

The contribution of NTFPs to poverty alleviation or diversification of livelihoods is dependent upon their sound management and sustainable use (Agrawal, 2007). If the abundance or productivity of NTFP species is impaired, then the potential contributions to local livelihoods will diminish over time (Uma Shaanker et al., 2004; Thang et al., 2010; Mutenje et al., 2011). Examples of overuse and diminishing stocks abound (see review by Ticktin, 2004; Thang et al., 2010). Negative impacts may be manifest at any of several scales, from genetic shifts up to large-scale ecosystem impacts (Hiremath, 2004; Uma Shaanker et al., 2004). But examples of the opposite, i.e. sustainable use, can also be found (e.g. Shackleton, 2001; Stanley et al., 2012), and therefore caution must be made against generalisations. Rather, predictive frameworks are required to help identity the contexts and circumstances in which sustainability bounds are likely to be breached and when not, so that pre-emptive actions can be considered. Even when faced with declining stocks there may be a short-term increase in incomes due to higher unit prices driven by increasing scarcity of the resource (e.g. Shackleton et al., 2002a), but in a context of weak management and harvesting, higher prices are likely to accelerate the rate of decline.

Whether or not a specific NTFP or the land upon which it is located is sustainability managed depends upon a host of ecological, social and economic factors (Uma Shaanker et al., 2004; Mutenje et al., 2011; Ticktin and Shackleton, 2011). Examples of ecological factors include the abundance and distribution of the resource, its regeneration, recruitment and maturation rates, availability of substitutes and so on.

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Social factors include aspects such as land tenure, governance arrangements and adherence, and cultural norms. Economic dimensions of the complex picture include variables such as the existence of alternative livelihood options, whether the NTFP is traded or not, poverty levels, relative costs of alternatives, access to markets, and the like. It is clear from only these few examples, that predicting the sustainability of NTFP harvests is a complex challenge. Not unsurprisingly therefore, few have attempted to unravel the different components, or assess their relative magnitudes. Velásquez Runk et al. (2004) found that not only are the ecological effects of harvesting immensely different for each species, but that the spatial, social, temporal and political variables differ as well. This makes the effective management of NTFPs an even more complex task. López-Feldman and Wilen (2008) modelled the effects of changes in price of a traded NTFP on local participation in the trade and the amount of resource extracted under two governance situations. Given the complexity of the issue, outcomes varied under different management scenarios. Ghate et al. (2009) considered not only the interplay of market proximity and local dependence on forest condition, but also how that was affected by the nature and strength of local institutions. Significantly, market access resulted in increased cash incomes from NTFPs, lower direct dependence and deteriorating forest condition. In examining governance attributes and ecological impacts independently, Mutenje et al. (2011) recorded a wide number of factors influencing each, amongst the most significant being monitoring and enforcement of rules, social homogeneity ecological knowledge and market integration.

Uma Shaanker et al. (2004) developed a conceptual framework to integrate a number of attributes that may influence the extent to which NTFPs are harvested sustainably or not and consequent impacts on the species and forest condition. They proposed three main correlates with the probability of sustainable harvesting, namely (i) the level of dependency on the resource, (ii) the level of local knowledge about the resource and (iii) the nature of the market chains. They hypothesised that high levels of dependence on NTFPs, combined with no or low levels of household local ecological knowledge (LEK) and a high degree of market failure would result in high ecological impacts to the resource or ecosystem. Alternatively, if high levels of dependency are coupled with high levels of household LEK as well as effective market structures, then, they proposed, it would lead to lower ecological impacts. When dependence on forest products is low, independent of the household LEK level or the market structure, it was proposed that the levels of disturbance or ecological impacts would also be low.

The objective of the work reported in this paper was to empirically test the Uma Shaanker et al. (2004) framework to determine the relative magnitude of each of the three different attributes underlying the probability of sustainable harvesting. We do so using data and information from eight villages in the semi-arid regions of South Africa.

2. Study sites

Eight rural villages in South Africa were selected, three in the Eastern Cape Province in the southeast of the country (Ntilini, Tidbury, Fairburn) and five in Limpopo Province (Finale A, Mabins B, Willows, Thorndale and Mogano) in the north of South Africa (Table 1). These particular villages were selected because of the availability of published work for each on NTFP use and values, which could be taken as an index of the level of dependency on NTFPs. Thus, one of the variables needed to assess the Uma Shaanker et al. (2004) model within the South African context was already available for each village. Additionally, they represent a range of rural settlements from small, remote and poorly serviced ones to large, better serviced ones on major secondary routes. All eight villages were located within the savanna or thicket biome of South Africa, within communal tenure areas, and are geographically situated in areas with low mean annual rainfall levels ranging between 488 mm and 680 mm (Table 1). Land is mostly divided into arable and residential plots, and residents are allowed free access for grazing and the extraction of NTFPs in the remaining areas.

The three Eastern Cape villages (Ntilini, Tidbury and Fairburn) are all located in the Kat River Valley in the Mpofu district. Ntilini is located closest to the small agricultural town of Fort Beaufort in the south and has approximately 180 households, Fairburn is situated closest to Seymour in the north with approximately 100 households, and Tidbury is positioned midway between the two with approximately 40 households (Shackleton et al., 2002b). Population densities are higher than on the surrounding privately owned commercial citrus farms, employment levels are low, and basic infrastructure is unevenly and inadequately distributed. Ntilini and Fairburn have access to electricity, whilst Tidbury does not. The proximity of the Kat River to the villages does ensure a basic supply of water for irrigation and domestic use, although it must be collected by hand in Ntilini and Tidbury (Shackleton et al., 2002b), Fairburn has recently installed taps on street corners within the village.

Three of the study villages (Finale A, Mabins B and Willows) are located in the Mametja Traditional Authority in Limpopo Province. They represent a range of rural settlements, from a large, well serviced

Table 1
The biophysical characteristics of the eight study villages.

Village	Province	Location	Vegetation type (Mucina and Rutherford, 2006)	Dominant species	Approximate mean annual rainfall (mm)
Ntilini	Eastern Cape	32° 42.4′ S 26° 36.0′ E	Bhisho Thornveld	*Acacia karroo*, *Euphorbia* spp., *Diospyros dichrophylla*, *Olea europea*	550
Tidbury	Eastern Cape	32° 38.6′ S 26° 39.5′ E	Bhisho Thornveld	*A. karroo*, *Euphorbia* spp., *D. dichrophylla*, *O. europea*	550
Fairburn	Eastern Cape	32° 33.6′ S 26° 42.5′ E	Bhisho Thornveld	*A. karroo*	550
Finale A	Limpopo Province	24° 24′ 15″ S 30° 42′ 30″E	Granite Lowveld	*Sclerocarya birrea*, *Combretum apiculatum*, *Acacia nigrescens*	488
Mabins B	Limpopo Province	24° 25′ S 30° 33′ E	Granite Lowveld	*S. birrea*, *C. apiculatum*, *A. nigrescens*	488
The Willows	Limpopo Province	24° 21′ 30″ S 30° 38′ 30″E	Granite Lowveld	*S. birrea*, *C. apiculatum*, *A. nigrescens*	580
Thorndale	Limpopo Province	24° 39′ S 31° 28′ E	Granite Lowveld	*Acacia burkei* *Phoenix reclinata* *S. birrea* *Combretum collinum*	575
Mogano	Limpopo Province	24° 2.9′ S 44.8° 44.8′ E	Polokwane Plateau Bushveld	*Acacia rehmanniana* *Acacia tortilis* *Dichrostachys cinerea*	505

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