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Review

Towards a theoretical framework for the management of non-timber forest products (NTFPs) in Swaziland: A review

Cliff S. Dlamini[1]* and Coert J. Geldenhuys[2]

[1]Swaziland Institute for Research in Traditional Medicine, Medicinal and Indigenous Food Plants, University of Swaziland, Swaziland.

[2]Department of Forest and Wood Science, Faculty of Agrisciences, University of Stellenbosch, P/B X1, Matieland 7602, South Africa.

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Sustainable forest management aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations. In Swaziland, despite the existence of numerous local, national, regional and international policies and legislation, sustainable forest management is far fetched. The objective of this paper was to review previous studies on policy reviews, the current status of the non-timber forest products (NTFP) sector, community consultations on resource use and management, user surveys to determine the actual quantities of harvested and utilized edible and medicinal NTFPs, and economic analyses for their direct use value, and inventory and economic valuation of standing stock of various NTFPs. Ulimatelty, this paper has made policy recommendations for the development of a theoretical framework for the sustainable management of NTFPs at the local, national, regional and international levels. This theoretical framework is divided into a set of eleven strategies. These are: Information and social communication; secure rights and access to products from natural forests and woodlands; adoption of innovative policies, revising and updating legislation and elaborating national forestry programmes; development and implementation of national level criteria and indicators for sustainable forest management; project planning and control techniques; local level guidelines for sustainable NTFP management; conservation and financing mechanisms; collaboration and networking between all institutions involved in research and development of NTFPs; institutional strengthening and capacity building; education and training at all levels of community structures; and research and development.

Key words: Non-timber forest products (NTFPs), policy, strategy, policies, legislation, economic valuation, sustainable management, assessment, sustainable resource use.

INTRODUCTION

Swaziland is a landlocked country with a total land area of 17,364 sq/km with a population of about one million (FAO and WFP, 2008). It is a predominantly rural and subsistence society, with a dual land tenure system consisting of Swazi Nation Land (SNL) that is held in trust by the King and allocated to households by chiefs and Title Deed Land (TDL) that is freehold. Swaziland is classified as a lower middle-income country whose income distribution is skewed, with an estimated 20% of the population accounting for more than 50% of national income. An estimated 43% of the population live in extreme poverty and 76% of the poor live in rural areas (FAO and WFP, 2008; Dlamini, 2010a).

The country is divided into four agro-ecological zones,

*Corresponding author. E-mail: cliffsdlamini@ymail.com or csdlamini@uniswa.sz. Tel: +268 6766612. Fax: +268 25185276.

Middleveld and the Highveld. The sub-tropical climate is characterised by wide ranges in total annual rainfall, including periods of droughts that particularly affect the Middleveld and Lowveld (Dlamini, 2007, 2010a, 2011; Dlamini and Geldenhuys, 2011a, b, c, d).

The pressure on natural forests and woodlands in Swaziland and most parts of the world requires a clear picture of the products and services, the users and uses for efficient policy-making and sustainable forest management planning. This NTFPs study is a first step towards an integrated approach to policy and strategy development for sustainable management of natural forests and woodlands in Swaziland. A multi-dimensional approach to strategy development should include a number of diverse studies (FAO, 1995, 2001, 2003a; Crafter et al., 1997; Mogaka et al., 2001; Barrow et al., 2002). A review is required of existing policies and legislation to determine adequacy and potential gaps. Analysis of the status of the NTFP sector is necessary to understand its extent and importance. Community consultations and ethno botanical surveys are important to understand user demand in relation to supply and economic value of products used. An inventory of the resource (standing stock) and its potential economic value in relation to the demand should form the basis for formulation of a concept for the sustainable management of forest resources. Previous studies on sustainable management of NTFPs have not included a combination of all the aforementioned critical aspects in the development process of policy and strategies, and often this has lead to ineffective policies (Crafter et al., 1997; FAO, 2001, 2003b; Mogaka et al., 2001; Barrow et al., 2002; Vedeld et al., 2004; Willis, 2004; Dlamini and Geldenhuys, 2011a, b, c, d).

The total value generated by a forest consists of wood and non-wood goods and services (Buttoud, 2000; Gluck, 2000; Dlamini, 2007). Goods and services of the forest resource can be classified into three broad categories, namely, direct use benefits, indirect use benefits and intermediate use services (DANCED, 2000a; Hassan, 2001; Hassan et al., 2002; Shackleton, 2002; Shackleton and Shackleton, 2004; Dlamini, 2007; 2010a, 2011). Direct use benefits include timber for construction and furniture, wood for crafts and household tools, fire wood, construction poles, wild fruits, wild vegetables, wild herbs, honey, bush meat, insects for food, bird eggs, medicinal products, thatch, grass hand-brushes, twig hand-brushes, weaving reeds, sand/clay, plant dyes, plant resins, seeds for rattles and decoration and other benefits. Indirect use benefits include pollination services, livestock grazing, recreation/aesthetic services (eco-tourism), religious functions and other benefits. Intermediate use services comprise carbon sequestration; water shed protection, protection against soil erosion, habitat for wild fauna and flora (breeding and nursery functions), biodiversity reserve, oxygen production, acid rain deposition, roles in the water cycle, runoff reduction (cultivated) and other services. Consequently, forest values can be classified into four broad categories: direct use values, indirect use values, option values and existence values (McKenney and Sarker, 1994; Clarke et al., 1996; Buttoud, 2000; Shackleton et al., 2000; Chipeta and Kowero, 2004; Clarke and Grundy, 2004; Dlamini and Geldenhuys, 2011a, b, c, d).

In the past, the focus in forest management has been on commercial timber, which is regarded as the primary forest product (Peters et al., 1989; Chopra, 1993; Godoy et al., 1993; McKenney and Sarker, 1994; DANCED, 2000b; Wong et al., 2001; Hassan et al., 2002). However, it is becoming clear that economically, environmentally, culturally and socially, non-timber forest goods and services are equally important (Falconer, 1992; Gunatilake et al., 1993; Chamberlain et al., 1998; Langoya and Long, 1998; Robles-Diaz-De-Leon and Kangas, 1999; Chapeskie, 1999; Shackleton et al., 2000; Dovie et al., 2001; Hassan et al., 2002; FAO, 2003a; Clarke and Grundy, 2004; Lawes et al., 2004; Shackleton and Shackleton, 2004, 2005; Olsen, 2005). However, in Swaziland in particular there has not been any commercial exploitation of timber from natural forests and woodlands, except extraction of timber for farm structures (DANCED, 2000b; Hassan et al., 2002; Dlamini, 2007, 2010a, 2011).

The working definition of NTFPs is “the vast array of goods and services of biological origin (including fuel wood and small wood) derived from forests, other wooded land and trees outside forests, that may be gathered from the wild or produced in forest plantations, agro-forestry schemes and from trees outside forests” (FAO, 2002). Millions of people worldwide harvest and use NTFPs for domestic and commercial purposes regularly or as alternatives during times of adversity (Shackleton and Shackleton, 2005; Dlamini and Geldenhuys, 2011a, b, c, d).

Although, it is easy to define and measure timber outputs from the forest, many NTFPs are often difficult to define and quantify (Balick and Mendelson, 1992; McKenney and Sarker, 1994; Shackleton et al., 2000; Gram, 2001; FAO, 2001, 2003a). An internationally accepted standard classification of NTFPs is yet to be developed. NTFPs are classified in many different ways, for example, by end use and plant part used (Chandrasekharan, 1995; Cook, 1995; Temu, 1995). A tentative classification system for ease of data collection by researchers for the regional outlook of NWFPs in Africa from various international classification systems was inconclusive (FAO, 2001). The categorization of NTFPs is important for resource assessment and economic valuation purposes (FAO, 2001; Hassan et al., 2002; Dlamini and Geldenhuys, 2011a, b, c, d).

The overall objective

The overall objective of this study is to illustrate how to

determine the socio-economic use, direct use values and management of natural forests and woodlands for edible and medicinal non-timber forest products in the four ecological zones of rural Swaziland as a basis for improvement of policy and strategy for the sustainable management of non-timber forest products, based on recent scientific studies.

Specific objectives

1. To illustrate how to review and assess the relevance of existing policies and legislation that affect the NTFPs sector in Swaziland. The hypothesis behind the assessment policies and legislation: the current national forest policy does not adequately guide the development of NTFPs.

2. To demonstrate the review of the current status of the NTFP sub-sector: to highlight past NTFPs valuation studies in Swaziland; to compile an up-to-date list of major use categories of NTFPs; and to rank NTFPs species in their order of importance. The hypothesis behind the review of the NTFP sector: there is insufficient research on the status, socio-economic use and value of NTFPs in Swaziland.

3. To reflect on a study that shows how to embark on community consultations to gather information on the communities' perception of preferred edible and medicinal NTFPs, their direct uses, the existing management strategies, threats to forest biodiversity and the domestication and commercialisation initiatives. The hypothesis behind the reflection on community consultations:

there are no existing traditional forest management plans that can complement the national policies

4. To illustrate how to undertake user surveys to determine the actual quantities of harvested and utilized edible and medicinal NTFPs, and to do an economic analyses of their direct use values. The hypotheses behind user surveys: the quantities and values of edible and medicinal NTFPs extracted and utilized vary amongst households in response to a myriad of local and external contextual conditions (Shackleton and Shackleton, 2004). Edible and medicinal NTFPs make a significant contribution to rural household income (Lawes et al., 2004; Chipeta and Kowero, 2004).

5. To give an insight of how to conduct resource surveys to assess the condition and actual quantities of standing stock of species for edible and medicinal non-timber forest products, and to do an economic analysis of the value of the standing stock. The hypothesis behind resource assessments: increased demand for NTFPs lead to the depletion of edible and medicinal NTFPs, which may promote natural forest/woodland degradation and deforestation

6. Formulation and development of a theoretical framework for the sustainable management of NTFPs in natural forests and woodlands.

A DETAILED SYNTHESES OF POLICY ANALYSES PROCEDURES FROM RECENT STUDIES

A recent study on policy review

A hierarchical method comprising four steps of preliminary selection of relevant policies and legislation, first assessment of all selected policies and legislation, second assessment of all selected policies and legislation and the final assessment of short-listed policies and legislation, respectively. This method was modified from these studies (Lamb, 1983; Falconer, 1992; FAO, 1995, 2001, 2003a, b; Crafter et al., 1997; Bhattarai and Hammig, 1998; DANCED, 2000b, 2001; GOS, 1999; Mogaka et al., 2001; Barrow et al., 2002; Geldenhuys, 2002; Hassan et al., 2002; Clarke and Grundy, 2004; Lawes et al., 2004; Shackleton and Shackleton, 2004, 2005; Janse and Ottisch, 2005; Emanuel et al., 2005; Olsen, 2005). A model of 21 criteria was designed to analyse and rank national and international policies (Dlamini, 2007, 2010a, 2011; Dlamini and Geldenhuys, 2011, c, d, e).

A recent study on the status of NTFPs

Past national studies on NTFPs were reviewed; national, regional and international sources of information was reviewed and face to face interviews with subject matter specialist were conducted to ascertain and establish NTFPs categories that exist in Swaziland and further rank various plant species in order of importance and multiple use (Campbell, 1987; Falconer, 1992; FAO, 1995, 2001; Clarke et al., 1996; Shackleton, 1996; Shackleton, 2002; Shackleton and Shackleton, 1997, 2000, 2004, 2005; Allen et al., 1998; Crafter et al., 1997; Helles, 1999; DANCED, 2000b; UNEP, 1992a; Alexander and Mclain, 2001; Dovie et al., 2001; Hassan, 2001; Hassan et al., 2002; Shackleton et al., 2000; Clarke and Grundy, 2004; Lawes et al., 2004; Janse and Ottisch, 2005; Dlamini and Geldenhuys, 2009).

Facts on site selection for community consultations, user surveys and resource surveys

1. They should cover a broad spectrum of sites, to allow calculation of variance. This is ensured by covering the four ecological zones of the country (Godoy et al., 1993; FAO, 2001; Dlamini and Geldehuys, 2011a, b, d). This makes it possible to use data for comparison and generalization and the full range of Swaziland's major forest types, with their associated variability in climatic and socio-economic conditions (Hassan et al., 2002);

2. The selected villages have to be part of communities that live adjacent to natural forests and woodlands and harvest, extract or collect and utilize NTFPs from the neighbouring natural forests and woodlands (Appasamy, 1993; Godoy and Bawa, 1993; Hall and Bawa, 1993; Hedge et al., 1996; Shackleton, 1996; Campbell et al., 1997; Crafter et al., 1997; Qureshi and Kumar, 1998; Shackleton and Shackleton, 2000; Shackleton et al., 2002; Dovie, 2003b; Dlamini and Geldehuys, 2011a, b, d). Only rural communities/villages were included in the study due to the low dependence of urban populations on direct harvesting of NTFPs from natural forests and woodlands (Hassan et al., 2002).

3. The natural forests and woodlands selected for the study should be shortlisted from the list of nominated forests developed during community consultations (FAO, 2003a; Dlamini and Geldehuys, 2011a, b).

A recent study on community consultations on resource use and management

The district forestry officer and agriculture extension officers in each

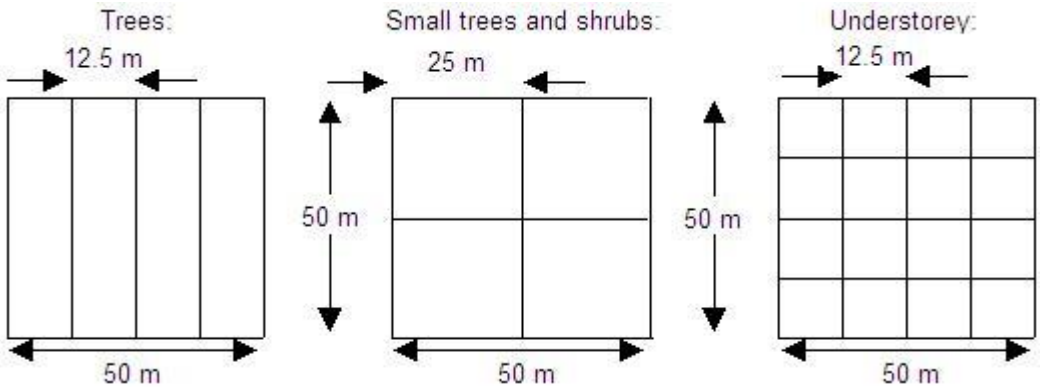

Figure 1. An illustration of the design of main plots and two levels of sub-plots for the resource surveys.

area selected two villages according the earlier site selection criteria and short-listed fourthy community representatives comprising twenty men and twenty women, and two community leaders were invited to be observers (Dlamini, 2007, 2010a, 2011).

Data collection was done through group discussions, individual interviews and the review of the National Forest Policy (Dlamini, 2007, 2011).

The model for statistical analysis was:

$$Y_{ijkln} = \mu + \alpha_i + \beta_j + \gamma_k + \delta_l + \alpha\beta_{ij} + \alpha\gamma_{ik} + \alpha\delta_{il} + \beta\gamma_{kl} + \beta\delta_{jl} + \gamma\delta_{kl} + \varepsilon_{ijkln}$$

where Y_{ijkln} = community response, μ = population mean, α_i = product effect (site or species or community), β_j = site effect, γ_k = species, δ_l = gender, $\alpha\beta_{ij}$ = product × site effect , $\alpha\gamma_{ik}$ = product × species, $\alpha\delta_{il}$ = product × gender, $\beta\gamma kl$ = site × species, $\beta\delta_{jl}$ = site × gender, $\gamma\delta_{kl}$ = species × gender and ε_{ij} = error.

The higher order interaction were used as part of error ($\varepsilon ijkln$).

User surveys and economic valuation-procedures from a recent study

Literature was reviewed, community meetings were held, employment status of members of households captured, questinnaires were completed and a nested sampling approach was followed where villages are nested on sites and in turn households are nested in villages. A maximum of 17 households were selected per village and 34 households per study site (Godoy et al., 1993; Gram, 2001; Wong et al., 2001; Hassan et al., 2002; Shackeleton et al., 2002). More details on data collectionn and analysis are given by Dlamini (2007). The economic valuation was based on a model by Shackleton and Shackleton (2002), where:

Annual value extracted per household = Annual quantities extracted (either for domestic use or trade) × Mean Farmgate Price'.

Models for statistical analysis were:

1. $Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$

where Yij= household profiles, μ = population mean, α_i = main effect (employment) and ε_{ij} = error.

2. $Y_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \varepsilon_{ijk}$

where Yijk = annual quantities and values, μ = population mean, α_i = main effect (site or species or village), β_j = duration effect, $\alpha\beta_{ij}$ = interaction effect of duration with main effect (site or species or community) and ε_{ij} = error (analysis of variance for a one- way classification).

Resource surveys and economic valuation-procedures from a recent study

Community meetings were held, literature from local, national and regional sources was reviewed, key informant interviews were conducted with 28 subject matter specialists, 40 traditional healers and 136 local collectors to gather information on the anatomy, botany, physiology and flowering and fruiting phenology of the various plant species in the selected natural woodlands (modified from Peters et al., 1989; Balick and Mendelson, 1992; Falconer, 1992; Chopra, 1993; Hall and Bawa, 1993; Peters, 1996; Robles-Diaz-De-Leon and Kangas, 1999; FAO, 2001; Dlamini, 2007).

The inventory design followed a nested sampling approach where a sample of larger plots was selected with a systematic group of sub-plots in a fixed pattern within the larger plots and even smaller plots within the sub-plots in Figure 1 (Sharma and Bhatt, 1982; Avery and Burkhart, 1983; Hall and Bawa, 1993; Ott, 1998; Campbell et al., 1997; Peters, 1996; Dlamini, 1998; Dlamini, 2010b; Peters and Tode, 1998; Wong et al., 2001).

The economic valuation model was based on the recommendations of Peters et al. (1989), Balick and Mendelson (1992), Godoy et al. (1993, 2000) and Dlamini (2010a, 2011), where:

1. Trees/Shrubs: Total value = number of trees × annual yield per tree × unit price.
2. Under-storey: Total value = number of individuals × annual production × unit price.

The model for statistical analysis was:

$$Y_{ij} = \mu + \alpha_i + \varepsilon_{ij}$$

where Yij = resource inventory and Inventory value, μ = population mean, α_i = main effect (site or species) and ε_{ij} = error (analysis of variance for a one-way classification).

RESULTS AND DISCUSSION OF THE RECENT STUDIES HIGHLIGHTED

Policy implications

NTFPs are of significant socio-economic use with direct

use values and benefits at the local and national levels in Swaziland confirming the environmental and socio-economic importance of NTFPs as mentioned in Hess et al. (1990), Balick and Mendelson (1992), Falconer (1992), Appasamy (1993), Chopra (1993), Godoy and Bawa (1993), Godoy et al. (1993), McKenney and Sarker (1994), FAO (1995, 2001) Lasschuit (1995), Clarke et al. (1996), Crafter et al. (1997), Mander (1998), Robles-Diaz-De-Leonand Kangas (1999), Yembi (1999), DANCED (2000b), Gram (2001), Hassan et al. (2002), Vedeld et al. (2004), Olsen (2005), Janse and Ottisch (2005), Te Velde et al . (2005), Trauernicht and Ticktin (2005), Shone and Harris (2005) and Shackleton and Shackleton (2005). According to Dovie (2003b) inadequate policy recognition has however led to the underestimation of the role of NTFPs in sustaining rural economies (Dlamini, 2011).

Policy makers are not yet sure what government, the private sector or local communities can do to preserve an optimum level of forest biodiversity (Bhattarai and Hammig, 1998; Dlamini, 2010a). Proper management systems should be provided, in the national and international policies and legislation relevant to the NTFP sector to ensure their sustainable use and management. A new theoretical framework was recommended in accordance with Specific Objective 6 of this study.

The existing national policies and legislation, including the national criteria and indicators for sustainable forest management, contain elements and issues of NTFPs but to a lesser extent as compared to the existing international policies and legislation. This has made it difficult to develop NTFPs at the local and national levels, despite their ecological, environmental, social, cultural, spiritual and economic roles in the country (Dlamini, 2011).

One of the reasons for the weak and ineffective policies is the lack of a broader stakeholder participation and involvement, including resource users or local communities, in policy and legislation formulation processes. This study developed and presents a new 4-step hierarchical approach to policy and legislation review and analysis. An in-depth assessment was made of a total of 16 national and international policies and legislation based on 21 criteria for assessment (Tables 1 and 2). This will form a basis for the improvement of future natural resources management policies and legislation (Dlamini, 2007, 2010a, 2011).

The research was aimed at investigating the importance of NTFPs in rural livelihood security and as safety nets. A closer analysis of the past studies showed that there is a profound lack of information on the status of NTFPs in the country. Therefore, there is still a great need for research on the qualitative and quantitative statistical data on the status of the full range of NTFPs (goods and services) in Swaziland. A similar concern was raised by Shackleton and Shackleton (2004) from a research study conducted in South Africa on the emergency net function which serves as an insurance in times of misfortune, such as drought, diseases and economic recessions. Omission of the total value of NTFPs in the Swaziland Nurses Association (SNA) in Swaziland leads to government not recognizing the value attached to NTFPs, thus resulting in easy land conversion from natural forests and woodlands to other land use options (e.g. Agriculture).

The up-to-date list of main categories of NTFPs (goods and services) compiled in this study is in line with those in recent regional and international studies and makes it a useful tool in the classification of NTFPs (Table 3). The matrix displaying multi-purpose properties of species of commonly used NTFPs in Swaziland is a good basis for species selection for local and national level domestication and commercialization initiatives. The re-classification of the major categories of NTFPs, the ranking of top priority NTFPs species and the recommendation for the formulation and development of a standard procedure for economic valuation of NTFPs in this study is an improvement of work carried out in Swaziland by DANCED (2000b) and Hassan et al. (2002) and Dlamini (2007).

There was wide variation in community responses (by site and by gender) to questions on preferred products and species (Figures 2 to 5). Local communities lack knowledge of the existing policies and legislation that safeguard the sustainable use of NTFPs in the adjacent natural forests and woodlands, and further stated that there are no existing traditional local-level NTFPs management systems. This is confirmed by the ongoing overexploitation and unsustainable use of NTFPs leading to the current accelerated rate of deforestation and forest degradation. Uncontrolled trade in NTFPs, by non-resident collectors, in South Africa has been seen to be one of the inevitable threats to forest biodiversity (Dovie, 2003b). This reaffirms the weak and ineffective national policies and legislation, and shows that the existing policies and legislation are not implementable. Proper and innovative policies and legislation need to be put in place to cope with the current challenges.

The positive side is that local communities have identified potential threats to forest biodiversity. Though, some of them may not be aware of the opportunity cost of the adjacent natural forests, all local communities are willing to participate in the conservation and sustainable use of the adjacent natural forests and woodlands. Most local communities already have initiatives towards selection of top priority species for domestication and commercialisation, and that is an opportunity for sustainable NTFPs management and development. The institutional, cultural, socio-economic, ecological/environmental and policy issues raised by local communities highlighted are a crucial and essential element for the formulation and development of guidelines for local-level sustainable management and development of NTFPs.

This study captured a wide variation of NTFPs utilization as recommended by Godoy et al. (1993),

Table 1. Detailed breakdown of the scores and ranking against NTFPs issues and elements for the selected international policies and legislation.

International policies and legislation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Grand Scores	Ranking
Convention on Biodiversity	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	42	1
SADC Forestry Protocol	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	41	2
UNCED Agenda 21	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	40	3
Millennium Development Goals	2	2	2	2	2	2	1	1	1	2	2	2	2	2	1	2	2	2	2	2	2	38	4
The Environmental Initiative of New Partnership for Africa Development (NEPAD)	2	2	2	2	2	2	1	1	1	2	2	2	2	2	1	2	2	2	2	2	2	38	4
SADC policy and strategy for Environment and Sustainable Development	2	2	2	2	2	2	1	1	1	2	2	2	2	2	1	2	2	2	2	2	2	38	4
The World Bank Forest Strategy/ Policy and Forest Certification	2	2	2	2	2	2	1	1	1	2	2	2	2	2	1	2	2	2	1	2	2	37	5
Convention in International Trade of Endangered Species of Flora and Fauna	1	1	2	2	1	1	2	2	2	2	2	2	2	1	2	2	2	0	1	1	1	33	6

The 21 ISSUES and elements of NTFPs:

1. Stakeholders involvement
2. Economic incentives
3. Existing gaps
4. Broad spectrum
5. Decentralisation
6. Sustainable management
7. Schedules of species
8. Red data list
9. Flora protection
10. Strategies for sustainable management
11. Commercialization and domestication
12. Implementability
13. Status of policy
14. Impact of alien invasive species
15. Ethnobotanical surveys
16. Trade chains
17. Valuation of NTFPs
18. Integrated forest management
19. Scientific understanding
20. Training
21. Collaboration

Issue adequately addressed = 2; Issue inadequately addressed = 1; Issue not addressed = 0.

FAO (2001), Dlamini (2007, 2010a, 2011) and Dlamini and Geldenhuys (2011a, b, c, d, e), and this will enable the results to be used for generali-zation. The method used in the economic valuation

valuation of NTFPs is an improvement of that suggested by Godoy et al. (1993, 2000), in that this study considered assessing the use of NTFPs at the village doorstep as well as those that are

utilized before the doorstep. This has resulted in higher quantities and with in specified villages across the four ecological zones of Swaziland, in the actual annual quantities harvested and direct

Table 2. Detailed breakdown of the scores and ranking against NTFPs issues and elements for the selected national policies and legislation.

National policies and legislation	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Grand scores	Ranking
National Biodiversity Strategy and Action Plan	0	0	1	2	1	1	2	1	1	2	2	2	2	2	2	2	2	1	2	1	1	30	1
Criteria and Indictors for Sustainable Forest Mgt.	1	0	2	2	1	1	0	0	1	2	2	2	2	2	2	2	2	0	2	2	2	30	1
National Environment Policy	0	1	1	2	1	1	0	1	1	2	2	2	2	2	2	2	2	1	2	1	1	29	2
National Forest policy	1	1	1	2	1	1	0	0	1	2	2	2	2	2	2	2	2	0	2	1	1	28	3
Game Act	1	1	0	2	0	0	2	0	0	2	2	1	1	0	2	2	2	0	0	1	0	19	4
Plant Control Act	0	0	0	1	0	0	2	0	2	1	1	0	0	2	0	0	0	0	1	0	0	10	5
Forest Preservation Act	0	0	0	1	0	0	0	1	1	0	0	1	1	1	0	1	1	1	0	0	0	9	6
National Trust Commission Act	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	1	1	0	0	1	0	8	7

The 21 Issues and elements of NTFPs:

1. Stakeholders involvement	7. Schedules of species	13. Status of policy	19. Scientific understanding
2. Economic incentives	8. Red data list	14. Impact of alien invasive species	20. Training
3. Existing gaps	9. Flora protection	15. Ethnobotanical surveys	21. Collaboration
4. Broad spectrum	10. Strategies for sustainable management	16. Trade chains	
5. Decentralisation	11. Commercialization and domestication	17. Valuation of NTFPs	
6. Sustainable management	12. Implementability	18. Integrated forest management	

Issue adequately addressed = 2; Issues inadequately addressed = 1; Issue not addressed = 0.

use values per household of selected edible and medicinal NTFPs (Table 4). Some households extract fewer edible NTFPs as compared to other households, particularly those that have reliable food aid programmes in the Shewula area in the Lubombo plateau. Some households extracted fewer medicinal NTFPs, particularly those that have easy access to modern medicines in the Siphofaneni area in the Lowveld. Households with a large number of unemployed members rely more heavily on NTFPs for medicines, foods, as well as rural household income than those with employed members. This was shown by the fact that reliance on NTFPs is low in the Shewula area where more household members are employed. Considering that over 70% of the population of Swaziland falls within rural poor (the unemployed), then the reliance on NTFPs is a huge subsidy to the Swaziland Government, as alluded to by Shackleton and Shackleton (2004) in the Republic of South Africa. The results of this study show the annual direct use values per household that are comparable to those reported by Hedge et al. (1996) from the Soliga households India, and High

Table 3. Use categories of NTFPs in Swaziland (goods and services).

Use category	Comments
Direct use	
1. Forest foods and drinks	Edible fruits, leaves, roots, buds, herbs, other edible portions that contribute to improving food security and nutritional status.
2. Forest medicines	Leaves, bark, fruits, roots, etc.
3. Thatching material	Different grasses used as roofing material.
4. Plant tannin and dyes	Plant dyes from bark and other parts, including vegetable tannin materials.
5. Household items and fibre products	Items made from indigenous forests found in households; include kitchen utensils, mats, sweepers, etc.
6. Handicrafts and fibre products	Everyday utensils, some also used in traditional ceremonies. Weapons such as knob sticks. Traded items made for tourists.
7. Animals and animal products	Ivory, trophies, bones, feathers, butterflies, live animals and birds and bushmeat, etc.
8. Fuelwood and charcoal	A major source of energy to both rural and urban households traded in large amounts throughout the country.
9. Other NTFPs	Spices, insect products, natural plant pigments, essential oils, incense wood, latex, plant gums, waxes, etc.
Indirect use	
10. Cultural ceremonies and rituals	Plants used in local and national ceremonies. Use of bird feathers in traditional gear, Plants and animals used as indicators, e.g. red chested cuckoo calling in the ploughing season.
11. Landscaping and ornamentals	Shade, windbreaks, garden plants, hedges, aesthetics. Improves the scenery.
12. Fodder and grazing	Trees, shrubs, grasses, and others that provide for livestock fodder.
13. Floral greenery	Ferns, wild flowers, herbs, etc.
Intermediate use services	
14. Tourism and recreation	Forests and trees provide habitats for animals and plants that attract foreign visitors and generate income. Useful in Biodiversity conservation.
15. Soil Fertility and soil conservation	Plant parts such as roots, leaves, fruits, bark, other, that contribute to soil stabilization and maintaining soil fertility.

Table 3. Contd.

16. Pollination services	Various insects; bees, beetles and other that contribute to crop production; including birds and bats.
17. Hydrological cycle and water conservation	Natural forests and woodlands play a crucial role in the water cycle and in water holding and circulation.
18. Other environmental services	Services such as oxygen production, acid rain deposition, carbon sequestration.

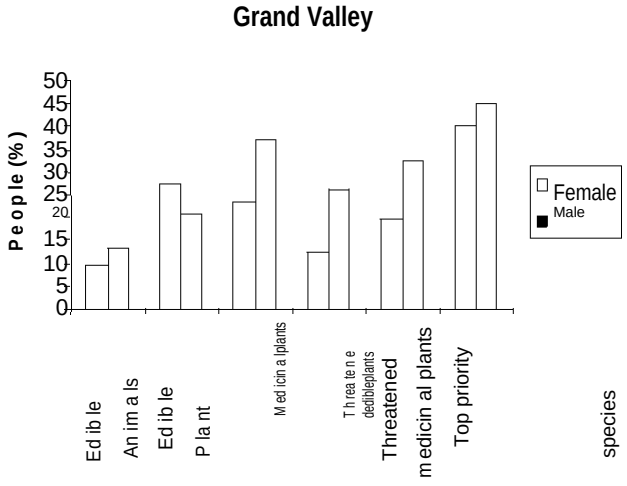

Figure 2. Graphical representation of the percentage responses of community representatives for the various product groups at Grand Valley area.

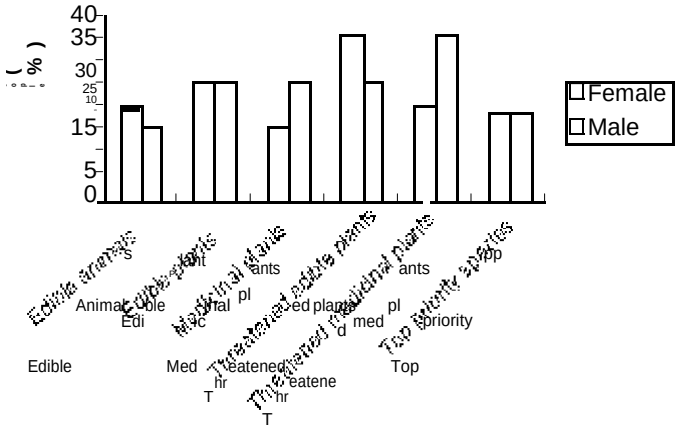

Figure 4. Graphical representation of the percentage responses of community representatives for the various product groups at Shewula Nature Reserve.

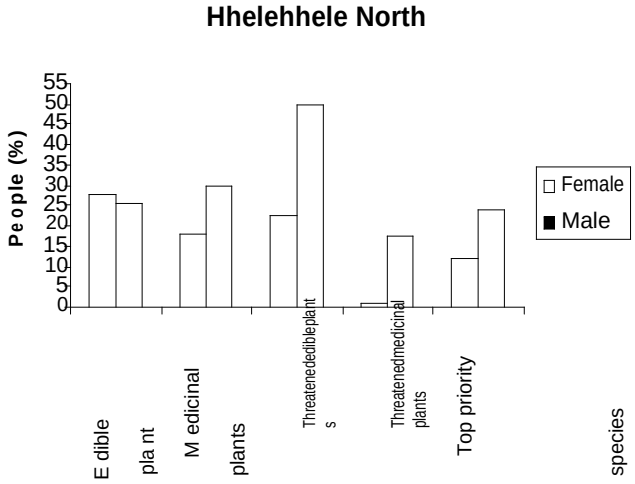

Figure 3. Graphical representation of the percentage responses of community representatives for the various product groups at Hhelehhele area.

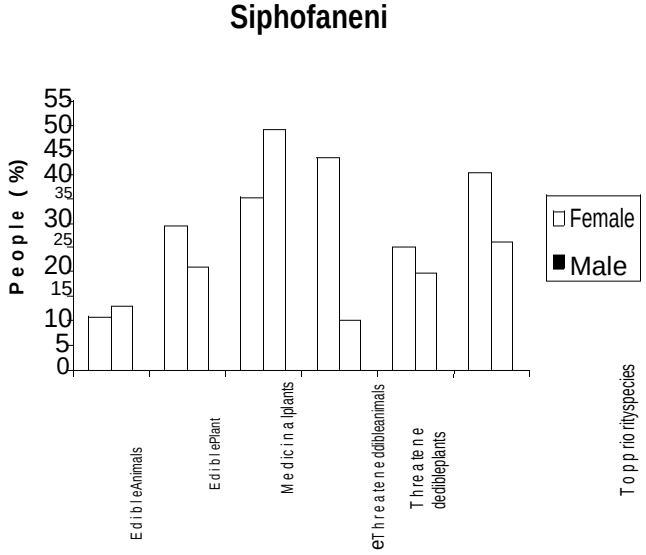

Figure 5. Graphical representation of the percentage responses of community representatives for the various product groups at Siphofaneni area.

Table 4. Combined ANOVA for User Surveys and Economic valuation in the various study sites.

Sources of variation	Hhelehhele North			Shewula			Siphofaneni			Grand Valley		
	Degrees of freedom	Mean squares	P-values	Degrees of freedom	Mean squares	P-values	Degrees of freedom	Mean squares	P-values	Degrees of freedom	Mean squares	P-values
Annual Quantities-Edibles												
Villages	1	94730.9	0.1700	1	28894.3	0.480	1	258316451.0	0.17	1	684210.17	0.450
Duration	2	2144800.4	<0.0001	3	323794.0	0.001	4	34293499.1	0.91	5	4051463.00	0.006
Villages × Duration	2	234789.0	0.0107	2	5393.5	0.910	1	42035186.6	0.58	3	149628.2	0.940
Annual Quantities-Medicinal												
Villages	1	0.2	0.873	1	44.8	0.005	1	12.7	<0.0001	1	551.9	<0.0001
Duration	4	18.2	0.070	4	24.8	0.002	8	10.0	<0.0001	4	1827.9	<0.0001
Villages × Duration	4	4.3	0.720	2	7.6	0.250	3	2.8	<0.0001	4	0.4	0.9600
Annual Values-Edibles												
Villages	1	773063.4	0.1900	1	126015.6	0.6200	1	2266113258.0	0.18	1	92592333.0	0.49
Duration	2	19242477.0	<0.0001	3	3583099.9	0.0003	4	296495866.0	0.91	5	332963035.0	0.13
Villages × Duration	2	2150924.0	0.0100	2	34227.3	0.9300	1	411554257.0	0.56	3	19389420.0	0.90
Annual Values-Medicinal												
Villages	1	4794.8	0.80	1	1000125.6	0.005	1	286166.7	<0.0001	1	12418691.4	<0.0001
Duration	4	410911.4	0.07	4	559886.7	0.002	8	225475.0	<0.0001	4	41127667.2	<0.0001
Villages × Duration	4	97929.7	0.72	2	172095.1	0.250	3	65117.5	<0.0001	4	9768.3	0.9600

Shackleton and Shackleton (2004) from South African rural households (Dlamini, 2007, 2010a, 20111; Dlamini and Geldenhuys, 2011a, b, d).

The NTFPs resource assessment and economic valuation in this study is a genesis of NTFPs inventory and valuation in Swaziland. This will forever be a benchmark for future NTFPs resource assessments and valuation studies. The previous GTZ national forest inventory of 1990 and the DANCED forest resource assessment of 1999 focused mainly on the distribution of woody species and there was no economic valuation at all. The sampling method used in this study yielded higher inventory values as compared to the NTFPs inventory studies by Peters et al. (1989) in the Amazonian rainforests, Balick and Mendelson (1992) in the Tropical forests and Robles-Diaz-De-Leon and Kangas (1999) in Maryland. The other reason for this, besides dif-ferences in forest types and species composition, could be that this study engaged smaller stratified sampling plots of 50 × 50 m (smaller than the conventional 1 ha), in order to include all the plant growth forms (trees, small tress, shrubs and under-story). Most of the other studies targeted only a certain growth form (e.g. trees, excluding shrubs and under-storey individuals).The assessment of NTFPs species distribution and estimation of the inventory values of the standing stock of NTFPs in the nominated natural forests and woodlands, showed relatively high economic values of the selected NTFPs.

The increased demand for NTFPs may result in uncontrolled over exploitation of NTFPs, leading to accelerated deforestation and immense forest degradation leading to disappearance and extinc-

Table 5. List of missing common/key species (according to available local literature and community consultations) in the inventory results across study sites.

Edible species	Medicinal species
Psalliota campestris	*Pittosporum viridiflorum*
Aloe maculata	*Drimia delagoensis*
Syzygium cordatum	*Schotia brachypetala*
Ficus sur	*Manilkara species*
Cephalanthus natalensis	*Harpephyllum caffrum*
Lannea discolor	*Encephalartos species*
Vangueria infausta	*Senecio rhyncholaenus*
Lantana rugosa	*Pterocarpus angolensis*
Berchemia zeyheri	*Maesa lanceolata*

Table 6. Species distribution in terms of number of individuals per species per category in the various natural forests and woodlands, from resource surveys.

Study area	Hhelehhele North	Shewula	Siphofaneni	Grand Valley
Landscape area	Highveld	Lubombo Plateau	Lowveld	Middleveld
Name of forest	Lufafa	Shewula Nature Reserve	Hlutse	Umtfumunye
Species total	18	18	12	34
Stems total	41	58	51	160
Categories	**Number of individuals (Number of species)**			
Edible plants	22 (7)	13 (8)	15 (6)	62 (15)
Medicinal plants	16 (11)	24 (11)	23 (6)	88 (26)
Multipurpose plants	3 (3)	21 (3)	13 (4)	10 (7)
Trees	21	31	35	62
Shrubs	11	12	11	26
Under-story	2	10	3	12
Other	7	5	2	60

tion of important NTFPs species in future (Table 5).

Even though the differences in the number of species was not statistical significant, they do show some variation. Umtfumunye Natural Forests and Woodlands, in the Middleveld, had the highest number of species, for both edible (15) and medicinal (26) NTFPs. The Shewula Nature Reserve, in the Lubombo Plateau had the highest number individual stems of multi-purpose plant species (21). Hlutse, in the Lowveld, had the lowest number of species (6 each) (Table 6). Overall, the findings of the study indicate that the natural forests and woodlands selected for the resource surveys are denuded or heavily depleted of the preferred tree species of edible and medicinal NTFPs. As a result, there were far too few trees per sampling plot and it is not possible to establish relative frequencies of tree species based on DBH and height. The findings of the inventory have shown that the Siphofaneni Woodlands in Hlutse had the highest number of individual stems per species per ha, while the Hhelehhele North Woodlands in Lufafa show the lowest population per ha; unit prices were variable. The highest inventory value came from Hlutse as well and the lowest from Lufafa. Annual yield was highest in Hlutse and lowest at Mtfumunye Woodlands in Grand Valley (Table 7). This could be attributed to the fact that the Siphofaneni site was fenced and entry is regulated and monitored (low deforestation), while in Grand Valley there is free entry into unfenced woodlands (high deforestation).

The results of the inventory and economic valuation indicated high significant differences in inventory value, yields and unit prices between the four nominated woodlands (Table 8). These values are relatively high despite the fast disappearance and extinction of top priority species as shown by the results of the inventory. Similar findings were gathered by Shackleton and Shackleton (2000) that extraction rates of several secondary forest resources are sustainable but not for more important or preferred ones like fuelwood, construc-

Table 7. Means for inventory and economic valuation in the various study sites.

Study area	Hhelehhele North	Shewula	Siphofaneni	Grand Valley
Landscape area	Highveld	Lubombo Plateau	Lowveld	Middleveld
Name of forest	Lufafa	Shewula Nature Reserve	Hlutse	Untfumunye
Number of species	18	18	12	34
Number of stems per species per ha	20.1	36.1	23.5	20.2
Inventory value per ha (US$)	230.8	785.2	852.0	510.0
Unit prices per species (US$)	7.6	12.0	11.5	14.6
Annual yield per ha (kg)	20.9	31.5	43.1	17.8

Exchange rate: 1 US$ is equivalent to R6.50 as at 2004 (Times of Swaziland, 2nd March, 2004).

Table 8. ANOVA for inventory and economic valuation in the various study sites.

Source of variation	**Degrees of freedom**	**Mean Squares**	**P-Values**
Number of stems per species	3	10464924.2	0.1100
Inventory Value per ha	3	229.1	0.0050
Unit prices per species	3	23843.7	0.0034
Annual yield per ha	3	587.1	0.0008

Exchange rate: 1 US$ is equivalent to R6.50 as at 2004 (Times of Swaziland, 2nd March, 2004).

tion wood and medicinal plants. An action programme for the rehabilitation of degraded forests and jungles is highly necessary, as part of the new National Forest Action Programme, to combat this potential environmental catastrophe.

CONCLUSIONS AND RECOMMENDATIONS

Based on the findings of the recent studies highlighted in this paper and previous studies cited in the text on the sustainable management of NTFPs, three broad issues were identified and a set of recommendations were made. These issues and recommendations are outlined as follows.

Issue 1

Lack of information on beneficial NTFPs for individual, community and national well-being as well as economic, ecological and social characteristics of NTFPs and their uses by decision makers, forest managers and resource users alike.

RECOMMENDATIONS

Strengthen government efforts to conduct research. Compile and disseminate information and statistics to key stakeholders on NTFPs resources and their socio-economic and ecological values. Also, government and development agencies should support education and public awareness programmes for NTFPs conservation and sustainable use.

Issue 2

The current lack of protected rights to access and benefit from NTFPs resources can adversely affect their conservation and sustainable use and discourage investment in the resource.

RECOMMENDATIONS

Government, with assistance from concerned agencies and organizations, should 1) develop and implement policies and legislation to provide secure access and benefits for the people whose livelihoods are dependent on or supplemented by NTFPs; and 2) ensure that stakeholders, particularly collectors, growers and traders are provided incentives to sustainably manage NTFPs resources.

Issue 3

Individuals, communities and institutions generally lack the technical, financial, political and social capacity to influence policies and generate information necessary to manage and monitor NTFPs resources effectively.

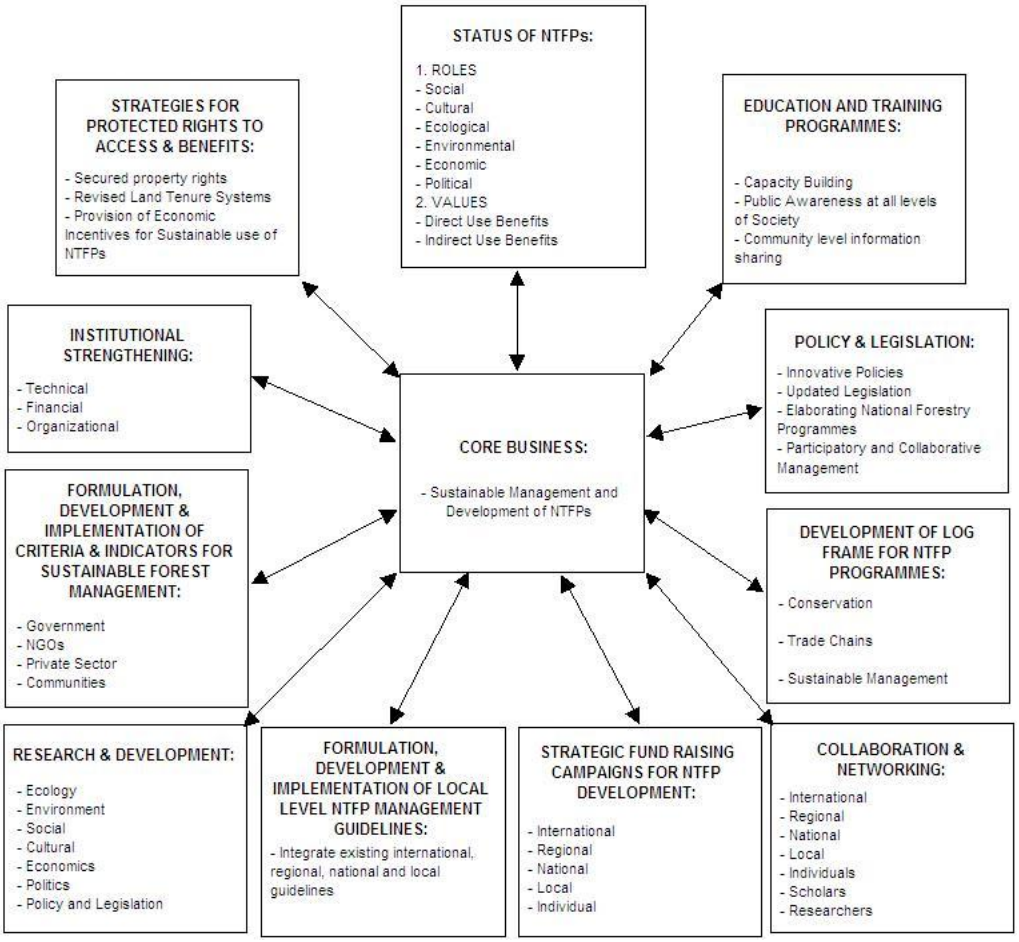

Figure 6. A Conceptual framework towards sustainable management and development of NTFPs (Dlamini, 2007).

RECOMMENDATIONS

Government, with assistance from concerned agencies and organizations, should support programmes and projects to build individual, institutional and community-based capacity to manage NTFPs through active participation of stakeholders. Government and research agencies should give priority to research and the development and dissemination of management practices to be integrated into multi-purpose forest and agro-forestry resource management.

The theoretical framework for the sustainable management of NTFPs

Based on the research findings, these studies made policy recommendations for the development of a new theoretical framework for the sustainable management of NTFPs at the local, national, regional and international levels. This theoretical framework is divided into a set of eleven strategies. These are:

1. Information and social communication;
2. Secure rights and access to products from natural forests and woodlands;
3. Adoption of innovative policies, revising and updating legislation and elaborating National Forestry programmes;
4. Development and implementation of national level criteria and indicators for sustainable forest management;
5. Project planning and control techniques;
6. Local level guidelines for sustainable NTFPs management;
7. Conservation and financing mechanisms;
8. Collaboration and networking between all institutions involved in research and development of NTFPs;
8. Institutional strengthening and capacity building;
10. Education and training at all levels of community structures;
11. Research and Development.

A detailed schematic presentation of the proposed theoretical framework is given in Figure 6.

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