Questionnaires Do Not Work! A Comparison of Methods Used to Evaluate the Structure of Buildings and Wood Used in Rural Households, South Africa

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Research

Abstract

The level of hardwood utilisation for house building was evaluated in a rural community of Maputaland, KwaZulu-Natal, South Africa. A full inventory of 42 households in that community was conducted, followed by a questionnaire survey coupled with a partial inventory of the same households. It was expected that the questionnaire design would be greatly improved by the prior survey, and that similar quantitative results could be obtained. The results show that despite a careful design, the questionnaires and coupled partial inventories provided significantly different results, thus placing considerable doubts on any research solely based on questionnaire results without proper ground proofing. The reasons for such differences are unclear. The main advantage of the questionnaire survey resided in the qualitative insight it offered for the analysis of the data.

Introduction

Maputaland harbours a rich range of rare and endemic, plant and animal species (Kirkwood & Midgley 1999, Mucina *et al*. 2003, Scott-Shaw 1999, van Wyk 1996, van Wyk & Smith 2001), and is recognized as an IUCN Centre of Plant Endemism (van Wyk & Smith 2001). It forms part of the Maputaland-Pondoland-Albany region, which has recently been identified as one of the nine new global biodiversity hot spots (Roach 2005). However, the survival of many of Maputaland's endemic plant species is threatened by the rapid expansion of the human population and the associated demand for firewood, building materials, medicinal plants, as well as land for agriculture and cattle grazing (Lawes & Obiri 2003).

The Maputaland region is therefore a conservation priority and forest and woodland management strategies based on sustainable utilisation are urgently needed. To design such sustainable harvesting strategies demand has to be matched with supply. This in turn can only be achieved if reliable information on the size and ecology of the resource base as well as current levels of wood removal by the local people are available (Lawes & Obiri 2003).

One of the methods most often employed by researchers as a source of information on how much the local people utilise the vegetation is questionnaires about the targeted species and the volumes of wood extracted for building and fuel. Another way to evaluate the use of the vegetation is to physically measure the utilized species *in situ* in the households. In this manner the targeted species are identified and the total volumes of wood utilized can be calculated to provide forest managers an estimate of the potential needs. Questionnaires are usually selected if time and resources are of essence (Godoy & Lubowski 1992, Gunatilake *et al*. 1993, Hall & Bawa 1993). How-

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ever, informant accuracy is often questionable in these types of surveys and needs to be addressed (Bernard *et al*. 1984). The questionnaire survey method is therefore fraught with controversy with regards to the quality and the meaning of the results produced for quantitative and qualitative information (Powe *et al*. 2005).

The focus of this study is on the rural community of Manqakulane, which lies at the heart of the Maputaland Center of Endemism (Figure 1). This rural community established the Tshanini Game Reserve on their land in 2000, and they have envisaged the sustainable utilisation of the natural renewable resources contained within. The main forms of utilisation will consist of firewood collection, the extraction of poles, beams and laths for the constructions of houses by villagers, as well as the gathering of medicinal plants by traditional healers. A management plan, based on the principle of sustainable utilisation of natural resources, is presently being developed for the Tshanini Game Reserve. The supply of renewable natural resources has been established by Gaugris (2004), in this paper the demand for wooden construction material is evaluated.

In the present study, three methods are used to obtain an estimate of the current level of natural resource utilisation. Firstly, conventional questionnaires were used to obtain information of a descriptive nature. Secondly, the questionnaires were partially validated by a limited *in situ* inventory and thirdly, a full validation of the resource use was done in a fully representative *in situ* inventory. The aims of the present paper are to present the scope of the different methods if both descriptive and quantitative information is required. The results obtained by the differ-

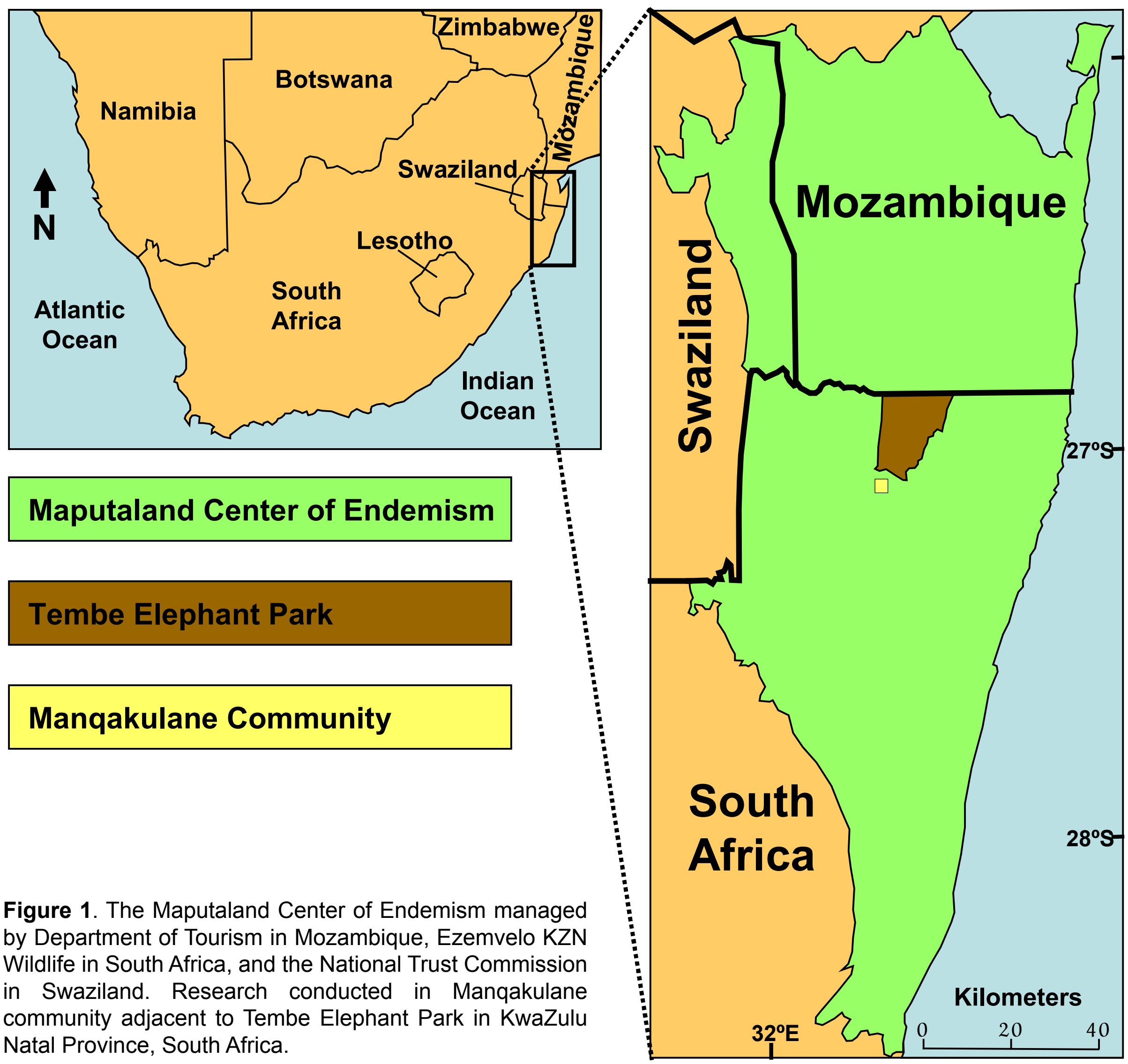

Figure 1. The Maputaland Center of Endemism managed by Department of Tourism in Mozambique, Ezemvelo KZN Wildlife in South Africa, and the National Trust Commission in Swaziland. Research conducted in Manqakulane community adjacent to Tembe Elephant Park in KwaZulu Natal Province, South Africa.

ent methods are compared and the confidence with which they can be incorporated into models of sustainable utilisation of renewable natural resources is evaluated.

Study area

At the time of the study in 2003, the land of the rural community of Manqakulane (centered at 27° 7' 5.9" S, 32° 24' 8.6" E) covered approximately 5 000 ha of which 2420 ha formed the Tshanini Game Reserve (Gaugris *et al*. 2004). Topographically the area mainly consists of a sandy plain that is interspersed with ancient littoral dunes with the Muzi swamp running along the eastern boundary (Matthews *et al*. 2001). The vegetation consists of open to closed woodland with patches of short to tall Sand Forest (Gaugris *et al*. 2004).

Approximately 800 people lived in the community in 2003. This population was spread out on the eastern portion of the community land where a safe water supply had been installed. The Manqakulane community lived in 110 households with each household containing from one to 13 structures (buildings) utilized for different purposes (Gaugris 2004). The community of Manqakulane is ruled by a local **iNduna** representing the king (**iNkosi**) of the Tembe Tribal Area. The households are dispersed in the forest around the Muzi swamp and broadly follow a north to south axis along the water line (Gaugris 2004).

Unemployment in the community is high and the income per household is low. Subsistence farming is a reality for the community people and reliance upon natural resources directly available in the surrounding environment is important. Wood is a main resource that is utilized for fire, house construction, and the manufacturing of tools for the household. Wood is also utilized by local artists to manufacture an assortment of music instruments, carvings and curios (Gaugris 2004).

Methods

Full in situ field inventory

For the full *in situ* inventory, all the households in the Manqakulane community were mapped by means of a Global Positioning System (GPS) and their building composition and structure recorded. These data were used by the Department of Statistics of the University of Pretoria, Pretoria, South Africa, to select 42 households in a stratified random manner for the *in situ* sampling.

In situ sampling involved a full inventory of all the buildings in a household. The basic measurements of the building were recorded and additional information about the building's basic specifications such as the numbers and sizes of doors and windows, the type of roof, the age and condition of the construction was documented. The main elements, i.e. main poles, main beams, roof laths and wall laths for a minimum wall-area of 4 m^2, in each building were further documented. For each item, the plant species was identified with the help of a trained assistant and the house builder, and the diameter and length of the piece of wood were recorded. No voucher specimens were collected so the data is based upon a combination of the house builders recognition of wood species and the researchers ability to correlate these with scientific species. Some social information about the function of the building and number of people sleeping in it were also noted. The full methodology and results are presented in Gaugris (2004).

Questionnaire

A questionnaire was designed with the combined help of the Department of Anthropology and the Department of Statistics of the University of Pretoria. The same households as those covered by the field inventories were selected for the questionnaire survey as it was hoped that the two methods would complement each other and would provide the opportunity to compare the results obtained with the different methods. The methodology implied visiting the people in their households. A young man from the community was trained to become the interviewer and to conduct the surveys in the local Zulu language as opposed to translating from the English language. Eight trial questionnaires were conducted to insure that the interviewer was fully conversant with the nature of the questions and was able to explain it to local people in a satisfactory manner. These trial questionnaires are not included in the present analysis.

For each site, the head of the household was greeted and his assistance requested. The purpose of the questionnaire was presented and each question was fully explained in Zulu before the answer was noted. The questionnaire queried the opinions of the various households about preferred materials, house building and recent changes in the vegetation. Once the questionnaire was completed, the head of the household was thanked for his help and saluted before leaving.

Partial validation of questionnaires by a limited in situ inventory

Special attention was paid to obtaining quantitative data on the natural resources utilisation, in addition to the data of a social nature. Therefore the questionnaire survey involved a limited inventory of the resources used for the building construction, subdivided in the same elements as for the field inventories. For the questions of a quantitative nature, the nearest available building made of wood in the visited household was used as an example and the head of the household was asked to identify the wood and to count and measure the elements. The full methodology and results are presented in Gaugris (2004).

Data analysis

The data from both the inventories and questionnaires were recorded in Microsoft Excel spreadsheets and analyzed by using the SAS® program (SAS® Version 8.2, SAS institute, SAS campus drive, CANY, NC 27513, U.S.A.). The data from the full inventory were analyzed by building type, structure type and element type. A mathematical model was developed to virtually rebuild the various building structures from the data collected and to evaluate quantities of natural material involved in the construction. The data were then analyzed to provide information per building type, per structure type and per element type as well as per species and size class, as well as to provide a model building representing the mean values for each criteria.

Species choice for building houses (general)

In the questionnaires, respondents were asked two questions on species selection: a) the species used most when building a house and b) the least preferred species when building a house. A list of species was compiled to answer both questions. The favored wood species were ranked from best to worse by using the people's own description and opinion of the wood species. The least favored species are ranked from worse to somewhat acceptable. The species lists obtained from the full and partial field inventories were classified following a ranking by decreasing order from the most utilized species to the least used one overall.

To compare the ranking orders obtained for the various species between the three methods a weighted scale was used. If a species is ranked equally between the two methods, it was given a score of 1.00. If a species is ranked differently but positions are only changed by +/- 1 position, a score of 0.75 was given. For +/- 2 positions difference a score of 0.50 was given, for +/- 3 positions difference a score of 0.25 was given, and for a difference of 4 and more positions a score of zero was given. The score were then represented as the percentage of the questionnaire survey species or partial inventory species that matched the ranking obtained in the full *in situ* inventory survey. The species match was expressed as the number of species found in common between two survey types. The number of species found in the other survey was expressed as a percentage of the total of species found.

Species choice for building houses (element specific)

The questionnaire coupled partial inventory was designed to answer similar questions as the full inventory, and especially to obtain information of a quantitative nature in addition to the descriptive social information normally obtained. The partial inventory evaluated the house-building situation by looking at the various main elements (main pole, main beam, wall lath), in the same manner as the full inventory did. In the questionnaire coupled partial inventory, counting the elements and the identification of the species used was the responsibility of the head of the household, rather than that of the researcher and his assistant as was the case during the full inventory. Lists of species were compiled per building element for both the partial and full inventories and ranked by decreasing order from the most to the least used in terms of frequency of utilisation.

Unfortunately, roof laths were not investigated in the partial inventory as it proved difficult to explain the idea to the respondents and the aspect had to be abandoned altogether. Intruding on the people's privacy by entering houses was considered un-ethical and was avoided. It was however, possible for the researcher to evaluate the roof laths in the full *in situ* inventory by investigating the roof overhangs and measuring the spacing between roof laths and identifying the species used from the outside. By mathematical modelling it was afterwards possible to evaluate the quantities of wood used and the species utilized. Ranking order differences and species match between surveys were calculated as described above.

House shape, wall material, mean number and mean diameter of elements

The proportion of houses of various shapes, wall and roof material were compared between the partial and full inventories by using chi square tests on the absolute frequencies. For the houses not made of bricks, a further comparison was made to evaluate differences between the two methods in describing the proportions of various wall types. Another two comparisons were made by using t-tests of paired samples for mean to evaluate differences in mean number and mean diameter of elements (main poles, main beams, wall laths) between the two methods, but restricted to houses not made of bricks and with walls made of wood or wood and mud.

Estimated volume of wood used in the community by using mean data

To finalise the present study the volume of wood currently standing in the wood and mud walls and wooden wall houses was estimated for the 110 households identified in the community by using the mean data from the partial and full inventories respectively and the results are compared.

Results

The complete analysis of results from the full *in situ* inventory and questionnaire surveys are presented in detail in Gaugris (2004) and Gaugris and van Rooyen (submitted) respectively. They are therefore not repeated here and only those results that are relevant and necessary to the present comparison of the methods are incorporated. A total of 42 households were sampled by means of the full inventory, and only 33 households responded to the questionnaire interviews and coupled partial inventory survey. The lower response to the questionnaires was attributed to the fact that people from the community did not fully understand the need to realize both surveys.

Species choice for building houses: general

The list of favored plant species drawn up for all three surveys does not discriminate which woody species are used in a particular part of the house building process (Table 1). However, even in its restricted scope, it clearly portrays the limitations of the questionnaire approach as opposed to the full field inventory. In terms of frequency of utilisation, according to the questionnaire surveys, the species *Brachylaena huillensis*, *Ptaeroxylon obliquum*, *Cleistanthus schlechteri*, *Newtonia hildebrandtii* and *Hymenocardia ulmoides* account for 86.79% of the people's answers. These species are clearly the most sought after species and therefore they should also be the most utilized species. However, from the full field inventory it appears that the five most utilized species by number of elements are *Catunaregam spinosa*, *Grewia microthyrsa*, *Erythroxylum delagoense*, *Hymenocardia ulmoides* and *Drypetes arguta*, but by volume of wood, the most utilized species are *Catunaregam spinosa*, *Brachylaena huillensis*, *Hymenocardia ulmoides*, *Grewia microthyrsa* and *Ptaeroxylon obliquum*. Furthermore, in terms of number of elements, the first five species represent only 50.31% of all elements used, and in terms of volume of wood, the first five species represent only 45.74% of the total wood utilized. It is also interesting to note that according to the field inventory *Cleistanthus schlechteri* is only rarely used, and ranks in 36th position in terms of number of elements used, accounting for only 0.42% of the wood used (although by volume it is in 11th position with 2.21% of the total volume of wood used), as opposed to its ranking in the question-

Table 1. The most utilised hard wood species and their percentage of utilization (based on frequency of utilization, for the full inventory, a classification by volume of wood utilised is also given) in rural households of the Manqakulane community, according to the three different surveys conducted in that community, in KwaZulu-Natal, South Africa, in 2003.

Survey	Questionnaire		Partial inventory		Full inventory			
Taxa	Utilization frequency		Utilization frequency		Utilization frequency		Wood volume used	
	No	%	No	%	No	%	No	%
Acacia burkei Benth.					67	0.09	49	0.23
Acalypha glabrata Thunb.					54	0.20	57	0.12
Acacia nilotica (L.) Del.					69	0.07	72	0.04
Albizia versicolor Welw. ex Oliv.					82	0.00	86	0.01
Ancylanthos monteiroi Oliv.					34	0.52	45	0.32
Antidesma venosum E. Mey. ex Tul.					25	0.92	31	0.59
Balanites maughamii Sprague					82	0.00	81	0.02
Brachylaena elliptica (Thunb.) DC.			25	0.42	13	1.71	20	1.06
Brachylaena huillensis O. Hoffm.	1	34.72	1	12.71	7	2.75	2	11.11
Bridelia cathartica Bertol.f. subsp. *cathartica*					10	1.90	18	1.16
Burchelia bubalina (L.f.) Sims.					39	0.39	48	0.24
Canthium suberosum Codd					69	0.07	72	0.04
Cassine aethiopica Thunb.					59	0.13	61	0.09
Catunaregam spinosa (Thunb.) Tirvengadum subsp. *spinosa*			7	5.51	1	19.54	1	12.35
Clausena ansata (Willd.) Hook. f. ex Benth.			16	1.69	16	1.51	25	0.94
Cleistanthus schlechteri (Pax) Hutch. var. *schlechteri*	3	11.40	6	5.93	36	0.42	11	2.21
Clerodendrum glabrum E. Mey.			21	0.85	13	1.71	20	1.06
Cola greenwayi Brenan			11	2.54	28	0.74	34	0.56
Combretum molle R.Br. ex G. Don	11	1.04			53	0.21	53	0.19

Survey	Questionnaire		Partial inventory		Full inventory			
Taxa	Utilization frequency		Utilization frequency		Utilization frequency		Wood volume used	
	No	%	No	%	No	%	No	%
Croton pseudopulchellus Pax	13	0.78			59	0.13	61	0.09
Croton steenkampianus Gerstner					82	0.00	87	0.00
Dalbergia obovata E. Mey					59	0.13	63	0.08
Deinbolia oblongifolia Brenan Brummitt			25	0.42	59	0.13	63	0.08
Dialium schlechteri Harms					19	1.25	17	1.20
Dichrostachys cinerea (L.) Wight & Arn.			20	1.27	11	1.77	19	1.10
Diospyros inhacaensis (E. Mey. ex Arn.) Radlk.	9	1.81	5	6.36	24	0.97	16	1.32
Drypetes arguta (Muell. Arg.) Hutch.	11	1.04	13	2.12	5	5.00	9	3.19
Ehretia obtusifolia Hochst. ex DC.					69	0.07	71	0.05
Erythrophleum lasianthum Corbishley					82	0.00	81	0.02
Erythroxylum delagoense Schinz.			13	2.12	3	7.44	6	5.45
Euclea natalensis A. DC. subsp. *natalensis*			25	0.42	40	0.38	33	0.57
Grewia caffra Meisn.			25	0.42	69	0.07	72	0.04
Grewia inaequilatera Garcke					54	0.20	57	0.12
Grewia microthyrsa K. Schum. ex Burret			10	4.24	2	11.84	4	7.41
Grewia monticola Sond.					29	0.73	37	0.47
Haplocoelum gallense (Engl.) Radlk.			21	0.85	47	0.28	43	0.34
Hymenocardia ulmoides Oliv.	5	4.40	2	9.32	4	6.49	3	7.53
Hyperacanthus microphyllus (K. Schum.) Bridson					59	0.13	63	0.08
Lagynias lasiantha (Sond.) Bullock					80	0.01	81	0.02
Leptactina delagoensis K. Schum.					82	0.00	81	0.02
Manikara concolor (Harv. ex C.H. Wr.) Gerstn					58	0.18	35	0.52
Manikara discolor (Sond.) J.H. Hemsl.			25	0.42	80	0.01	70	0.07
Margaritaria discoidea (Baill.) Webster var. *discoidea*					49	0.26	54	0.17
Maytenus senegalensis (Lam.) Exell					69	0.07	72	0.04
Memecylon sousae A. & R. Fernandes					82	0.00	87	0.00
Monanthotaxis caffra (Sond.) Verdc.			25	0.42				
Monodora junodii Engl. & Diels					9	2.43	15	1.52
Newtonia hildebrandtii (Vatke) Torre var. *hildebrandtii*	4	10.10	21	0.85	79	0.04	41	0.42
Ochna arborea Burch. ex DC. var. *arborea*	14	0.26	25	0.42	21	1.14	26	0.88
Ochna barbosae Robson					59	0.13	63	0.08
Ochna natalitia (Meisn.) Walp.					69	0.07	72	0.04
Pavetta spp.					82	0.00	87	0.00
Pavetta schumanianna F. Hoffm. ex K. Schum.					69	0.07	78	0.04
Phyllanthus reticulatus Poir.					54	0.20	57	0.12

Survey	Questionnaire		Partial inventory		Full inventory			
Taxa	Utilization frequency		Utilization frequency		Utilization frequency		Wood volume used	
	No	%	No	%	No	%	No	%
Plectroniella armata (K. Schum.) Robyns			25	0.42	8	2.50	14	1.60
Psydrax locuples (K. Schum.) Bridson			16	1.69	12	1.76	12	2.05
Psydrax obovata (Eckl. & Zeyh.) Bridson subsp. *obovata*	8	2.07	9	4.66	6	4.34	8	3.67
Ptaeroxylon obliquum (Thunb.) Radlk.	2	26.17	3	8.47	15	1.62	5	7.34
Pteleopsis myrtifolia (Laws.) Engl. & Diels			25	0.42	40	0.38	32	0.58
Rhus gueinzii Sond.			21	0.85	17	1.35	22	1.00
Rothmania fischeri (K. Schum.) Bullock					38	0.40	46	0.27
Salacia leptoclada Tul.			25	0.42	18	1.32	27	0.82
Sapium integerrimum (Hochst.) J. Léonard					46	0.28	47	0.26
Schotia brachypetala Sond.					83	0.00	81	0.02
Spirostachys africana Sond.	7	2.33	16	1.69	49	0.26	10	2.31
Strychnos gerrardii N.E.Br.					26	0.79	36	0.51
Strychnos madagascariensis Poir.			25	0.42	33	0.59	42	0.37
Strychnos spinosa Lam.					69	0.07	72	0.04
Suregada zanzibariensis Baill.			25	0.42	32	0.66	40	0.43
Tabemaemontane elegans Stapf					82	0.00	87	0.00
Tarenna junodii (Schinz) Brem.					49	0.26	55	0.16
Tarenna littoralis (Hiern) Bridson					44	0.33	51	0.21
Tecoma capensis (Thunb.) Spach					69	0.07	79	0.04
Terminalia sericea Burch. ex DC.	6	2.59	16	1.69	27	0.78	7	4.99
Thespesia acutiloba (Bak. f.) Exell & Mendonça							72	0.04
Toddaliopsis bremekampii Verdoorn			25	0.42	49	0.26	55	0.16
Tricalysia capensis (Meisn.) Sim					59	0.13	63	0.08
Tricalysia lanceolata (Sond.) Burtt Davy					22	1.11	29	0.68
Trichilia emetica Vahl					68	0.07	63	0.08
Umnukelambeiba					54	0.20	57	0.12
Uvaria caffra E. Mey ex Sond.					31	0.72	39	0.44
Vepris lanceolata (Lam.) G. Don					23	0.98	30	0.62
Vitex amboniensis Guerke					30	0.72	38	0.45
Wrightia natalensis Stapf			13	2.12	35	0.50	24	0.95
Xylotheca kraussiana Hochst.					59	0.13	63	0.08
Zanthoxylun capensis (Thunb.) Harv.			11	2.54	48	0.27	49	0.23
Zantoxylum leprieuri Guill. & Perr.					44	0.33	52	0.20
Ziziphus mucronata Willd. subsp. *mucronata*			25	0.42	43	0.35	44	0.33
Gumpole	10	1.30	3	8.47	42	0.36	13	1.78
Plank			7	5.51	36	0.42	23	0.96
Reeds					20	1.18	28	0.72

naires as third preferred species and 11.40% of the number of elements used. *Newtonia hildebrandtii* is a similar, although even more extreme, case. It is highly valued by the people, but in fact hardly ever used.

From the partial inventory, the species *Brachylaena huillensis*, *Hymenocardia ulmoides*, Gumpoles, *Ptaeroxylon obliquum* and *Diospyros inhacaensis* are the five most used species, accounting for 45.33% of the total, while *Catunaregam spinosa*, the most used species by number of elements and volume of wood used according to the full *in situ* field inventory only ranks seventh with 5.51% of the total.

Table 2 shows the match in ranking and in terms of species listed between the various surveys. While rank matching is best between questionnaires and full inventories, it remains well below 50%, and below 10% between the questionnaires and full inventories and between the partial and full inventories. Most species mentioned in the questionnaires and identified in the partial inventories are found in the species list of the full inventory. However the species lists drawn from the questionnaires and partial inventories are much shorter than that of the full field inventory, the latter shows that a wide range of materials are used, while the other two show only a limited sample of the range of natural resources utilized.

Species choice for building houses: element specific

Comparison of the lists of species per element type drawn up from the partial and full inventory, shows that active involvement of the people in the household during the survey offers a much-improved picture of the use of woody species in house building (Table 3). The full list of species identified for each building element is presented in

Table 2. A results comparison between the three surveys, in terms of most utilized hard wood species (frequency of utilization) in the Manqakulane community, KwaZulu-Natal, South Africa, in 2003.

Comparison between questionnaire and partial surveys	**(%)**
Rank matching questionnaire / partial	23.21
Match of species questionnaire / partial	85.71
Match between species partial / questionnaire	36.84
Comparison between partial and full surveys	**(%)**
Rank matching partial / full	5.92
Match of species partial / full	97.37
Match of species full / partial	42.22
Comparison between questionnaire and full surveys	**(%)**
Rank matching questionnaire / full	8.93
Match of species questionnaire / full	
Match of species full / questionnaire	

Table 3. Comparison of surveys in terms of building elements species choices, between the partial and full inventories, as established by visual identification on the houses of households in the Manqakulane community, northern Maputaland, KwaZulu-Natal, South Africa, in 2003.

Comparison between partial and full surveys		**Number of species counted**	
Main Poles	(%)	Partial	Full
Rank matching partial / full	50.00	15	50
Match of species partial / full	100.00		
Match of species full / partial	30.00		
Main Beams			
Rank matching partial / full	23.68	19	57
Matchi of species partial / full	94.74		
Match of species full / partial	31.58		
Roof Laths			
Rank matching partial / full	27.08	24	84
Match of species partial / full	100.00		
Match of species full / partial	28.57		

Table 4. The least desired species for house building according to a questionnaire survey in the community of Manqakulane, KwaZulu-Natal, South Africa, in 2003.

Worse to average ranking	**Less favored species in increasing order**	**(%)**
20	*Afzelia quanzensis*	0.31
19	*Cassine aethiopica*	0.92
17	*Haplocoelum gallense*	1.22
	Ochna arborea	1.22
14	*Balanites maughamii*	2.14
	Drypetes arguta	2.14
	Hymenocardia ulmoides	2.14
13	*Euclea natalensis*	2.45
12	*Sclerocarya birrea*	2.75
10	*Tabenaemontane elegans*	3.06
	Terminalia sericea	3.06
9	*Strychnos madagascariensis*	3.67
8	*Psydrax locuples*	3.98
6	*Strychnos spinosa*	4.28
	Acacia burkei	4.28
5	*Spirostachys africana*	4.59
4	*Cleistanthus schlechteri*	5.20
3	*Dialium schlechteri*	8.26
2	*Diospyros inhacaensis*	11.93
1	*Pteleopsis myrtifolia*	32.42

Appendix I. In terms of main poles, there is a 50% ranking match between the partial and full inventories. For the main beams and wall laths, ranking match is 23.68% and 27.08% respectively. The main advantage of questionnaires that could be identified was in establishing a list of least favored species based on personal preferences (Table 4). According to people's opinions, the species *Afzelia quanzensis*, *Cassine aethiopica*, *Haplocoelum gallense*, *Ochna arborea* and *Balanites maughamii* are the five worse wood species. It was not possible to determine this through the field inventories.

House shape, wall material, and mean number and mean diameter of elements

The partial and full inventory surveys provided statistically different answers when examining the proportions of house shapes by wall material and roof material (Table 5). However, there were no statistically significant differences between the proportions of wall types in house made of brick derived by the two methods (rectangular or square houses (Table 6).

Both surveys showed that walls of wood and mud predominate in the construction of houses. In the case of the mean number of elements for houses of various shapes and roofing material but with walls made of wood and mud (Table 7), there was a significant difference between the two methods. In general, the partial inventory overestimated the number of elements compared with the full inventory. The mean diameters of the elements in houses of different shapes and roof types (Table 8) also differed significantly between the two methods. Once again mean di-

Table 5. Comparison of the proportion of house shapes by wall type and roof type between the partial and full inventory surveys in the community of Manqakulane, northern Maputaland, KwaZulu-Natal, South Africa, in 2003.

			Partial invetory		Full inventory	
House shape	**Wall material**	**Roof material**	**Frequency**	**(%)**	**Frequency**	**(%)**
Square	brick	Corrugated iron	6	4.48	28	7.05
	brick	Thatch	0	-	2	0.50
Round	brick	Corrugated iron	1	0.75	0	-
	brick	Thatch	0	-	1	0.25
Square or rectangular	wood	Corrugated iron	62	46.27	153	38.54
	wood	Thatch	33	24.63	96	24.18
	reed	Corrugated iron	0	-	35	8.82
	reed	Thatch	0	-	2	0.50
Round	wood	Corrugated iron	3	2.24	0	-
	wood	Thatch	29	21.64	65	16.37
	reed	Thatch	0	-	15	3.78
Total			134	100.00	397	100.00

Significant difference X^2 = 18.85; df = 10; P < 0.05

Table 6. Comparison of the proportion of houses with the various wall types between partial and full inventories in the community of Manqakulane, northern Maputaland, KwaZulu-Natal, South Africa, in 2003.

House shape	**Rectangular**				**Round**			
Survey	**Partial inventory**		**Full inventory**		**Partial inventory**		**Full inventory**	
Wall type	**Frequency**	**(%)**	**Frequency**	**(%)**	**Frequency**	**(%)**	**Frequency**	**(%)**
Bricks	6	4.48	30	7.56	1	0.75	1	0.25
Wood poles	4	2.99	5	1.26	1	0.75	3	0.76
Wood & mud	49	36.57	131	33.00	18	13.43	42	10.58
Wood & cement	17	12.69	91	22.92	2	1.49	18	4.53
Wood & stone	12	8.96	22	5.54	0	-	2	0.50
Reeds	15	11.19	37	9.32	9	6.72	15	3.78
Total	103	76.87	316	79.60	31	23.13	81	20.40
	No significant difference x^2=5.12; df=5; P>0.05				No significant difference x^2=3.28; df=5; P>0.05			

Table 7. Comparison of the mean number of elements used in the various house shapes of buildings made with wood and mud walls, between the partial and full field inventory surveys in the community of Manqakulane, northern Maputaland, KwaZulu-Natal, South Africa, in 2003.

House type	Roof type	Element type	Partial inventory (mean no of elements)	Full inventory (mean no of elements)
Rectangular	Corrugated iron	Main poles	19	18
		Beams	7	4
		Roof laths	-	4
		Wall laths (1 panel)	86	92
	Thatched	Main poles	19	17
		Beams	22	25
		Roof laths	-	79
		Wall laths (1 panel)	86	55
Square	Corrugated iron	Main poles	19	13
		Beams	7	2
		Roof laths	-	3
		Wall laths (1 panel)	86	50
	Thatched	Main poles	19	16
		Beams	22	22
		Roof laths	-	66
		Wall laths (1 panel)	86	56
Round	Thatched	Main poles	17	17
		Beams	22	21
		Roof laths	-	77
		Wall laths (1 panel)	86	59

Significant difference (excl. roof laths) $t=2.42$; $df=14$; $P<0.01$

ameters were in general smaller in the full inventory than in the partial inventory.

Estimated volume of wood used in the community by using mean data

The estimated volume of wood used in the wood and mud walls and wooden wall houses of the community's 110 identified households was estimated at 104.08 m^3 and 65.80 m^3 by using the house shape and roof information and mean of measurements obtained through the partial inventories and full inventories respectively (Table 9).

Discussion

In the present study, the full *in situ* inventory was thorough and based on a statistically substantiated sample (Gaugris 2004). It was therefore used as the expected reference against which the questionnaire and partial inventory were compared. The full field inventory was also conducted before the questionnaire survey. The questionnaire design could therefore benefit from the previously conducted full inventories, which provided a clear picture of the nature of the information required to make the two studies comparable. This increased awareness of the target population and target information, coupled with statistically approved sample size, pre-testing of the methodology and appropriateness of the survey method were expected to provide similar data in a much more efficient time frame. However, despite this greatly improved and favorable design, it was clear that based on the results from the questionnaire and partial inventory, the planning and conservation efforts of any project catering for the sustainable utilisation of renewable natural resources would address the wrong aspects and obtain a skewed representation of the current situation. The number of significant differences between the two methods would seriously question the results of a model solely based on data obtained through questionnaires or partial inventories. The latter is highlighted in the last comparison (Table 9), where it is clear that results from partial inventories lead to a serious over estimation of the current volume of wood utilized in households of the community of Manqakulane.

However, the questionnaires provided information of a qualitative nature that could not have been derived from analyzing the quantitative results, especially when favored or least favored species are described. In Table 4, the species *Drypetes arguta* and *Hymenocardia ulmoides* are among the least favored species, but they figure prominently in the results from the field inventories. This type of qualitative information allows the researchers to suggest the hypothesis that although the wood is not appreciated, it is possibly the most easily available species, because other more favored specie have already been utilized.

It is difficult to attribute particular reasons to the discrepancies observed. The method of communication, different levels of understanding, different value systems, or poor local knowledge of the species utilized are all possible reasons that could play a role to explain the discrepancies. However, it is clear that to obtain quantitative information on the utilisation of woody resources, a full *in situ* inventory will provide reliable information, whereas a questionnaire survey will only provide an order of magnitude. When planning a questionnaire it is important to ascertain that the accuracy of the answers is sufficient for the purpose of the study (Bernard *et al*. 1984). In their report, Bernard *et al*. (1984) concluded that over half of the reports from questionnaires were incorrect in some way. In the present type of study it is obvious that accuracy gleaned from questionnaires as well as from the partial inventories is insufficient.

Based on the present results there are few useful data of a quantitative nature that could be gleaned from the questionnaires. An average of four questionnaires and partial inventories could be conducted in a day, whereas only two full inventories could be conducted in the same time. From the present results, for a quantitative study it appears a waste of time to conduct the questionnaires without the full inventories. The present study suggests that when information of a quantitative nature is sought, questionnaires should be avoided altogether.

This case study was initiated to obtain complementary information by using two methods. However, the results of a quantitative nature obtained through the partial validation of the questionnaires were disappointing. The ground proofing of the present study provides the researchers with an enlightening proof of the difficulty to take information at face value. White *et al*. (2005) discuss the inherent limitations of questionnaire surveys used in ecology without

Table 8. Comparison of the mean diameter of elements used in the various house shapes of buildings made with wood and mud walls, between the partial and full field inventory surveys in the community of Manqakulane, northern Maputaland, KwaZulu-Natal, South Africa, in 2003.

House type	Roof type	Element type	Questionnaire mean diameter of elements (cm)	Field inventory mean diameter of elements (cm)
Rectangular	Corrugated iron	Main poles	6.72	6.95
		Beams	5.86	5.07
		Roof laths	-	4.59
		Wall laths (1 panel)	2.36	2.20
	Thatched	Main poles	6.72	6.32
		Beams	5.86	3.70
		Roof laths	-	2.50
		Wall laths (1 panel)	2.36	2.12
Square	Corrugated iron	Main poles	6.72	7.01
		Beams	5.86	4.70
		Roof laths	-	4.25
		Wall laths (1 panel)	2.36	2.44
	Thatched	Main poles	6.72	5.34
		Beams	5.86	3.48
		Roof laths	-	2.35
		Wall laths (1 panel)	2.36	2.11
Round	Thatched	Main poles	6.72	6.50
		Beams	5.86	4.40
		Roof laths	-	2.32
		Wall laths (1 panel)	2.36	2.30
				Significant difference t=3.05; df=14; P<0.01

Table 9. Comparison of the estimated total volume of wood (in m^3) used in the community by using mean data from the partial and full inventory surveys conducted in the community of Manqakulane, KwaZulu-Natal, South Africa, in 2003.

House type	Roof type	Element type	Estimated total volume of wood (m^3)	
			Partial inventory	Full inventory
Rectangular	Corrugated iron	Main poles	3.93	4.51
		Beams	1.25	0.51
		Roof laths		
		Wall laths (1 panel)	19.51	20.25
	Thatched	Main poles	2.09	1.65
		Beams	2.13	0.95
		Roof laths		
		Wall laths (1 panel)	10.39	4.77
Square	Corrugated iron	Main poles	3.93	3.14
		Beams	1.25	0.31
		Roof laths		
		Wall laths (1 panel)	19.51	8.67
	Thatched	Main poles	2.09	1.06
		Beams	2.13	0.70
		Roof laths		
		Wall laths (1 panel)	10.39	3.75
Round	Thatched	Main poles	3.58	2.75
		Beams	4.14	2.21
		Roof laths		
		Wall laths (1 panel)	17.75	10.58
Total volume (m^3)			**104.08**	**65.80**
				Significant difference t=2.93; df=14; P<0.01

ground proofing. From our results we can only agree with their recommendations for best practice in questionnaire-based studies, especially that ground proofing is essential. According to the authors of the present study, ground proofing is imperative when any information of quantitative nature is sought. This appears especially valid when additional barriers of a social nature (culture, language, education) are encountered. It is worrying that an increasing number of studies are conducted by using questionnaires without ground proofing (White *et al*. 2005). From the results of the present study we feel that information of a quantitative nature gathered by questionnaires without ground proofing should be approached with considerable circumspection. The present study suggests that full inventories should be coupled with questionnaires to obtain the best insight in the utilisation of natural resources.

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