

Models of Valuation of Non-Timber Forest Products: A Case Study of *Imbrasia belina* Dynamics in the South East Lowveld, Zimbabwe

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Abstract: This study is based on a valuation technique which was applied to *Imbrasia belina* commonly known as (mopane worms) found in the South East Lowveld of Zimbabwe between December, 2012 and March, 2013. The income value/flow and wealth/stock method was used for the study. Data on tenure regime where the *Imbrasia belina* were harvested, harvester type (harvester or buyer), age of buyer (years), selling price at local market (R kg⁻¹), value of mopane worms at the local market (calculated using the formula $V = PXQ$) where V = Value (Rands), P = Price (R kg⁻¹) and Q = Quantity of mopane worms harvested (kg)), export selling price (R kg⁻¹), export value of mopane worms (given by the formula, $V_1 = P_1XQ_1$, where V_1 = Export value of mopane worms (Rands), P_1 = Price (R kg⁻¹), Q_1 = Quantity of mopane worms harvested (kg)), quantities of mopane worms harvested (kg), quantities of mopane worms bought (kg), quantities of mopane worms exported (kg), quantities of mopane worms consumed at local market (kg), quantities of mopane worms used for personal consumption (kg) and quantities of mopane worms bartered (kg). The data collected in the study area were imputed into the model: $V = \sum^N (P_{ij}Q_{ij})$ (where, V = Net total discounted value of the (Non Timber Forest Product) NTFP's from a hectare of forest, P_{ij} = Price of the j th NTFP's in the i th period, Q_{ij} = The quantity or flow of the NTFP in the i th period, N = Number of NTFP's species) to calculate the local and export values of mopane worms. The existence of the South African export market for mopane worms was significant in (Gonarezhou compared to Chikombdzi and Gonakudzingwa small scale farms compared to Chikombedzi communal, $p = 0.000$). The average local market price for mopane worms was \$7.61 kg⁻¹ whilst that for export market was \$207.22 kg⁻¹. The implications of these values is their influence to national governments in determining the level of management and resources that should be allocated to forestry departments towards conservation of non timber forest products like mopane worms.

Key words: Non Timber Forest Products (NTFP's), economic value, valuation techniques flow, stock, model, mopane worms

INTRODUCTION

The focus on tropical forests in the past had been on timber benefits overlooking economic benefits derived from Non Timber Forest Products (NTFPs), Tewari (2000). Decisions on conversion of forestlands to agriculture or to any other land use are according to Tewari (2000) are determined mainly by economic considerations for example the need to export forest products to generate foreign exchange or the demand for timber and other environmental services. The total economic value of forests is a function of the estimated values of timber, non-timber forest products and environmental benefits. The total value of forests helps the policy maker to make appropriate choices in deciding on where and how many resources should be deployed in any given situation. The

challenge which decision makers face is determination of the value of the non timber forest products. The aim of this study, therefore was to investigate economic value of harvesting *Imbrasia belina* (mopane worms) across four different tenure regimes in the South East Lowveld of Zimbabwe and the market benefits that the different actors get along the chain.

MATERIALS AND METHODS

Study area: The study was conducted in the South-East Lowveld of Zimbabwe (Fig. 1). The area occupies the region 21-22°15'S and 32° 30-32°15'E and covers about 300000 ha in extent. The study was conducted in the four tenure property regimes: Gonarezhou National Park (GNP), (state property),

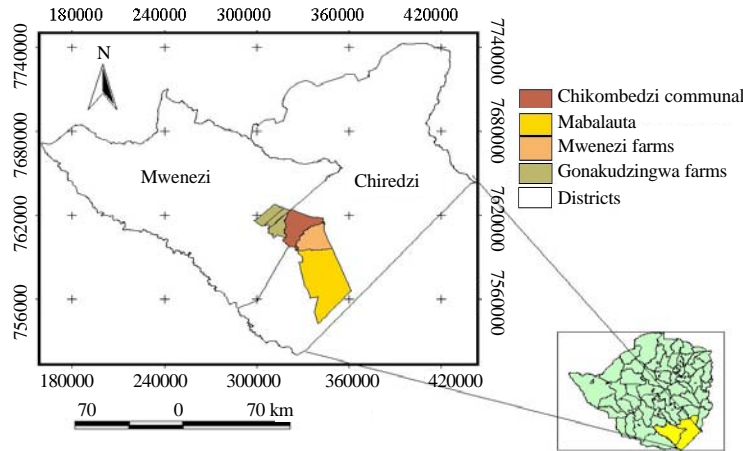


Fig. 1: Location of the study area

Gonakudzingwa Small Scale Farms (GSSCF) (private property), Chikombedzi Communal Area (CCA) (common property) and Mwenenzi Resettlement Farms (MRA) (Semi-state property regime). MRA is composed of the following farms: Edenvale, Jabula, Nardice and Iroonwood. Mwenenzi Resettlement Area (MRA) has elements of both state and communal property regimes. The occupiers of MRA do not have the title to the land, neither the power nor the right to sale the land. However, the occupiers of the land got the use rights to work on the land to derive livelihoods from it. GNP is a state property managed by the department of parks and wildlife management in the sustainable management of wildlife resources. GSSCF is a group of private farms owned by farmers who got title to the land. GSSCF is private property regime where the farmers practice mixed crop and animal husbandry on their pieces of land (about 700 ha in extent). MRA is semi-state property regime which possesses both elements of state and communal property regime. The occupiers of MRA hold only use rights to the land but do not have the power nor the authority to sale the land. However, the occupiers of the land got the use rights to work on the land to derive livelihoods from it. CCA is communal property regime where the farmers hold the traditional use rights to the land.

The study area falls in the natural ecological region 5 classification of Zimbabwe and rainfall ranges between 400-500 mm year⁻¹ with an annual temperatures of 18-24°C (Low and Rebelo, 1996). The study area experiences 3 climatic seasons: A hot dry period from August to October, a cold dry period from May to July and a hot wet period from November to April. The altitude of the study area varies between 165 and 575 m above sea level (Mlambo, 2007). The soils are predominantly shallow sands of the siallitic group derived from sandstone

(Nyamapfene, 1991). *Colospermum mopane* is the dominant tree found in the study area in association with *Kirkia acuminata*, *Dalbergia melanoxylon*, *Adansonia digitata*, *Combretum apiculatum*, *Combretum imberbe*, *Acacia nigrescens* and *Commiphora* species.

Sampling methods: A questionnaire was distributed to 68 respondents of different age groups and gender found in the 4 tenure regimes of Gonarezhou National Park (GNP), Gonakudzingwa Small Scale Commercial Farms (GSSCF), Mwenenzi Resettlement Area (MRA) and Chikombedzi Communal Area (CCA) which are involved in the harvesting or buying of mopane worms. The survey was conducted between December, 2012 to March, 2013.

The respondents were interviewed in the harvesting area and along the roads found in the 4 tenure regimes. Of the total 68 respondents interviewed, 15 were interviewed in Gonarezhou national park, 19 in Gonakudzingwa small scale farms, 23 in Mwenenzi resettlement area and 11 in Chikombedzi communal area. The harvesters were followed to harvesting areas and interviewed on the ground by the researcher whilst harvesting. The researcher and mopane worm harvester interaction on the ground helped to validate the correctness of information which was provided by the harvester. Data on quantities of mopane worms harvested (kg), tenure regimes where mopane worms were harvested, age of harvester, gender, price of mopane worms at local market or export market (kg), mopane worms bought (kg), whether the mopane worms were used for personal consumption or not (kg), quantities (kg) of mopane worms bartered and export destinations of mopane worms were recorded. In all cases, information regarding where harvesters could be located was obtained through the national parks office in the case of Gonarezhou national park, homestead in the case of

Gonakudzingwa small scale farms or sabhuku (kraal head) in the case of Chikombedzi communal and Mwenezi resettlement areas. In the field, getting information on the next group of harvesters was through asking the last group if they had seen other harvesters in the area (snow ball method). The data collected were analyzed using Analysis of Variance (ANOVA) in SPSS programme for significant differences. The valuation generic model used by Tewari (2000) on non timber forest products was adopted for this study.

Valuation conceptual models: The question is how do researchers determine the value of the mopane worms, a non timber forest product? What models or techniques of valuation should be applied to NTFPs of this kind and what challenges arise in doing so? The value of NTFP's researchers are describing is economic or value in exchange which is determined by forces of demand and supply. The value in exchange assumes that a market and a price of NTFPs exist. Tewari (2000) describes 2 types of value concepts applied to NTFPs, namely; the flow and stock. Flow concept assumes that a stream of quantities of NTFPs in this case mopane worms will continue to be harvested periodically ($t = 0 \dots T$) on a sustainable basis over the life cycle of a tree or forest. On the other hand, the stock concept assigns value to the entire standing stock of the NTFP's after some inventory of the NTFP's.

The following assumptions were made in coming up with conceptual models to value NTFPs:

- That there are N types of NTFPs that can be harvested per hectare of forest
- That the NTFP's in the forest yields stream of tangible benefits over a given period of time, T
- That all NTFP's from the forest are marketable and have a price P which is depended on demand and supply
- That the prices for the NTFP's are known during the harvesting period
- That the extraction/harvesting Cost (C) of the NTFP is known

Based on the information earlier researchers can estimate the net present value of the NTFPs from a hectare of forest as follows:

$$V = \sum^N [P_{ij}Q_{ij} - C_{ij}]^{e^{-rT}} \quad (1)$$

Where:

V = Net total discounted value of the NTFP's from a hectare of forest

P_{ij} = Price of the jth NTFP's in the ith period

Q_{ij} = The quantity or flow of the NTFP in the ith period

C_{ij} = The extraction or harvesting cost of the NTFP's in the ith period

I = 1,T

J = 1,N

e^{-r} = Discount rate

T = Length of time period

N = No. of NTFP's species

Equation 1 provides the value of the NTFP's in this case mopane worms. This model provides an insight in terms of the information required to estimate the value of the NTFP's. For Eq. 1 to research the following information is required:

- An accurate estimates of quantities of NTFP's
- To estimate the Cost of extraction (C) or harvesting of the NTFP's, for example labour, capital used, etc
- Knowledge of prices of NTFP's derived from (local, regional or international) where the NTFP's is traded
- The termination date of harvesting the NTFP's which is depended on its biological characteristics or cycle of harvest

The value of the NTFP's, V, derived this way is the dynamic value in actual sense, since it takes the long run streams of income over time. The dynamic value is an important parameter because it helps important decisions on resource allocation to be made and whether the forest would be managed for timber, non timber forest products, environmental benefits or a combination of these factors. However, dynamic value has its share of challenges for example, estimating quantities of the NTFP's extracted, prices required for future projections, costs of extraction and determination of discount rate which is very difficult to estimate. As a result of these difficulties, the dynamic model has been modified by using the one time income value model also known as static income value model in Eq. 2.

$$V = \sum^N [P_{ij}Q_{ij} - C_{ij}] \quad (2)$$

The advantage of this model is that there is no need to worry about the discount rate or over time projections of extracted quantities of NTFP's. So, the static income model is simply the current income value of the NTFP's. Equation 2 can further be simplified by ignoring the extraction Costs (C), i.e., by assuming that $C = 0$. This assumption is based on information that $C =$ Mainly the labour cost incurred to extract NTFP's which attract a very low real wage in the NTFP producing countries of the world; thus leading to Eq. 3 which represents the stock or wealth value concept. Equation 1-3 would remain essentially the same except that Q represents the total inventory of the NTFP's.

$$V = \sum^N [P_y Q_{ij}] \quad (3)$$

The challenge arises in choosing the market Price (P). The market price of the NTFP has the effect of going down assuming the entire inventory of the NTFP is put on the market. This is a demand and supply issue found in economics as described by Godoy (1992).

RESULTS

Valuation of mopane worms: Equation 1 and 2 were used to derive Eq. 3 which is a simplified version of the equations earlier to calculate the average values of mopane worms in the study area across the 4 tenure regimes. The values for the local market were obtained by multiplying the local price by the quantity of mopane worms harvested, i.e., Local Value = Price (P) in (\$)×Quantity (Q) (kg) of mopane worms. Price is pegged in United States (\$) whilst the quantity of the mopane worms is measured per kilogram (kg). The values across the tenure regimes were then averaged to get the local values compared to the average export values. The average local market price for mopane worms was found to be \$7.61 kg⁻¹ whilst that for export market was \$207.22 kg⁻¹ across the tenure regimes.

Descriptive statistics: Table 1 shows the mean, standard error, standard deviation from the mean and 95% confidence intervals for tenure and how it affects the independent variables of age, type of harvester, gender of harvester, price and quantities harvested in (Gonarezhou National Park (GNP), Gonakudzingwa Small Scale Farms (GSSCF), Mwenezi Resettlement Area (MRA) and Chikomedzi Communal Area (CCA).

Analysis of Variance (ANOVA): The Analysis of Variance (ANOVA) showed that there were significant differences (0.000<p<0.004 between tenure regime where the mopane worms were harvested and the price of the mopane worms at the local market, export selling price of the worms, quantities of mopane worms harvested, quantities exported and quantities of mopane worms bartered (Table 2).

Post hoc tests: Multiple comparison analysis (Table 3) showed that there were significant differences between tenure regime and mopane worm local market ((Gonarezhou National Park and Mwenezi resettlement area, Gonarezhou and Chikomedzi and Gonakudzingwa small scale farms and communal area) (0.0001 <p<0.03)). Irrespective of the existence of the lucrative South African mopane worms had significant local market use.

The export market selling price was significant in (Gonarezhou and Chikomedzi communal area p = 0.000), Gonakudzingwa small scale farms and Chikomedzi communal area p = 0.001, using Least Square Difference (LSD) whilst almost similar but significant results were obtained between Gonarezhou and Chikomedzi p = 0.004. As for Chikomedzi and Gonakudzingwa, p = 0.001 was found through the Games-Howell analysis.

The quantities of mopane worms harvested was significant (Gonarezhou National Park and Mwenezi resettlement area, Gonarezhou national park and Chikomedzi communal, Gonakudzingwa small scale farm and Chikomedzi, 0.003<p<0.001).

Quantities of mopane worms bought from other harvesters for export was not significant after realization of the benefits to be derived from own harvesting compared to buying the worms from others.

Table 1: Descriptive statistics

Tenure regime	N	Mean	SD	SE	95% confidence interval for mean			
					Lower bound	Upper bound	Min.	Max.
Harvester								
Gonarezhou national park	15	1.0000	0.00000	0.00000	1.0000	1.0000	1.00	1.00
Gonakudzingwa small scale commercial farms	19	1.1053	0.31530	0.07234	0.9533	1.2572	1.00	2.00
Mwenezi resettlement area	23	1.0000	0.00000	0.00000	1.0000	1.0000	1.00	1.00
Chikomedzi communal area	11	1.0000	0.00000	0.00000	1.0000	1.0000	1.00	1.00
Total	68	1.0294	0.17021	0.02064	0.9882	1.0706	1.00	2.00
Age								
Gonarezhou national park	15	3.4000	1.59463	0.41173	2.5169	4.2831	1.00	6.00
Gonakudzingwa small scale commercial farms	19	4.8947	1.99707	0.45816	3.9322	5.8573	1.00	8.00
Mwenezi resettlement area	23	6.1304	2.66807	0.55633	4.9767	7.2842	1.00	11.00
Chikomedzi communal area	11	4.7273	3.06891	0.92531	2.6656	6.7890	1.00	10.00
Total	68	4.9559	2.52412	0.30609	4.3449	5.5668	1.00	11.00
Gender								
Gonarezhou national park	15	1.8000	0.41404	0.10690	1.5707	2.0293	1.00	2.00
Gonakudzingwa Small scale commercial farms	19	1.7368	0.45241	0.10379	1.5188	1.9549	1.00	2.00
Mwenezi resettlement area	23	1.7391	0.44898	0.09362	1.5450	1.9333	1.00	2.00
Chikomedzi communal area	11	1.4545	0.52223	0.15746	1.1037	1.8054	1.00	2.00
Total	68	1.7059	0.45903	0.05567	1.5948	1.8170	1.00	2.00

Table 1: Continue

Tenure regime	N	Mean	SD	SE	95% confidence interval for mean			
					Lower bound	Upper bound	Min.	Max.
Selling at local market								
Gonarezhou national park	15	7.3000	2.81450	0.72670	5.7414	8.8586	4.50	13.00
Gonakudzingwa small scale commercial farms	19	8.2105	2.83488	0.65037	6.8442	9.5769	4.50	14.00
Mwenezi resettlement area	23	7.0913	2.45337	0.51156	6.0304	8.1522	4.00	13.00
Chikomedzi communal area	11	5.6000	1.50997	0.45527	4.5856	6.6144	4.00	8.00
Total	68	7.2088	2.61669	0.31732	6.5754	7.8422	4.00	14.00
Export market selling price								
Gonarezhou national park	15	17.0667	2.89005	0.74621	15.4662	18.6671	12.00	22.00
Gonakudzingwa small scale commercial farms	19	16.7368	3.72443	0.85444	14.9417	18.5320	12.00	24.00
Mwenezi resettlement area	23	14.2609	4.66337	0.97238	12.2443	16.2775	6.00	26.00
Chikomedzi communal area	11	10.4545	3.55988	1.07334	8.0630	12.8461	7.00	18.00
Total	68	14.9559	4.46022	0.54088	13.8763	16.0355	6.00	26.00
Quantities harvested								
Gonarezhou national park	15	224.6667	139.46923	36.01080	147.4312	301.9022	50.00	500.00
Gonakudzingwa small scale commercial farms	19	180.6842	153.71765	35.26525	106.5947	254.7737	0.00	600.00
Mwenezi resettlement area	23	106.9565	74.93541	15.62511	74.5520	139.3610	20.00	300.00
Chikomedzi communal area	11	32.0000	44.36215	13.37569	2.1971	61.8029	5.00	150.00
Total	68	141.3971	130.04731	15.77055	109.9189	172.8752	0.00	600.00
Quantities bought								
Gonarezhou national park	15	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
Gonakudzingwa small scale commercial farms	19	15.6316	46.82498	10.74239	-6.9373	38.2005	0.00	150.00
Mwenezi resettlement area	23	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
Chikomedzi communal area	11	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
Total	68	4.3676	25.27810	3.06542	-1.7510	10.4863	0.00	150.00
Quantities exported								
Gonarezhou national park	15	185.6667	148.64707	38.38051	103.3487	267.9847	0.00	500.00
Gonakudzingwa small scale commercial farms	19	167.2105	129.07387	29.61158	104.9989	229.4221	0.00	500.00
Mwenezi resettlement area	23	88.4783	80.07716	16.69724	53.8503	123.1062	0.00	290.00
Chikomedzi communal area	11	18.1818	44.23080	13.33609	-11.5328	47.8965	0.00	140.00
Total	68	120.5441	123.00703	14.91679	90.7701	150.3182	0.00	500.00
Quantities used in local market								
Gonarezhou national park	15	26.3333	42.40395	10.94865	2.8508	49.8159	0.00	150.00
Gonakudzingwa small scale commercial farms	19	14.4737	14.42362	3.30901	7.5217	21.4256	0.00	50.00
Mwenezi resettlement area	23	3.0435	11.05144	2.30439	-1.7355	7.8225	0.00	50.00
Chikomedzi communal area	11	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
Total	68	10.8824	23.86125	2.89360	5.1067	16.6580	0.00	150.00
Quantities used for personal consumption								
Gonarezhou national park	15	8.1333	12.13535	3.13333	1.4130	14.8537	0.00	50.00
Gonakudzingwa small scale commercial farms	19	12.8421	23.27914	5.34060	1.6219	24.0623	0.00	100.00
Mwenezi resettlement area	23	15.2174	14.49751	3.02294	8.9482	21.4866	0.00	50.00
Chikomedzi communal area	11	13.3636	5.95437	1.79531	9.3634	17.3638	5.00	20.00
Total	68	12.6912	16.04960	1.94630	8.8063	16.5760	0.00	100.00
Quantities bartered								
Gonarezhou national park	15	5.2000	7.69230	1.98614	0.9401	9.4599	0.00	25.00
Gonakudzingwa small scale commercial farms	19	2.8947	2.96076	0.67924	1.4677	4.3218	0.00	8.00
Mwenezi resettlement area	23	0.2174	1.04257	0.21739	-0.2335	0.6682	0.00	5.00
Chikomedzi communal area	11	0.4545	1.50756	0.45455	-0.5582	1.4673	0.00	5.00
Total	68	2.1029	4.40536	0.53423	1.0366	3.1693	0.00	25.00
Countries where mopane worms exported								
Gonarezhou national park	15	1.0667	0.25820	0.06667	0.9237	1.2097	1.00	2.00
Gonakudzingwa small scale commercial farms	19	1.0526	0.22942	0.05263	0.9421	1.1632	1.00	2.00
Mwenezi resettlement area	23	1.5217	0.89796	0.18724	1.1334	1.9100	1.00	3.00
Chikomedzi communal area	11	2.6364	0.80904	0.24393	2.0928	3.1799	1.00	3.00
Total	68	1.4706	0.83703	0.10150	1.2680	1.6732	1.00	3.00

Table 2: ANOVA table

Tenure regime	Sum of squares	df	Mean square	F	Sig.
Harvester					
Between groups	0.152	3	0.051	1.809	0.155
Within groups	1.789	64	0.028		
Total	1.941	67			
Age					
Between groups	68.688	3	22.896	4.091	0.010
Within groups	358.180	64	5.597		
Total	426.868	67			

Table 2: Continue

Tenure regime	Sum of squares	df	Mean square	F	Sig.
Gender					
Between groups	0.871	3	0.290	1.403	0.250
Within groups	13.246	64	0.207		
Total	14.118	67			
Selling at local market					
Between groups	47.979	3	15.993	2.492	0.068
Within groups	410.776	64	6.418		
Total	458.755	67			
Local market value					
Between groups	386142.761	3	128714.254	4.915	0.004
Within groups	1676070.107	64	26188.595		
Total	2062212.868	67			
Export market selling price					
Between groups	361.088	3	120.363	7.927	0.000
Within groups	971.780	64	15.184		
Total	1332.868	67			
Quantities harvested					
Between groups	292259.884	3	97419.961	7.415	0.000
Within groups	840864.395	64	13138.506		
Total	1133124.279	67			
Quantities bought					
Between groups	3345.388	3	1115.129	1.808	0.155
Within groups	39466.421	64	616.663		
Total	42811.809	67			
Quantities exported					
Between groups	243899.001	3	81299.667	6.759	0.000
Within groups	769859.867	64	12029.060		
Total	1013758.868	67			
Quantities used in local market					
Between groups	6542.032	3	2180.677	4.416	0.007
Within groups	31605.027	64	493.829		
Total	38147.059	67			
Quantities for personal consumption					
Between groups	463.797	3	154.599	0.589	0.624
Within groups	16794.718	64	262.417		
Total	17258.515	67			
Quantities bartered					
Between groups	267.450	3	89.150	5.524	0.002
Within groups	1032.830	64	16.138		
Total	1300.279	67			
Countries where mopane worms are exported					
Between groups	20.776	3	6.925	16.939	0.000
Within groups	26.165	64	0.409		
Total	46.941	67			

Table 3: Post hoc tests

Multiple comparisons		95% confidence interval					
Dependent variables	Tenure (I)	Tenure (J)	Mean		Sig.	Lower bound Upper bound	
			difference (I-J)	SE			
Harvester (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-0.10526	0.05776	0.073	-0.2206	0.0101
		Mwenezi resettlement area	0.00000	0.05550	1.000	-0.1109	0.1109
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	0.00000	0.06638	1.000	-0.1326	0.1326
		Gonarezhou national park	0.10526	0.05776	0.073	-0.0101	0.2206
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	0.10526*	0.05184	0.046	0.0017	0.2088
		Chikombedzi communal area	0.10526	0.06335	0.101	-0.0213	0.2318
		Gonarezhou national park	0.00000	0.05550	1.000	-0.1109	0.1109
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-0.10526*	0.05184	0.046	-0.2088	-0.0017
		Mwenezi resettlement area					
		Chikombedzi communal area	0.00000	0.06130	1.000	-0.1225	0.1225
		Gonarezhou national park	0.00000	0.06638	1.000	-0.1326	0.1326
		Gonakudzingwa small scale commercial farms	-0.10526	0.06335	0.101	-0.2318	0.0213
		Mwenezi resettlement area	0.00000	0.06130	1.000	-0.1225	0.1225
			Chikombedzi communal area				

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean		Sig.	95% confidence interval		
			difference (I-J)	SE		Lower bound	Upper bound	
Games-howell	Gonarezhou national park	Gonarezhou national park						
		Gonakudzingwa small scale commercial farms	-0.10526	0.07234	0.483	-0.3097	0.0992	
		Mwenezi resettlement area	0.00000	0.00000	-	0.0000	0.0000	
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	0.00000	0.00000	-	0.0000	0.0000	
		Gonarezhou national park	0.10526	0.07234	0.483	-0.0992	0.3097	
		Gonakudzingwa small scale commercial farms	0.10526	0.07234	0.483	-0.0992	0.3097	
	Mwenezi resettlement area	Chikombedzi communal area	0.10526	0.07234	0.483	-0.0992	0.3097	
		Gonarezhou national park	0.00000	0.00000	-	0.0000	0.0000	
		Gonakudzingwa small scale commercial farms	-0.10526	0.07234	0.483	-0.3097	0.0992	
	Chikombedzi communal area	Mwenezi resettlement area	0.00000	0.00000	-	0.0000	0.0000	
		Chikombedzi communal area	0.00000	0.00000	-	0.0000	0.0000	
		Gonarezhou national park	0.00000	0.00000	-	0.0000	0.0000	
	Age (LSD)	Gonarezhou national park	Gonakudzingwa small scale commercial farms	-1.49474	0.81710	0.072	-3.1271	0.1376
			Mwenezi resettlement area	-2.73043*	0.78513	0.001	-4.2989	-1.1620
			Chikombedzi communal area	-1.32727	0.93909	0.162	-3.2033	0.5488
Gonakudzingwa small scale commercial farms		Gonarezhou national park	1.49474	0.81710	0.072	-0.1376	3.1271	
		Gonakudzingwa small scale commercial farms	-1.23570	0.73341	0.097	-2.7008	0.2294	
		Mwenezi resettlement area	0.16746	0.89629	0.852	-1.6231	1.9580	
Mwenezi resettlement area		Chikombedzi communal area	0.16746	0.89629	0.852	-1.6231	1.9580	
		Gonarezhou national park	2.73043*	0.78513	0.001	1.1620	4.2989	
		Gonakudzingwa small scale commercial farms	1.23570	0.73341	0.097	-0.2294	2.7008	
Chikombedzi communal area		Mwenezi resettlement area	1.40316	0.86724	0.111	-0.3294	3.1357	
		Chikombedzi communal area	1.40316	0.86724	0.111	-0.3294	3.1357	
		Gonarezhou national park	1.32727	0.93909	0.162	-0.5488	3.2033	
Games-howell		Gonarezhou national park	Gonakudzingwa small scale commercial farms	-1.49474	0.61598	0.092	-3.1637	0.1742
			Mwenezi resettlement area	-2.73043*	0.69212	0.002	-4.5949	-0.8659
			Chikombedzi communal area	-1.32727	1.01278	0.572	-4.2720	1.6175
	Gonakudzingwa small scale commercial farms	Gonarezhou national park	1.49474	0.61598	0.092	-0.1742	3.1637	
		Gonakudzingwa small scale commercial farms	-1.23570	0.72070	0.330	-3.1682	0.6968	
		Mwenezi resettlement area	0.16746	1.03253	0.998	-2.8083	3.1433	
	Mwenezi resettlement area	Chikombedzi communal area	0.16746	1.03253	0.998	-2.8083	3.1433	
		Gonarezhou national park	2.73043*	0.69212	0.002	0.8659	4.5949	
		Gonakudzingwa small scale commercial farms	1.23570	0.72070	0.330	-0.6968	3.1682	
	Chikombedzi communal area	Mwenezi resettlement area	1.40316	1.07968	0.575	-1.6569	4.4632	
		Chikombedzi communal area	1.40316	1.07968	0.575	-1.6569	4.4632	
		Gonarezhou national park	1.32727	1.01278	0.572	-1.6175	4.2720	
	Gender (LSD)	Gonarezhou national park	Gonakudzingwa small scale commercial farms	-0.16746	1.03253	0.998	-3.1433	2.8083
			Mwenezi resettlement area	-1.40316	1.07968	0.575	-4.4632	1.6569
			Chikombedzi communal area	-1.40316	1.07968	0.575	-4.4632	1.6569
Gonakudzingwa small scale commercial farms		Gonarezhou national park	0.06316	0.15714	0.689	-0.2508	0.3771	
		Gonakudzingwa small scale commercial farms	0.06087	0.15099	0.688	-0.2408	0.3625	
		Mwenezi resettlement area	0.34545	0.18059	0.060	-0.0153	0.7062	
Mwenezi resettlement area		Chikombedzi communal area	0.34545	0.18059	0.060	-0.0153	0.7062	
		Gonarezhou national park	-0.06316	0.15714	0.689	-0.3771	0.2508	
		Gonakudzingwa small scale commercial farms	-0.00229	0.14104	0.987	0.2840	0.2795	
Chikombedzi communal area		Chikombedzi Communal Area	0.28230	0.17236	0.106	-0.0620	0.6266	
		Gonarezhou national park	-0.06087	0.15099	0.688	-0.3625	0.2408	
		Gonakudzingwa small scale commercial farms	0.00229	0.14104	0.987	-0.2795	0.2840	
Gonarezhou national park		Mwenezi resettlement area	0.28458	0.16678	0.093	-0.0486	0.6178	
		Chikombedzi communal area	0.28458	0.16678	0.093	-0.0486	0.6178	
		Gonakudzingwa small scale commercial farms	-0.28230	0.17236	0.106	-0.6266	0.0620	
Gonakudzingwa small scale commercial farms	Mwenezi resettlement area	-0.28458	0.16678	0.093	-0.6178	0.0486		
	Chikombedzi communal area	-0.28458	0.16678	0.093	-0.6178	0.0486		
	Gonarezhou national park	-0.28230	0.17236	0.106	-0.6266	0.0620		

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean		Sig.	95% confidence interval	
			difference (I-J)	SE		Lower bound	Upper bound
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	0.06316	0.14900	0.974	-0.3411	0.4674
		Mwenezi resettlement area	0.06087	0.14210	0.973	-0.3243	0.4460
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	0.34545	0.19032	0.298	-0.1909	0.8819
		Gonarezhou national park	-0.06316	0.14900	0.974	-0.4674	0.3411
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	-0.00229	0.13977	1.000	-0.3776	0.3730
		Chikombedzi communal area	0.28230	0.18859	0.459	-0.2490	0.8136
		Gonarezhou national park	-0.06087	0.14210	0.973	-0.4460	0.3243
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	0.00229	0.13977	1.000	-0.3730	0.3776
		Mwenezi resettlement area					
		Chikombedzi communal area	0.28458	0.18319	0.429	-0.2351	0.8043
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-0.34545	0.19032	0.298	-0.8819	0.1909
		Mwenezi resettlement area	-0.28230	0.18859	0.459	-0.8136	0.2490
Gonakudzingwa small scale commercial farms	Mwenezi resettlement area	-0.28458	0.18319	0.429	-0.8043	0.2351	
	Chikombedzi communal area						
	Gonarezhou national park						
Selling at local market (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-0.91053	0.87504	0.302	-2.6586	0.8376
		Mwenezi resettlement area	0.20870	0.84080	0.805	-1.4710	1.8884
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	1.70000	1.00567	0.096	-0.3091	3.7091
		Gonarezhou national park	0.91053	0.87504	0.302	-0.8376	2.6586
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	1.11922	0.78541	0.159	-0.4498	2.6883
		Chikombedzi communal area	2.61053*	0.95984	0.008	0.6930	4.5280
		Gonarezhou national park	-0.20870	0.84080	0.805	-1.8884	1.4710
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-1.11922	0.78541	0.159	-2.6883	0.4498
		Mwenezi resettlement area					
		Chikombedzi communal area	1.49130	0.92874	0.113	-0.3641	3.0347
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-1.70000	1.00567	0.096	-3.7091	0.3091
		Mwenezi resettlement area	-2.61053*	0.95984	0.008	-4.5280	-0.6930
Gonakudzingwa small scale commercial farms	Mwenezi resettlement area	-1.49130	0.92874	0.113	-3.3467	0.3641	
	Chikombedzi communal area						
	Gonarezhou national park						
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-0.91053	0.97523	0.787	-3.5608	1.7398
		Mwenezi resettlement area	0.20870	0.88870	0.995	-2.2228	2.6402
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	1.70000	0.85754	0.224	-0.6785	4.0785
		Gonarezhou national park	0.91053	0.97523	0.787	-1.7398	3.5608
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	1.11922	0.82745	0.536	-1.1095	3.3480
		Chikombedzi communal area	2.61053*	0.79388	0.014	0.4425	4.7785
		Gonarezhou national park	-0.20870	0.88870	0.995	-2.6402	2.2228
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-1.11922	0.82745	0.536	-3.3480	1.1095
		Mwenezi resettlement area					
		Chikombedzi communal area	1.49130	0.68481	0.153	-0.3719	3.3545
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-1.70000	0.85754	0.224	-4.0785	0.6785
		Mwenezi resettlement area	-2.61053*	0.79388	0.014	-4.7785	-0.4425
Gonakudzingwa small scale commercial farms	Mwenezi resettlement area	-1.49130	0.68481	0.153	-3.3545	0.3719	
	Chikombedzi communal area						
	Gonarezhou national park						
Local market value (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	96.61404	55.89502	0.089	-15.0491	208.2772
		Mwenezi resettlement area	183.75362*	53.70792	0.001	76.4597	291.0475
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	197.66667*	64.23930	0.003	69.3339	325.9994
		Gonarezhou national park	-96.61404	55.89502	0.089	-208.2772	15.0491
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	87.13959	50.16953	0.087	-13.0856	187.3647
		Chikombedzi communal area	101.05263	61.31173	0.104	-21.4316	223.5369
		Gonarezhou national park	-183.75362*	53.70792	0.001	-291.0475	-76.4597
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-87.13959	50.16953	0.087	-187.3647	13.0856
		Mwenezi resettlement area					
		Chikombedzi communal area	13.91304	59.32467	0.815	-104.6016	132.4277
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-197.66667*	64.23930	0.003	-325.9994	-69.3339
		Mwenezi resettlement area	-101.05263	61.31173	0.104	-223.5369	21.4316
Gonakudzingwa small scale commercial farms	Mwenezi resettlement area	-13.91304	59.32467	0.815	-132.4277	104.6016	
	Chikombedzi communal area						
	Gonarezhou national park						

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean			95% confidence interval	
			difference (I-J)	SE	Sig.	Lower bound	Upper bound
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	96.61404	86.13730	0.682	-149.6624	342.8905
		Mwenezi resettlement area	183.75362	83.68514	0.171	-58.6258	426.1330
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	197.66667	83.09327	0.127	-43.8495	439.1828
		Gonarezhou national park	-96.61404	86.13730	0.682	-342.8905	149.6624
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	87.13959*	24.77608	0.009	18.9539	155.3252
		Chikombedzi communal area	101.05263*	22.69676	0.002	36.9050	165.2003
		Gonarezhou national park	-183.75362	83.68514	0.171	-426.1330	58.6258
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-87.13959*	24.77608	0.009	-155.3252	-18.9539
		Mwenezi resettlement area					
		Chikombedzi communal area	13.91304	9.93535	0.512	-13.6758	41.5019
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	-197.66667	83.09327	0.127	-439.1828	43.8495	
	Gonakudzingwa small scale commercial farms	-101.05263*	22.69676	0.002	-165.2003	-36.9050	
Mwenezi resettlement area	Mwenezi resettlement area	-13.91304	9.93535	0.512	-41.5019	13.6758	
	Chikombedzi communal area						
	Chikombedzi communal area						
Export market selling price (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	0.32982	1.34589	0.807	-2.3589	3.0186
		Mwenezi resettlement area	2.80580*	1.29323	0.034	0.2223	5.3893
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	6.61212*	1.54682	0.000	3.5220	9.7022
		Gonarezhou national park	-0.32982	1.34589	0.807	-3.0186	2.3589
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	2.47597*	1.20803	0.045	0.0627	4.8893
		Chikombedzi communal area	6.28230*	1.47632	0.000	3.3330	9.2316
		Gonarezhou national park	-2.80580*	1.29323	0.034	-5.3893	-0.2223
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-2.47597*	1.20803	0.045	-4.8893	-0.0627
		Mwenezi resettlement area					
		Chikombedzi communal area	3.80632*	1.42848	0.010	0.9526	6.6600
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	-6.61212*	1.54682	0.000	-9.7022	-3.5220	
	Gonakudzingwa small scale commercial farms	-6.28230*	1.47632	0.000	-9.2316	-3.3330	
Mwenezi resettlement area	Mwenezi resettlement area	-3.80632*	1.42848	0.010	-6.6600	-0.9526	
	Chikombedzi communal area						
	Chikombedzi communal area						
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	0.32982	1.13441	0.991	-2.7437	3.4034
		Mwenezi resettlement area	2.80580	1.22570	0.120	-0.4955	6.1071
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	6.61212*	1.30725	0.000	2.9338	10.2905
		Gonarezhou national park	-0.32982	1.13441	0.991	-3.4034	2.7437
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	2.47597	1.29445	0.239	-0.9938	5.9458
		Chikombedzi communal area	6.28230*	1.37191	0.001	2.4703	10.0943
		Gonarezhou national park	-2.80580	1.22570	0.120	-6.1071	0.4955
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-2.47597	1.29445	0.239	-5.9458	0.9938
		Mwenezi resettlement area					
		Chikombedzi communal area	3.80632	1.44831	0.065	-0.1733	7.7860
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	-6.61212*	1.30725	0.000	-10.2905	-2.9338	
	Gonakudzingwa small scale commercial farms	-6.28230*	1.37191	0.001	-10.0943	-2.4703	
Mwenezi resettlement area	Mwenezi resettlement area	-3.80632	1.44831	0.065	-7.7860	0.1733	
	Chikombedzi communal area						
	Chikombedzi communal area						
Quantise harvested (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	43.98246	39.59041	0.271	-35.1085	123.0734
		Mwenezi resettlement area	117.71014*	38.04129	0.003	41.7139	193.7064
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	192.66667*	45.50066	0.000	101.7686	283.5647
		Gonarezhou national park	-43.98246	39.59041	0.271	-123.0734	35.1085
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	73.72769*	35.53505	0.042	2.7383	144.7171
		Chikombedzi communal area	148.68421*	43.42707	0.001	61.9287	235.4397
		Gonarezhou national park	-117.71014*	38.04129	0.003	-193.7064	-41.7139
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-73.72769*	35.53505	0.042	-144.7171	-2.7383
		Mwenezi resettlement area					
		Chikombedzi communal area	74.95652	42.01963	0.079	-8.9873	158.9004
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	-192.66667*	45.50066	0.000	-283.5647	-101.7686	
	Gonakudzingwa small scale commercial farms	-148.68421*	43.42707	0.001	-235.4397	-61.9287	
Mwenezi resettlement area	Mwenezi resettlement area	-74.95652	42.01963	0.079	-158.9004	8.9873	
	Chikombedzi communal area						
	Chikombedzi communal area						

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean			95% confidence interval		
			difference (I-J)	SE	Sig.	Lower bound	Upper bound	
Games-howell	Gonarezhou national park	Gonarezhou national park						
		Gonakudzingwa small scale commercial farms	43.98246	50.40253	0.819	-92.7354	180.7003	
		Mwenezi resettlement area	117.71014*	39.25458	0.034	7.5066	227.9137	
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	192.66667*	38.41467	0.001	83.8910	301.4423	
		Gonarezhou national park	-43.98246	50.40253	0.819	-180.7003	92.7354	
		Gonakudzingwa small scale commercial farms						
	Mwenezi resettlement area	Mwenezi resettlement area	73.72769	38.57178	0.249	-32.3773	179.8327	
		Chikombedzi communal area	148.68421*	37.71667	0.003	44.2084	253.1601	
		Gonarezhou national park	-117.71014*	39.25458	0.034	-227.9137	-7.5066	
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-73.72769	38.57178	0.249	-179.8327	32.3773	
		Mwenezi resettlement area	74.95652*	20.56826	0.005	19.0591	130.8539	
		Chikombedzi communal area	-192.66667*	38.41467	0.001	-301.4423	-83.8910	
	Quantities bought (LSD)	Gonarezhou national park	Gonarezhou national park					
			Gonakudzingwa small scale commercial farms	-15.63158	8.57711	0.073	-32.7663	1.5032
			Mwenezi resettlement area	0.00000	8.24150	1.000	-16.4643	16.4643
Gonakudzingwa small scale commercial farms		Chikombedzi communal area	0.00000	9.85754	1.000	-19.6927	19.6927	
		Gonarezhou national park	15.63158	8.57711	0.073	-1.5032	32.7663	
		Gonakudzingwa small scale commercial farms						
Mwenezi resettlement area		Mwenezi resettlement area	15.63158*	7.69853	0.046	0.2520	31.0112	
		Chikombedzi communal area	15.63158	9.40830	0.102	-3.1637	34.4268	
		Gonarezhou national park	0.00000	8.24150	1.000	-16.4643	16.4643	
Chikombedzi communal area		Gonakudzingwa small scale commercial farms	-15.63158*	7.69853	0.046	-31.0112	-0.2520	
		Mwenezi resettlement area	0.00000	9.10339	1.000	-18.1861	18.1861	
		Chikombedzi communal area	0.00000	9.85754	1.000	-19.6927	19.6927	
Games-howell		Gonarezhou national park	Gonarezhou national park					
			Gonakudzingwa small scale commercial farms	-15.63158	10.74239	0.483	-45.9927	14.7295
			Mwenezi resettlement area	0.00000	0.00000	-	0.0000	0.0000
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	0.00000	0.00000	-	0.0000	0.0000	
		Gonarezhou national park	15.63158	10.74239	0.483	-14.7295	45.9927	
		Gonakudzingwa small scale commercial farms						
	Mwenezi resettlement area	Mwenezi resettlement area	15.63158	10.74239	0.483	-14.7295	45.9927	
		Chikombedzi communal area	15.63158	10.74239	0.483	-14.7295	45.9927	
		Gonarezhou national park	0.00000	0.00000	-	0.0000	0.0000	
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-15.63158	10.74239	0.483	-45.9927	14.7295	
		Mwenezi resettlement area	0.00000	0.00000	-	0.0000	0.0000	
		Chikombedzi communal area	0.00000	0.00000	-	0.0000	0.0000	
	Quantities exported (LSD)	Gonarezhou national park	Gonarezhou national park					
			Gonakudzingwa small scale commercial farms	18.45614	37.88200	0.628	-57.2219	94.1341
			Mwenezi resettlement area	97.18841*	36.39973	0.010	24.4716	169.9052
Gonakudzingwa small scale commercial farms		Chikombedzi communal area	167.48485*	43.53721	0.000	80.5093	254.4604	
		Gonarezhou national park	-18.45614	37.88200	0.628	-94.1341	57.2219	
		Gonakudzingwa small scale commercial farms						
Mwenezi resettlement area		Mwenezi resettlement area	78.73227*	34.00163	0.024	10.8062	146.6583	
		Chikombedzi communal area	149.02871*	41.55309	0.001	66.0169	232.0406	
		Gonarezhou national park	-97.18841*	36.39973	0.010	-169.9052	-24.4716	
Chikombedzi communal area		Gonakudzingwa small scale commercial farms	-78.73227*	34.00163	0.024	-146.6583	-10.8062	
		Mwenezi resettlement area	70.29644	40.20639	0.085	-10.0250	150.6179	
		Chikombedzi communal area	-167.48485*	43.53721	0.000	-254.4604	-80.5093	
Gonarezhou national park		Gonakudzingwa small scale commercial farms	-149.02871*	41.55309	0.001	-232.0406	-66.0169	
		Mwenezi resettlement area	-70.29644	40.20639	0.085	-150.6179	10.0250	
		Chikombedzi communal area						

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean		Sig.	95% confidence interval	
			difference (I-J)	SE		Lower bound	Upper bound
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	18.45614	48.47586	0.981	-113.9184	150.8307
		Mwenezi resettlement area	97.18841	41.85524	0.127	-20.3010	214.6778
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	167.48485*	40.63145	0.004	52.1489	282.8208
		Gonarezhou national park	-18.45614	48.47586	0.981	-150.8307	113.9184
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	78.73227	33.99476	0.118	-13.9101	171.3747
		Chikombedzi communal area	149.02871*	32.47609	0.001	59.5058	238.5516
		Gonarezhou national park	-97.18841	41.85524	0.127	-214.6778	20.3010
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-78.73227	33.99476	0.118	-171.3747	13.9101
		Mwenezi resettlement area					
		Chikombedzi communal area	70.29644*	21.36935	0.013	12.3131	128.2798
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-167.48485*	40.63145	0.004	-282.8208	-52.1489
		Chikombedzi communal area	-149.02871*	32.47609	0.001	-238.5516	-59.5058
Quantities Used local market (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	11.85965	7.67547	0.127	-3.4739	27.1932
		Mwenezi resettlement area	23.28986*	7.37514	0.002	8.5563	38.0234
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	26.33333*	8.82130	0.004	8.7108	43.9559
		Gonarezhou national park	-11.85965	7.67547	0.127	-27.1932	3.4739
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	11.43021	6.88925	0.102	-2.3327	25.1931
		Chikombedzi communal area	14.47368	8.41929	0.090	-2.3458	31.2932
		Gonarezhou national park	-23.28986*	7.37514	0.002	-38.0234	-8.5563
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-11.43021	6.88925	0.102	-25.1931	2.3327
		Mwenezi resettlement area					
		Chikombedzi communal area	3.04348	8.14643	0.710	-13.2309	19.3178
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-26.33333*	8.82130	0.004	-43.9559	-8.7108
		Chikombedzi communal area	-14.47368	8.41929	0.090	-31.2932	2.3458
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	11.85965	11.43777	0.731	-20.7410	44.4603
		Mwenezi resettlement area	23.28986	11.18853	0.203	-8.8952	55.4749
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	26.33333	10.94865	0.122	-5.4897	58.1563
		Gonarezhou national park	-11.85965	11.43777	0.731	-44.4603	20.7410
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	11.43021*	4.03233	0.037	0.5279	22.3326
		Chikombedzi communal area	14.47368*	3.30901	0.002	5.1215	23.8259
		Gonarezhou national park	-23.28986	11.18853	0.203	-55.4749	8.8952
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-11.43021*	4.03233	0.037	-22.3326	-0.5279
		Mwenezi resettlement area					
		Chikombedzi communal area	3.04348	2.30439	0.560	-3.3554	9.4424
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-26.33333	10.94865	0.122	-58.1563	5.4897
		Chikombedzi communal area	-14.47368*	3.30901	0.002	-23.8259	-5.1215
Quantise for personal consumption (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-4.70877	5.59517	0.403	-15.8864	6.4689
		Mwenezi resettlement area	-7.08406	5.37624	0.192	-17.8243	3.6562
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	-5.23030	6.43045	0.419	-18.0766	7.6160
		Gonarezhou national park	4.70877	5.59517	0.403	-6.4689	15.8864
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	-2.37529	5.02204	0.638	-12.4080	7.6574
		Chikombedzi communal area	-0.52153	6.13739	0.933	-12.7824	11.7393
		Gonarezhou national park	7.08406	5.37624	0.192	-3.6562	17.8243
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	2.37529	5.02204	0.638	-7.6574	12.4080
		Mwenezi resettlement area					
		Chikombedzi communal area	1.85375	5.93848	0.756	-10.0097	13.7172
	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	5.23030	6.43045	0.419	-7.6160	18.0766
		Chikombedzi communal area	0.52153	6.13739	0.933	-11.7393	12.7824
Gonakudzingwa small scale commercial farms	Gonakudzingwa small scale commercial farms	-1.85375	5.93848	0.756	-13.7172	10.0097	
	Mwenezi resettlement area						
	Chikombedzi communal area						

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean difference (I-J)	SE	Sig.	95% confidence interval	
						Lower bound	Upper bound
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	-4.70877	6.19191	0.871	-21.6063	12.1888
		Mwenezi resettlement area	-7.08406	4.35384	0.378	-18.8492	4.6811
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	-5.23030	3.61122	0.484	-15.2780	4.8174
		Gonarezhou national park	4.70877	6.19191	0.871	-12.1888	21.6063
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	-2.37529	6.13679	0.980	-19.0967	14.3462
		Chikombedzi communal area	-0.52153	5.63428	1.000	-16.1785	15.1355
		Gonarezhou national park	7.08406	4.35384	0.378	-4.6811	18.8492
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	2.37529	6.13679	0.980	-14.3462	19.0967
		Mwenezi resettlement area					
		Chikombedzi communal area	1.85375	3.51587	0.952	-7.6784	11.3859
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	5.23030	3.61122	0.484	-4.8174	15.2780	
	Gonakudzingwa small scale commercial farms	0.52153	5.63428	1.000	-15.1355	16.1785	
Mwenezi resettlement area	Mwenezi resettlement area	-1.85375	3.51587	0.952	-11.3859	7.6784	
	Chikombedzi communal area						
	Chikombedzi communal area						
Quantities bartered (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	2.30526	1.38753	0.102	-0.4666	5.0772
		Mwenezi resettlement area	4.98261*	1.33323	0.000	2.3192	7.6461
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	4.74545*	1.59466	0.004	1.5597	7.9312
		Gonarezhou national park	-2.30526	1.38753	0.102	-5.0772	0.4666
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	2.67735*	1.24540	0.035	0.1894	5.1653
		Chikombedzi communal area	2.44019	1.52199	0.114	-0.6003	5.4807
		Gonarezhou national park	-4.98261*	1.33323	0.000	-7.6461	-2.3192
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-2.67735*	1.24540	0.035	-5.1653	-0.1894
		Mwenezi resettlement area					
		Chikombedzi communal area	-0.23715	1.47266	0.873	-3.1791	2.7048
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	-4.74545*	1.59466	0.004	-7.9312	-1.5597	
	Gonakudzingwa small scale commercial farms	-2.44019	1.52199	0.114	-5.4807	0.6003	
Mwenezi resettlement area	Mwenezi resettlement area	0.23715	1.47266	0.873	-2.7048	3.1791	
	Chikombedzi communal area						
	Chikombedzi communal area						
Games-howell	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	2.30526	2.09908	0.695	-3.6514	8.2619
		Mwenezi resettlement area	4.98261	1.99800	0.104	-0.8075	10.7727
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	4.74545	2.03749	0.134	-1.1070	10.5979
		Gonarezhou national park	-2.30526	2.09908	0.695	-8.2619	3.6514
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	2.67735*	0.71318	0.006	0.6947	4.6600
		Chikombedzi communal area	2.44019*	0.81730	0.028	0.2073	4.6731
		Gonarezhou national park	-4.98261	1.99800	0.104	-10.7727	0.8075
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	-2.67735*	0.71318	0.006	-4.6600	-0.6947
		Mwenezi resettlement area					
		Chikombedzi communal area	-0.23715	0.50386	0.964	-1.6923	1.2180
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	-4.74545	2.03749	0.134	-10.5979	1.1070	
	Gonakudzingwa small scale commercial farms	-2.44019*	0.81730	0.028	-4.6731	-0.2073	
Mwenezi resettlement area	Mwenezi resettlement area	0.23715	0.50386	0.964	-1.2180	1.6923	
	Chikombedzi communal area						
	Chikombedzi communal area						
Countries where mopane worms exported (LSD)	Gonarezhou national park	Gonarezhou national park					
		Gonakudzingwa small scale commercial farms	0.01404	0.22085	0.950	-0.4272	0.4552
		Mwenezi resettlement area	-0.45507*	0.21220	0.036	-0.8790	-0.0311
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	-1.56970*	0.25382	0.000	-2.0768	-1.0626
		Gonarezhou national park	-0.01404	0.22085	0.950	-0.4552	0.4272
		Gonakudzingwa small scale commercial farms					
	Mwenezi resettlement area	Mwenezi resettlement area	-0.46911*	0.19822	0.021	-0.8651	-0.0731
		Chikombedzi communal area	-1.58373*	0.24225	0.000	-2.0677	-1.0998
		Gonarezhou national park	0.45507*	0.21220	0.036	0.0311	0.8790
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	0.46911*	0.19822	0.021	0.0731	0.8651
		Mwenezi resettlement area					
		Chikombedzi communal area	-1.11462*	0.23440	0.000	-1.5829	-0.6464
Gonarezhou national park	Gonarezhou national park						
	Gonakudzingwa small scale commercial farms	1.56970*	0.25382	0.000	1.0626	2.0768	
	Gonakudzingwa small scale commercial farms	1.58373*	0.24225	0.000	1.0998	2.0677	
Mwenezi resettlement area	Mwenezi resettlement area	1.11462*	0.23440	0.000	0.6464	1.5829	
	Chikombedzi communal area						
	Chikombedzi communal area						

Table 3: Continue
Multiple comparisons

Dependent variables	Tenure (I)	Tenure (J)	Mean			95% confidence interval		
			difference (I-J)	SE	Sig.	Lower bound	Upper bound	
Games-howell	Gonarezhou national park	Gonarezhou national park						
		Gonakudzingwa small scale commercial farms	0.01404	0.08494	0.998	-0.2177	0.2458	
		Mwenezi resettlement area	-0.45507	0.19875	0.125	-0.9987	0.0885	
	Gonakudzingwa small scale commercial farms	Chikombedzi communal area	-1.56970*	0.25288	0.000	-2.3253	-0.8141	
		Gonarezhou national park	-0.01404	0.08494	0.998	-0.2458	0.2177	
		Gonakudzingwa small scale commercial farms						
	Mwenezi resettlement area	Mwenezi resettlement area	-0.46911	0.19449	0.100	-1.0035	0.0653	
		Chikombedzi communal area	-1.58373*	0.24955	0.000	-2.3354	-0.8320	
		Gonarezhou national park	0.45507	0.19875	0.125	-0.0885	0.9987	
	Chikombedzi communal area	Gonakudzingwa small scale commercial farms	0.46911	0.19449	0.100	-0.0653	1.0035	
		Mwenezi resettlement area						
		Chikombedzi communal area	-1.11462*	0.30751	0.008	-1.9691	-0.2601	
			Gonarezhou national park	1.56970*	0.25288	0.000	0.8141	2.3253
			Gonakudzingwa small scale commercial farms	1.58373*	0.24955	0.000	0.8320	2.3354
			Mwenezi resettlement area	1.11462*	0.30751	0.008	0.2601	1.9691
		Chikombedzi communal area						

*The mean difference is significant at the 0.05 level

Table 4: Valuation data by gender and age in the four tenure regimes

Tenure	Harvester/			Selling at local mkt (R kg ⁻¹)	Local V = PXQ (Rands)	ESP* (R kg ⁻¹)	Export V1 = P1XQ1 (Rands)	Harvested (kg)	Bought (kg)	Export				Export countries
	buyer	Age	Gender							mkt (kg)	Local market	Personal consum	Bartered	
1	1	2	2	10.0	300.00	20	1000.00	100	0	50	30	10	10	1
1	1	3	2	6.0	60.00	18	540.00	50	0	30	10	5	5	1
1	1	3	2	6.0	30.00	16	720.00	60	0	45	5	5	5	1
1	1	2	1	11.0	275.00	20	4000.00	250	0	200	25	5	20	1
1	1	1	1	5.5	55.00	18	1620.00	105	0	90	10	5	0	1
1	1	5	1	5.0	0.00	20	10000.00	500	0	500	0	0	0	1
1	1	6	2	12.0	0.00	18	8100.00	460	0	450	0	10	0	1
1	1	2	2	6.5	0.00	16	4000.00	300	0	250	0	50	0	1
1	1	3	2	6.0	600.00	15	3000.00	310	0	200	100	5	5	1
1	1	5	2	13.0	195.00	22	5940.00	300	0	270	15	10	5	1
1	1	1	2	6.0	60.00	18	5400.00	320	0	300	10	10	0	1
1	1	5	2	5.5	55.00	15	2250.00	165	0	150	10	2	3	1
1	1	4	2	8.0	1200.00	16	0.00	150	0	0	150	0	0	2
1	1	4	2	4.5	135.00	12	1800.00	200	0	150	30	5	25	1
1	1	5	2	4.5	0.00	12	1200.00	100	0	100	0	0	0	1
2	1	6	2	10.0	0.00	15	3000.00	200	0	200	0	0	0	1
2	1	5	1	8.0	160.00	16	800.00	80	0	50	20	2	8	1
2	1	5	2	7.0	210.00	14	5600.00	450	0	400	30	15	5	1
2	1	7	2	9.0	0.00	18	9000.00	600	0	500	0	100	0	1
2	1	8	2	4.5	90.00	12	2400.00	230	0	200	20	5	5	1
2	1	4	1	10.0	0.00	20	4800.00	280	0	240	0	40	0	1
2	1	3	1	6.0	60.00	15	2250.00	170	0	150	10	3	7	1
2	1	4	1	5.0	100.00	12	3600.00	330	0	300	20	4	6	1
2	1	6	2	12.0	120.00	23	2300.00	118	0	100	10	5	4	1
2	2	7	2	6.5	0.00	18	2700.00	0	150	150	0	0	0	1
2	2	6	2	6.0	0.00	16	2352.00	0	147	147	0	0	0	1
2	1	8	2	13.0	130.00	22	1100.00	68	0	50	10	3	5	1
2	1	2	2	7.0	350.00	14	0.00	59	0	0	50	3	6	2
2	1	2	2	5.0	150.00	12	600.00	90	0	50	30	5	5	1
2	1	5	2	10.0	200.00	18	900.00	78	0	50	20	4	4	1
2	1	4	2	14.0	0.00	24	4320.00	200	0	180	0	20	0	1
2	1	1	2	8.0	200.00	16	1920.00	150	0	120	25	5	0	1
2	1	4	2	5.0	150.00	13	650.00	80	0	50	30	20	0	1
2	1	6	1	10.0	0.00	20	4800.00	250	0	240	0	10	0	1
3	1	5	1	13.0	0.00	26	7540.00	300	0	290	0	10	0	1
3	1	9	2	9.0	0.00	18	2700.00	150	0	150	0	0	0	1
3	1	4	2	6.0	120.00	15	3750.00	275	0	250	20	5	0	1
3	1	8	2	4.0	0.00	8	0.00	50	0	0	0	50	0	3
3	1	7	2	11.0	0.00	20	2000.00	135	0	100	0	35	0	1
3	1	3	2	6.0	0.00	15	1500.00	125	0	100	0	25	0	1
3	1	2	2	4.0	200.00	6	0.00	55	0	0	50	5	0	3

Table 4: Continue

Tenure	Harvester/ buyer		Age	Gender	Selling at local mkt (R kg ⁻¹)	Local V = PXQ (Rands)	ESP* (R kg ⁻¹)	Export V1 = P1XQ1 (Rands)	Harvested (kg)	Bought (kg)	Export			Export countries	
											market (kg)	Local market	Personal consum		Bartered
3	1	7	1		9.0	0.00	16	1120.00	75	0	70	0	5	0	1
3	1	8	2		9.0	0.00	18	3330.00	200	0	185	0	10	5	1
3	1	6	2		6.0	0.00	15	2550.00	190	0	170	0	20	0	1
3	1	9	2		5.0	0.00	10	0.00	45	0	0	0	45	0	3
3	1	8	2		9.0	0.00	18	1440.00	90	0	80	0	10	0	1
3	1	6	2		8.0	0.00	16	800.00	60	0	50	0	10	0	1
3	1	3	2		6.0	0.00	12	600.00	55	0	50	0	5	0	1
3	1	1	2		4.0	0.00	12	720.00	65	0	60	0	5	0	1
3	1	7	2		7.6	0.00	16	1120.00	75	0	70	0	5	0	1
3	1	5	2		6.0	0.00	10	0.00	35	0	0	0	35	0	3
3	1	6	2		5.0	0.00	8	0.00	30	0	0	0	30	0	3
3	1	9	1		7.0	0.00	15	1200.00	85	0	80	0	5	0	1
3	1	2	1		5.0	0.00	12	1200.00	105	0	100	0	5	0	1
3	1	9	1		4.5	0.00	10	1400.00	145	0	140	0	5	0	1
3	1	11	2		10.0	0.00	20	1800.00	95	0	90	0	5	0	1
3	1	6	1		9.0	0.00	12	0.00	20	0	0	0	20	0	3
4	1	4	2		7.6	0.00	12	0.00	5	0	0	0	5	0	3
4	1	2	2		5.0	0.00	8	0.00	10	0	0	0	10	0	3
4	1	5	2		4.0	0.00	8	0.00	5	0	0	0	5	0	3
4	1	9	2		6.0	0.00	8	0.00	10	0	0	0	10	0	3
4	1	2	2		4.0	0.00	16	960.00	80	0	60	0	20	0	1
4	1	10	1		7.0	0.00	18	2520.00	150	0	140	0	10	0	1
4	1	1	1		6.0	0.00	10	0.00	15	0	0	0	15	0	3
4	1	2	1		4.0	0.00	8	0.00	12	0	0	0	12	0	3
4	1	8	1		8.0	0.00	10	0.00	20	0	0	0	20	0	3
4	1	5	1		6.0	0.00	10	0.00	25	0	0	0	20	5	3
4	1	4	1		4.0	0.00	7	0.00	20	0	0	0	20	0	3
Total								140912.00							
Average value (Rands)						76.10		2072.24							

Exchange rate: US \$1:R10 (South African Rand); Tenure regimes; 1 = Gonarezhou national park (state tenure), 2 = Gonakudzingwa small scale farms (private tenure), 3 = Mwenezi resettlement area (semi-state tenure), 4 = Chikomedzi communal area (Communal tenure); Harvester or buyer of mopane worms, Harvester = 1, buyer = 2; Age = of harvester or buyer, 1>15 years, 2 = 16-20 years, 3 = 21-25 years, 4 = 26-30 years, 5 = 31-35 years, 6 = 36-40 years, 7 = 41-45 years, 8 = 46-50 years, 9 = 51-55 years, 10 = 56-60 years, 11 = 61+years; Gender of harvester or buyer of mopane worms, 1 = male, 2 = female; Selling at local market/kg (Rands/kg): Export prize = Export selling prize of mopane worms to South Africa (R/kg) harvested (kg) = Quantities of mopane worms harvested (kg) dry weight; Bought (kg) = Quantities of mopane worms bought from other harvesters (kg) dry weight exported = Quantities of mopane worms exported to South Africa (kg) dry weight = 1; harare export = 2 local market = Quantities of mopane worms sold at local market (kg) dry weight = 3: Personal consumption = Quantities of mopane worms used for personal consumption (kg) dry weight bartered = Quantity of mopane worms exchanged with other household commodities (kg) dry weight export countries = Countries where the mopane worm were exported.* Export selling price

Quantities of mopane worms bartered at local market was significant in (Mwenezi and Gonarezhou national park and Chikomedzi and Gonarezhou; 0.004 < p < 0.000) after realizing the importance of barter trade to meet immediate obligations by the mopane worm harvesters.

Quantities of mopane worms used for local consumption to meet dietary requirements especially for safety net was found to be significant in (Mwenezi and Gonarezhou and Chikomedzi and Gonarezhou national park; 0.004 < p < 0.002).

Quantities of mopane worms exported was significant in (Gonarezhou national park compared to Chikomedzi Communal and Gonakudzingwa small scale farms compared to Chikomedzi communal area; 0.001 < p < 0.000).

The existence of the South African export market for mopane worms was significant in (Gonarezhou compared to Chikomedzi and Gonakudzingwa small scale farms

compared to Chikomedzi Communal p = 0.000). The average local market price for mopane worms was \$7.61 kg⁻¹ whilst that for export market was \$207.22 kg⁻¹ (Table 4).

Table 5 on the list of appendices shows a typology of estimates of non-timber forest products (ntfps) values and estimation methods used in some selected studies harvested in different parts of the world.

Why value Non Timber Forest Products (NTFPs)? The question of why value non-timber forest products for example mopane worms depends upon the view of policy maker in question. In general, valuation of any product or resource is considered an essential step in deciding the use of the scarce resources. Placing a value on non timber forest products would allow policy makers to choose appropriate mix of management regimes to apply to the scarce resources which is whether the resource should be

Table 5: Typology of estimates of non-timber forest products (ntfps), values and estimation methods

Study	Country	NTFPs	Value	T (years)	Discount rate (%)	Method of estimation
Peters <i>et al.</i> (1989)	Ecuador	Fruit and latex	\$6820/ha/year	-	5	Dynamic wealth model
Grimes <i>et al.</i> (1994)	Ecuador	Many products	\$2306/ha/year	-	5	Dynamic income model
Godoy and Feaw (1989)	Indonesia	Rattan	\$495/ha/year	25	10	Dynamic income model
Chopra (1993)	India	Fuelwood and fodder	\$889-1086 per ha/annum	30	12	Dynamic income model
Kant (1996)	Gujarat and West Bengal, India	Fuelwood, fodder and many other NTFPs	\$99/family/year	-	-	Static income model
Gunatilake <i>et al.</i> (1993)	Sri Lanka	Fuelwood and fodder	\$92/ha/year \$253/family/year	-	-	Static income model
Appasamy (1993)	Tamil Nadu, India	Fuelwood and fodder	\$80/ha/year	-	-	Static income model
\$74/family/year	-	-	Static income model	-	-	
Alcorn (1989) cited in Adger <i>et al.</i> (1995)	Mexico	Coffee and other NTFPs	\$330/ha/year (excluding coffee)	-	-	Static income model
			\$1540/ha/year	-	-	Static income model
Mufandaedza	Zimbabwe	Imbrasia belina (mopane worms)	\$7.61-207.22 kg ⁻¹	-	-	Static income model

The estimated values of *Imbrasia belina* (mopane worms) (kg). These results are quite comparable from studies undertaken on other NTFPs across the different environments of the world

managed for timber resources, non timber forest products or environmental services. Based on this knowledge of values decision makers would then make appropriate investment and management decisions on non timber forest conservation (Anderson, 1990).

The existence of the South African market for mopane worms was found to be significant in Gonarezhou compared to Chikombedzi and Gonakudzingwa small scale farms compared to Chikombedzi communal. The average local market price for mopane worms was \$7.61kg⁻¹ whilst that for export market was \$207.22 kg⁻¹. Comparing the local market to export, the export market was about 27 times more lucrative to local market, hence the drive to sell mopane worms in South Africa. This means that based on the values placed on the natural resources, it would be possible to prioritize and allocate resources towards conservation. Besides, based on the knowledge of values of different resources it would also be possible to know which resource to grow, support and manage. A case in point is the Gujarat Forestry in India where based on ecological significance and value of non timber forest products, Gujarat banned timber logging operations indefinitely (Tewari, 1998). Also, a similar situation occurred in the United States of America where environmental benefits outweighed the timber benefits and this resulted in non cutting of timber (Hartman, 1976). Information on values of fruit and latex reported by Peters *et al.* (1989) (Table 5), Allegretti (1990), Anderson, (1990), made a point that valuation of non timber forest products strengthens the cause of forest conservation. This was confirmed by Mufandaedza in the management of mopane worms.

The WRI (1999) reported a deforestation rate of 16 million ha which could even be higher now but could have been reduced had information on natural resource values been easily available.

Proper valuation of NTFP's acts as a positive indicator to the investors. This means that high valued NTFP's acts as centers of attraction to investors. From this study, it could be deduced that prices of mopane

worms attracts a premium in South Africa which could boost the economic performance of trading countries. However, market development and awareness would be required to promote the product to the end users. Valuation of non timber forest products like mopane worms would possibly stimulate the process of marketization of the resource with the possibility of developing institutional arrangements that govern economic exploitation of the scarce resource in question. On the other hand, valuation of non timber forest products is a key tool in forestry departments to mobilize support from government budgetary allocations. According to Bateman (1991), this principle had helped the forestry department in the United Kingdom in attracting greater amount of budgetary support for conservation. Proper valuation of non timber forest products has an immense value in determining compensation in cases of loss or damage in the courts of law as cited by USDI (1986) and Condon (1998). This study had also shown that the quantities of mopane worms harvested were significant in Gonarezhou national park, Mwenezi resettlement area and Gonakudzingwa small scale farms. Chikombedzi communal area had poor harvests because of depletion of the resource. On realization of the export values of mopane worms, a significant number of harvesters bought some mopane worms for the South African export market. Therefore, an awareness programme on valuation of non timber forest products including mopane worms holds the key to sustainable management of forest resources.

CONCLUSION

The study in the South East Lowveld of Zimbabwe explains how the valuation of mopane worms or any other non timber forest product for that matter could be approached and how this would help to develop the resource. It is assumed that proper valuation of non timber forest products lead to sustainable and informed decisions on the use of the product. The information on

values of the mopane worms across the tenure regimes studied aids decision making process and creates awareness to policy makers on the importance of mopane worms. This helps to raise the conservation status of the worms. Generally speaking, armed with the knowledge of values of different resources it would also be possible to know which resource to grow, support and manage. This information is not only relevant to the south East Lowveld of Zimbabwe but to other regions where mopane worms or other non timber forest products are threatened.

ACKNOWLEDGEMENTS

The researchers would like to acknowledge the assistance rendered by the department of national parks and wildlife management staff based at Mabalauta in the Gonarezhou national park, Mr. Marapira from the Department of Agriculture and Extension Services based at Chikombedzi and many officers from Chiredzi Rural District Council whom researchers cannot mention individually by name, the local people in the 4 tenure regimes of Chikombedzi communal area, Mwenezi resettlement area, Gonakudzingwa private farms and Gonarezhou national park.

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