Assessing rural peoples' intention to adopt sustainable forest use and management practices in South Africa

Chidiebere Ofoegbu [a,b,*] and Chinwe Ifejika Speranza [b,c]

[a]Forest Science Postgraduate Programme, University of Pretoria, Pretoria, South Africa;

[b]United Nations University, Institutes for Environment and Human Security, Bonn, Germany;

[c]Institute of Geography, University of Bern, Bern, Switzerland

*CONTACT Chidiebere Ofoegbu; ofoegbu.c@gmail.com; 11 Soleon Court, Cnr Guildford Road and Liesbeek West Road, Rosebank 7700, Cape Town, South Africa.

Abstract

This study examined rural peoples' intention to adopt sustainability practices in communally managed forests in Vhembe district, South Africa, using the theory of planned behavior as a conceptual frame-work. A total of 155 respondents were surveyed. The data was analyzed using structural equation modeling (SEM). The results showed that rural people have a strong intention to adopt sustain-able forest-use and management practices. Out of the three con-structs comprising the theory of planned behavior, subjective norm (SN) and attitude to behavior (AB) positively correlated with inten-tion, with SN having the strongest influence on intention. Perceived behavioral control (PBC), which is the third construct, negatively correlated with intention. The study indicates that respondents' sub-jective belief about the approval or disapproval of sustainable forest management (SFM) practices by other relevant people mainly influ-enced their intention to adopt or not adopt such practices. Thus, strategies and policies to enhance the sustainable management of communally owned forests in South Africa need to consider local actor contexts and sociocultural norms and values. In this regard, the engagement of influential people at the community level, and the demonstration of the short- and long-term benefits of sustainable forest use and management practices offer promising entry points.

Introduction

Globally, forests[1] provide important social, economic and ecological functions and are essential components of climate change mitigation and adaptation at the local, national, and regional levels (Dlamini, 2014). Forest-related mitigation activities such as afforestation/reforestation or reducing deforestation, and adaptation activities such as community based forest management are recognised to be efficient and cost effective (Chia Chia, Somorin, Sonwa, & Tiani, 2013; Chidumayo, Okali, Kowero, & Larwanou, 2011). They are also strongly linked to enhanced rural livelihoods resilience to climate and socioeconomic risks (FAO, 2015a; Dlamini, 2014). Thus, forests are an important component of the adaptation strategies needed to address the direct and indirect impacts of climate and socioeconomic challenges (Naidoo, Davis, & Van Garderen, 2013; Locatelli et al., 2010).

In South Africa, forest based livelihoods are a significant component of rural livelihoods strategy (DAFF, 2010; Ole-Meiludie & Mwihomeke, 2006). About 40% of South Africa's population reside in rural communities (Turpie & Visser, 2013). These communities are characterised by poor access to basic services and facilities, and high unemployment (Linkd, 2013). From the livelihood perspective, forests provide many direct and indirect benefits to rural households in South Africa (Shackleton, Campbell, Wollenberg, & Edmunds, 2002). Commonly cited direct benefits include (i) provisioning of households with goods either for meeting basic needs or for cash saving particularly during periods of hardship, and (ii) Small-scale trade in forest goods (Shackleton, Shackleton, Buiten, & Bird, 2007). Most indirect benefits of forest to rural households in South Africa include (i) provisioning of browse and fodder for livestock, and (ii) tourism enterprises (Shackleton et al., 2007). Additionally, both the South African National Climate Change Response Strategy, and the Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) recognised the forest sector as central to rural livelihood resilience to climate and socioeconomic challenges (Department of Environmental Affairs: DEA, 2013; Department of Environmental Affairs and Tourism: DEAT, 2004).

Consequently, sustainable forest management programmes such as community forestry, forest enterprise development, community woodlot etc. are increasingly being implemented in South Africa (DAFF, 2010; Holmes, 2007). These initiatives are aimed at enhancing rural livelihoods resilience to social-ecological challenges (Hajost and Zerbock, 2013). However, despite the potential multiple benefits associated with sustainable forest use and management, sustainability of these benefits has been poor (Hajost and Zerbock, 2013; Holmes-Watts & Watts, 2008). This is largely because most forests in rural South Africa are treated as open access resources (Gugushe, Grundy, Theron, & Chirwa, 2008; Isaacs & Mohamed, 2000). These often lead to noncompliance with regulations guiding the use and management of the forests. The most affected are the communally/tribally managed forests (DAFF, 2010; Gugushe et al., 2008). In a survey of forest stakeholders' adoption of sustainable forest management practices in the Eastern Cape Province of South Africa, Obiri & Lawes (2002)

---

[1] The term forests as used in this study is all encompassing and includes indigenous forests, woodlands, thickets and tree plantations. This definition conforms to the definition used by the FAO, which means any land with greater than 10% cover by woody, perennial plants (FAO 2015b).

2

observed varying responses. They reported that all resource users and managers were aware of regulation that requires them to obtain permit for using state managed forests. However, only few stakeholders were aware that such permit was needed to access communal/tribal managed forests. Furthermore, among the few that were aware of the requirement to obtain permit for using communal/tribal managed forests, none of them obtained the permit. Thus there is a need to understand resource users' perceptions and government framing of sustainable forest management.

Conceptualising Sustainable forest use and management in South Africa's rural communities

The South African government approach to Sustainable Forest Management (SFM) is aimed at addressing forest degradation and deforestation while increasing direct benefits to the environment and people, particularly the previously disadvantaged people (Department of Water Affairs and Forestry: DWAF, 1997). The South Africa's National Forests Act, 1998 (Act 84 of 1998), and the Forestry Law Amendment Act, 2005 (Act 35 of 2005), stipulate the rules and guidelines for fostering SFM in the country (Holmes-Watts and Watts, 2008). These policies provide guidelines on how people and communities can use forests sustainably. The South African forest policy and legislation contained 24 sets of principles and criteria, and a series of indicators that are used to conceptualise, evaluate and implement SFM in the country (DAFF, 2016). While adherence to these policies guidelines have helped in fostering sustainable forest use and management in most state and privately managed forests in the country, same cannot be said for communal/tribal managed forests (DAFF, 2016; Gugushe et al., 2008; Obiri and Lawes, 2002).

Most forests in rural communities of South Africa are owned and managed by tribal/communal authorities (Gugushe et al., 2008; Berliner, 2005). These forests are often treated as open access resources with local residents rarely complying with regulation guiding their use and management (Gugushe et al., 2008; Geldenhuys, 2002). This challenge has resulted in deforestation and forest degradation in majority of the communally managed forests in the country (DWAF, 2005) leading to the notion that rural communities' members may not have the attitude to support sustainable forest use and management. Thus in this study, sustainable forest use and management was operationalised as households' conformity with government policy and regulation guiding forest use and management practices at rural community level in South Africa. The study used 12 of the national forest management principles and criteria that applies to communal/tribal managed forests in the country to conceptualise SFM (Table 1).

Table 1. Criteria and Indicators for fostering sustainable forest management in South Africa

No	Criteria
1	Biodiversity of natural forests is conserved
2	Forest ecosystem structures are conserved and processes maintained
3	Forests are protected from negative effects of fire, pests, diseases and alien plants
4	Production potential is maintained or improved
5	Forests make a positive contribution to the economy
6	The forest economy is resilient
7	Cultural, ecological, recreational, historical, aesthetic and spiritual sites and services supplied by forests are maintained.
8	The distribution of employment benefits from forests is fair
9	The distribution of the costs from forestry is fair
10	There is effective stakeholder participation in forestry management
11	Forests are developed and managed so that persons or categories of persons previously disadvantaged by unfair discrimination are advanced.
12	People participate in forestry policy development and review

Adapted from the South Africa national level principles, criteria, indicators and standards (DAFF, 2016)

Several studies investigating factors influencing weak adoption of sustainable forest use and management practices by rural communities in South Africa, focus on social and economic variables (Holmes, 2007; Fabricius, 2004; Isaacs & Mohamed, 2000). Holmes-Watts and Watts (2008) observed that several community forest management projects in South Africa focussed majorly on benefit sharing in the form employment provision and access to forest products, while ignoring the aspect of participation in management responsibilities and decision-making. Lack of experience and innovation on the part of forestry officials operating in grassroots communities was identified as a limiting factor to the implementation of effective people-centred community forest management in South Africa (Holmes, 2007; Isaacs & Mohamed, 2000). Furthermore, Holmes-Watts and Watts (2008) noted that capacity enhancement for effective community participatory forest management initiatives focused solely on state forest department personnel.

However, if forest management programmes are to be used to enhance rural household livelihood sustainability and resilience to climate and socioeconomic challenges, then rural households' behaviour towards adoption of sustainable forest use and management practices must be understood (Bourke & Luloff, 1994; Infield, 1988). Little is known about how psychosocial factors i.e. attitude, subjective norm and perceived behavioural control influence rural households behavioural intention towards adoption of sustainable forest use and management practices in South Africa. And what this might imply for sustainable management of communal\tribal managed forests in the country.

The present research thus investigates psychosocial factors influencing rural households' behavioural intention towards adoption of sustainable forest use and management, and how this might help towards establishment of effective and sustainable forest development initiatives in rural South Africa. The study applies the widely used psychosocial model the Theory of Planned Behaviour (TPB) (Ajzen, 2013), to analyse psychosocial factors that

influences rural households' behavioural intentions towards adoption of sustainable forest use and management practices. Meijer, Catacutan, Sileshi & Nieuwenhuis (2015) used the TPB to explain tree planting intention of rural farmers in Malawi. Karppinen (2005) used the TPB to investigate forest owners' choice of reforestation method with respect to forest management decisions. Borges et al. (2014) used the TPB to investigate farmers' intention to use improved natural grassland. In the cases reviewed, the TPB was shown to be a satisfactory model in envisaging people's behavioural intention. The study main objective is to use the TPB constructs (i.e., attitude, subjective norms, and perceived behavioural control) to assess rural households' behavioural intentions towards adoption of sustainable forest use and management practices.

Theoretical framework: The theory of planned behaviour
The theory of planned behaviour was used as the theoretical framework to investigate rural households' behavioural intentions towards adoption of sustainable forest use and management practices. The TPB is a general theoretical framework useful in explaining human behavioural intention (Ajzen, 2013). The TPB as illustrated in figure 1, hypothesises that behavioural intention can be elicited from three psychological concepts: attitude to behaviour (AB), subjective norm (SN), and perceived behavioural control (PBC) (Ajzen, 2013; Meijer et al., 2015). Attitude is defined as "a person's favourable or unfavourable evaluation of the behaviour" (Borges, Alfons & Lansink, 2016). Subjective norm is "the perceived social pressure to perform or not to perform a specific behaviour" (Meijer et al., 2015). Perceived behavioural control refers to how an individual perceives his or her capacity to execute a specific behaviour (Borges et al., 2014).

In general, behavioural intention is higher if attitude and subjective norm to that behaviour are more favourable and if perceived behavioural control is high (Knussen, Yule, MacKenzie, & Wells, 2004). As a general rule, the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's behavioural intention to perform the behaviour in question (Karim Ghani, Rusli, Biak, & Idris, 2013). Attitude, behavioural intention, subjective norm, and perceived behavioural control were elicited using questionnaire.

Thus a respondent (household) will have a stronger behavioural intention to adopt sustainable forest use and management practices under the following conditions: if they evaluate the outcome of their adoption of the practice to be more favourable (positive attitude), when the social pressure to adopt the practice is strong (positive subjective norm), and when they have positive perceptions about their own capacity to adopt the practice (positive PBC).

Therefore the study tested the three following hypotheses:

H1: Attitude towards the behaviour positively affects households' behavioural intention towards adoption of sustainable forest use and management practices.

H2: Subjective norm positively affects households' behavioural intention towards adoption of sustainable forest use and management practices.

H3: The perceived behavioural control positively affects or increases households' behavioural intention towards adoption of sustainable forest use and management practices.
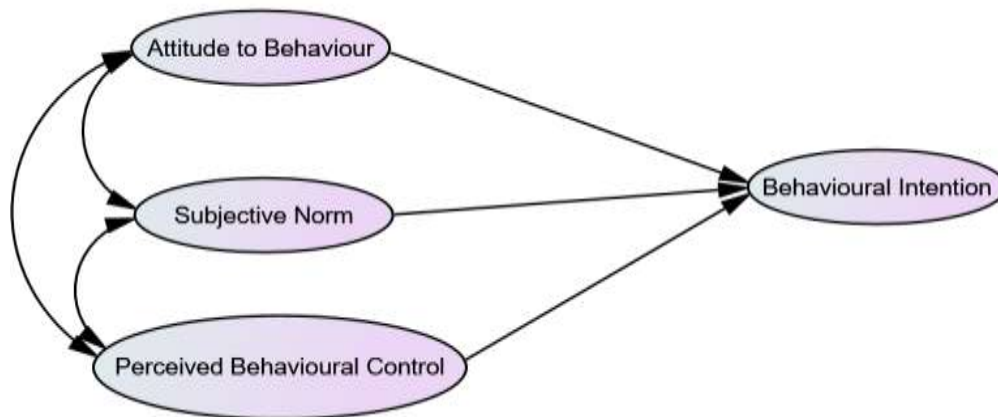

Figure 1: Theory of Planned Behaviour (Ajzen, 1991)

Methodology

Study Area

A total of 11 rural communities from Vhembe district (**Figure 2**), South Africa were selected for this study. The communities are located in Thulamela and Makhado municipalities of Vhembe district. Vegetation type and dominant livelihood strategy were used as criteria to select these two municipalities out of the four municipalities that make up Vhembe district (Cooperative Governance and Traditional Affairs: CoGTA, 2012). The sampled villages in these two municipalities were chosen because of widespread forest based livelihood activities by the inhabitants (Ofoegbu, Chirwa, Joseph & Babalola, 2016).
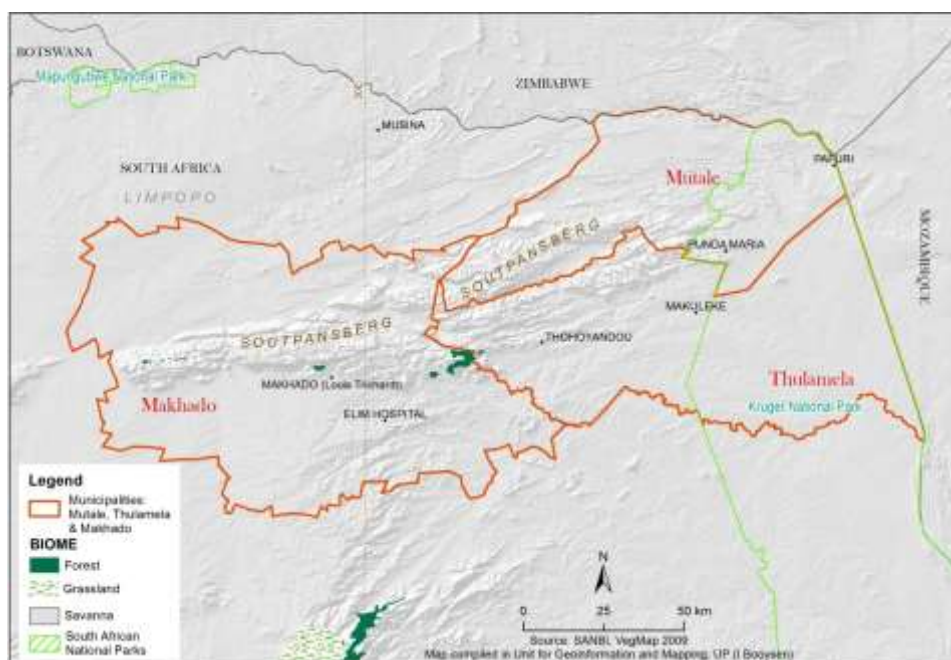
Figure 2: Map of Vhembe District where the study was conducted (Source: SSA, 2011)

A total of 155 respondents were surveyed. Proportionate random sampling was used to sample 75 and 80 respondents in Thulamela and Makhado municipalities respectively. All respondent are directly or indirectly dependent on forests for livelihood (CoGTA, 2012; Ole-Meiludie & Mwihomeke, 2006). While a majority rely on forests for supply of firewood, pole, thatch grass for roofing, and fodder for livestock, some make a living from small scale trade in forest products. Few respondents are employed in the forest industry (Ofoegbu et al. 2016). Makhado and Thulamela are made up of Savannah and woodland vegetation, respectively (Rosmarin, 2013). Most respondents were within the age range of 41- 50 and 51 -60. Thulamela had more male respondents while the opposite is the case in Makhado. Furthermore, majority of the respondents in both municipalities were unemployed and had no formal education. This limits the people's capacity to participate in the formal economic sector, hence majority of households are involved in the informal economic sector, and are mostly engaged in subsistence agriculture and forest based livelihood (Table 2). Poverty, defined as "level of consumption below which individuals are unable to purchase sufficient food to provide them with an adequate diet" (National Planning Commission: NCP, 2011), is also widespread in the area.

Table 2. Demographic profile of respondents

Demographic characteristics	Total number of respondents (n=155)	
	Thulamela (%)	Makhado (%)
Age (Years)		
≤ 30	15	4
31-40	23	21
41-50	25	30
51-60	24	15
61 and above	13	30
Gender (%)		
Male	57	42
Female	43	58
Marital Status (%)		
Single	40	24
Married	40	50
Divorced	20	26
Employment Status		
Unemployed	52	60
Retired	7	9
Self Employed	13	21
Employed	27	10
Student	1	0
Highest level of Education (%)		
No formal education	23	53
Grade 11 or Lower	19	13
Grade 12(Matric, std. 10)	20	19
Post-matric diploma or certificate	20	9
Post-matric diploma baccalaureate degree (s)	15	8
Postgraduate degree(s)	4	0

Table 3. Statement and scales used for measuring the four TPB constructs

Item	Statement	Scale 1-7
BI_1	I am _____to engage in sustainable forest use and management in response to communal climate and socioeconomic risk management	Strongly likely-Strongly unlikely
BI_2	I _____ to engage in sustainable forest use and management over the next 6 months	Strongly intend – strongly unintended
BI_3	I have a _____ intention to adopt sustainable forest use and management over the next 6 months	Very strong- Very weak
AB_1	I think that engaging in sustainable forest use and management practice is _____ to my livelihood resilience to climate change impacts	Extremely beneficial-Extremely not-beneficial
AB_2	I think that engaging in sustainable forest use and management is _____ to my capacity to cope and adapt to socioeconomic shocks	Extremely beneficial-Extremely not-beneficial
AB_3	I think that engaging in sustainable forest use and management will _____ sustainability of forest based livelihood in my community	Extremely enhance-Extremely not enhance
AB_4	I think that engaging in sustainable forest use and management will _____ my socioeconomic wellbeing	Extremely improve – extremely not improve
AB_5	I feel positively about the possibility of engaging in sustainable forest use and management with respect to climate change adaptation in my community	Strongly agree – Strongly disagree
SN_1	If I engaged in sustainable forest use and management people who are important to me would approve/disapprove	Extremely approve – Extremely disapprove
SN_2	Most people who are important to me think that engaging in sustainable forest use and management is desirable/ undesirable	Extremely desirable – Extremely undesirable
SN_3	Most people who are important to me would support my adoption of sustainable forest use and management practices	Highly probable- highly improbable
SN_4	I care _____ about the opinion of people who are important to me with respect to my engaging in sustainable forest use and management practices	Very much- Very barely
PBC_1	My knowledge and expertise to engage in sustainable forest use and management is quite adequate	Strongly agree – Strongly disagree
PBC_2	Easy access to technical assistance will _____ my engagement in sustainable forest use and management	Extremely facilitate-Extremely not facilitate
PBC_3	Possession of skills and expertise is _____ to my engagement in sustainable forest use and management	Extremely important – Extremely not important
PBC_4	It is mostly up to me whether I engage in sustainable forest use and management	Strongly agree – Strongly disagree
PBC_5	It is _____ that reduction of my dependence on forest for subsistence and income will enhance my engagement in sustainable forest use and management	Strongly likely – Strongly unlikely

BI = Behavioural Intention; AB =Attitude to Behaviour; SN = Subjective Norm; PBC = Perceived Behavioural Control

TPB Constructs Item Measurement

The study questionnaires were designed to elicit information from respondents on the four TPB constructs: (1) behavioural intention, (2) attitude to behaviour, (3) subjective norm and (4) perceived behavioural control with respect to adoption of sustainable forest use and management practices (Table 3). Sustainable forest use and management was explained to the

respondents in terms of the criteria specified in Table 1, hence sustainable forest use and management means meeting any of the criteria listed in Table 1. The questionnaire was designed following the guidelines recommended by Ajzen (2013; 2011). The questionnaire was divided into six (6) main sections: (1) general information; (2) socioeconomic information; (3) attitude towards adoption of sustainable forest use and management practices with respect to adaptation to climate and socioeconomic shocks; (4) subjective norms (perception about social pressure to engage in sustainable forest use and management); (5) perceived behavioural control (perception about ability to engage); (6) behavioural intentions to engage in sustainable forest use and management practices.

Seventeen items were used to capture the four constructs of the TPB. The measurement scale is based on a seven-point likert scale ranging from one (most positive answer) to seven (most negative answer) (Borges et al., 2016; Borges et al., 2014; Ajzen, 2013).

Survey Process

The data collection took place from January to February 2016. The interview team for the study comprised the researcher and two enumerators. The enumerators were selected based on their academic qualifications and experience with questionnaire survey study. Given the strategic need to ensure that the study questions were communicated to respondents in their mother tongue for accurate understanding (Swanepoel & Beer, 2006), the study questionnaire was translated into the two dominant local languages (Tshivenda and Xitsonga). The translated questionnaire was then pre-tested to ensure its accuracy, and feedbacks were used to make final corrections. The field enumerators were put through a training workshop on the study objectives. The workshop was followed with a pilot survey to enable the enumerators to have field experience of the administration of the questionnaire before the actual study. Following the approach pattern used by Ham and Theron (2001), rural community chiefs and headsmen were briefed about the study months before the actual study. Direct observation and administration of the questionnaire were the methods applied in gathering the data for this study. As recommended by Bless and Smith (1995), the survey process was thoroughly carried out to avoid bias.

Data Analysis: Structural Equation Modelling

Analysis was based on the Structural Equation Modelling technique (SEM) using Amos add-on in Statistical Package for the Social Sciences (SPSS) Version 21 (Olorunniwo & Hsu, 2007). In structural equation modelling, multiple regressions are used to explore how study variables relate and the extent of such relations (Division of Statistics and Scientific Computation, 2012; Hair, Black, Babin, & Anderson, 2010).

The following analysis steps were followed: Step 1: The data for the study were first screened for conformity with the assumptions for SEM (Division of Statistics and Scientific Computation 2012). The screened data were then used to test the study TPB model. This was done by following a two-step approach (Borges et al., 2016). Step 2a: A Confirmatory Factor

Analysis (CFA) to obtain a satisfactory measurement model (MM). Step 2b: Use of the MM to develop and test the study structural model (SM) (cf. Borges et al., 2016).

Results

Data Screening Result

The test for multivariate normality (multivariate outliers) using Mahalonobis test identified 5 questionnaires as outliers: 1 from Thulamela, and 4 from Makhado. These outliers were subsequently excluded from the study analysis, reducing our total analysed sample to 150 questionnaires. Responses in the outlier questionnaire are the most extreme i.e. the observations are distant from other observations.

The result of the test for multiple collinearity assumption showed that two items (AB1 and AB2), measuring attitude to behaviour constructs violated the assumption for multiple collinearity. Thus the two items are not independent. They seem to be measuring same thing. The two items were found to both have tolerance values less than 0.10 and VIF values greater than 10 (Table 4). The two items were then excluded from the study analysis because they were technically measuring the same thing. This was done to eliminate redundancy in our model (Gefen, Straub, & Boudreau, 2000).

Table 4. Multicollinearity test of the TPB items

Coefficients[a]							
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.232	1.920		2.205	.029		
	AB1	.116	1.837	.024	.063	.950	.038	26.536
	AB2	-1.042	1.963	-.217	-.531	.597	.033	30.149
	AB3	.401	.572	.088	.701	.485	.357	2.805
	AB4	-.009	.290	-.003	-.031	.975	.592	1.689
	AB5	.318	.276	.091	1.154	.251	.889	1.125
	SN1	-.048	.530	-.015	-.090	.928	.195	5.128
	SN2	.623	.527	.195	1.182	.239	.204	4.894
	SN3	-.814	.415	-.265	-1.959	.052	.304	3.288
	SN4	.602	.376	.191	1.602	.111	.392	2.550
	PBC1	.683	.270	.237	2.533	.012	.634	1.578
	PBC2	-.006	.354	-.002	-.018	.986	.416	2.404
	PBC3	.103	.365	.031	.281	.779	.448	2.234
	PBC4	-.066	.294	-.021	-.224	.823	.659	1.517
	PBC5	-.158	.201	-.079	-.786	.433	.552	1.812
	BI1	1.104	.411	.376	2.686	.008	.283	3.528
	BI2	-.965	.566	-.336	-1.704	.091	.143	6.982
	BI3	.585	.500	.200	1.170	.244	.191	5.227

The result of the reliability test showed that the PBC construct had an Alpha Cronbach value of 0.566. Items PBC4 and PBC5 were eliminated from the PBC construct to raise the Alpha Cronbach value to 0.707. Thus all four constructs had values greater than 0.7. This suggests that all four constructs could be considered as reliable. The data screening process thus reduced both PBC and AB constructs item to 3. The remaining numbers of items for each construct (Table 4) are as follows: Attitude to behaviour (3items), Subjective norms (4 items), Perceived behaviour control (3 items), and Behavioural intention (3 items).

Discriminant and convergent validity results

Table 5 and 6 present the results of the discriminant validity and convergent validity for the constructs. The Composite Reliability (CR) test for the constructs showed good values; ranging from 0.716 to 0.927, exceeding the recommended level of 0.7 which was suggested by Gefen et al. (2000). The average variance extracted (AVE) for the constructs showed good values; ranging from 0.427 to 0.809, exceeding the recommended level of 0.41 as suggested by Mcfarlane and Boxall (2003) for human behavioural studies.

Table 5: Convergent Validity result for the four TPB constructs

Convergent Validity	BI	AB	SN	PBC
$AVE = \sum x12/N$	0.809	0.499	0.427	0.573
$CR = ^{cR}\frac{(\sum \lambda)^2}{(\sum \lambda)^2 + \sum var(\varepsilon)}$	0.927	0.793	0.716	0.778
Convergent validity	Established	Established*	Established	Established

The result of the discriminant validity test showed that all the constructs meets the criteria for discriminant validity assumption (Table 6). All the constructs have AVEs greater than their correlation squared. According to Sentosa and Mat (2012) and Division of Statistics and Scientific Computation (2012) average variance extracted (AVE) should be more than the correlation squared of the two constructs to support discriminant validity. Hence the obtained factor loadings AVE and CR indicate a convergent validity of the MM.

**Table 6:** Discriminant validity result for the four TPB constructs

Discriminant Validity			Factor Correlation	Correlation Squared	AVE_1 (AVEs should be $>r^2$)	AVE_2	Discriminant Validity
AB	<-->	PBC	0,091	0,008281	0.499	0.573	*
SN	<-->	PBC	-0,118	0,013924	0.427	0.573	*
BI	<-->	PBC	-0,010	0,0001	0.809	0.573	*
SN	<-->	AB	0,148	0,021904	0.427	0.499	*
AB	<-->	BI	0,170	0,0289	0.499	0.809	*
SN	<-->	BI	0,355	0,126025	0.427	0.809	*

* Discriminant validity established

The Measurement Model

After obtaining a satisfactory result from the convergent and discriminant validity test, we proceeded to examine the model validity. This was done by measuring the overall goodness of fit (GOF) statistics. The GOF was evaluated by checking the chi square value (X^2), goodness of fit index (GFI), the normed fit index (NFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Generally an acceptable model fit is indicated by GFI, NFI, and CFI values higher than 0.9 and by RMSEA value smaller than 0.08 (Division of Statistics and Scientific Computation, 2012; Hair et al., 2010; Olorunniwo and Hsu, 2007).

To assess the fit of the measurement model, we generated several GOF statistics indices. The normed chi square was ($\chi2 = 313,900$; df =84; 0.000; CMIN/DF = 3,737) which was lower than 3. The goodness of fit index (GFI) (0.810), the comparative fit index (CFI) (0.842) and the normed fit index (NFI) (0.798), all registered values lesser than the 0.9 cut off value as suggested by Bagozzi & Yi (1988). Moreover, the roots mean square error of approximation (RMSEA) was 0.133, which was higher than the recommended 0.08 (Gefen et al., 2000). This indicates a weak fit of the TPB model. Hence we re-estimated the model. In order to do these we had to improve the model by examining the model modification indices. The model was improved by inserting a correlation between the e3 and e4 error terms (Borges et al., 2016). The result of the re-estimated MM indicated an acceptable fit to the data ($\chi2 = 92,177$; df =58; 0.000; CMIN/DF = 1,589); GFI = 0.913; CFI = 0.962; NFI = 0.905; and RMSEA = 0.062.
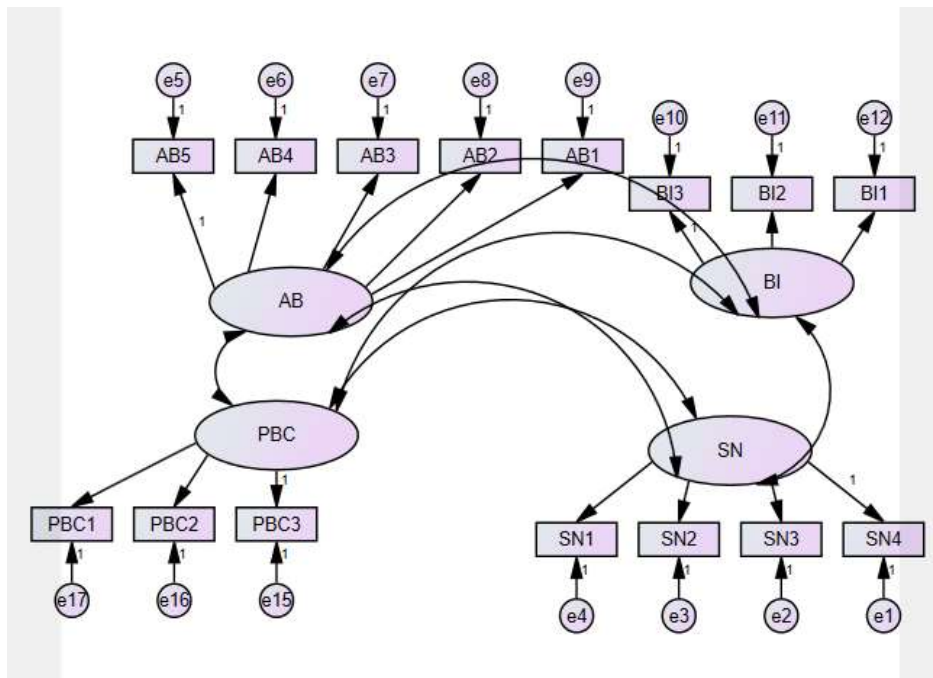
Figure 3: Pairwise Correlation of the Measurement Model (MM).

Legend: circle: an error term; square: a measurable item; ellipse: a latent construct; straight arrow: a dependence relation; curved arrow: a correlational relation

The Structured Model

After obtaining a satisfactory measurement model, we verified the structural model (SM). We drew our hypothesized models and examined the underlying directional relationships among behavioural intentions, attitude to behaviour, subjective norms and perceived behavioural control (Borges et al., 2016; Olorunniwo & Hsu, 2007). The model allowed us to graphically view the inferred causal relationships between the four TPB constructs (Division of Statistics and Scientific Computation, 2012; Olorunniwo & Hsu, 2007). This was done to test the study three hypotheses as stated in section 2.2. The result of the SM is presented in table 7.

Table 7: Outcomes of the structural model (SM)

Structural relation	Standardized parameter	P (Value) at (0.05) level
AB --> BI	0.222	0.028
SN --> BI	0.373	0.013
PBC --> BI	-0.013	0.879

Table 7 shows that the regression coefficients of AB on BI and SN on BI are positive while the coefficient of PBC on BI is negative. SN has the highest regression coefficient (Table 7), and is thus the main determinant of BI. Thus we cannot reject hypothesis H1 (Attitude has a positive influence on rural households behavioural intention) and hypothesis H2 (Subjective norm has a positive influence on rural households behavioural intention). As the regression coefficient of PBC on BI is negative and insignificant we cannot accept hypothesis H3 (Perceived behavioural control has a positive influence on rural households' behavioural intention).

Discussion and Implications

The analysis demonstrated the use of the TBP conceptual framework, and SEM analytical technique in explaining rural peoples' behavioural intention towards adoption of sustainable forest use and management practices in South Africa. The application of the TBP conceptual framework and SEM analytical approach showed good prospect for understanding the complex behaviour and intention of rural people towards sustainable forest management. This methodological approach demonstrates high level of reliability in understanding factors that influences people behaviour and intention towards forest management. The methodological approach can be applied at national level to help understand people behaviour towards forest use and management. This insight will be needful for formulating policies to aid effective forest governance.

Ideally the three (AB, SN and PBC) TPB predictors construct should have shown statistically significant and positive influence on behavioural intention (Ajzen, 2011). This was not the case in this study. Only SN and AB were found to have positive significant influence on behavioural intention. This is in contrast to the findings of Heirman & Walrave (2012) study on predicting adolescent perpetration in cyberbullying in Belgium, Halder et al. (2016) study on predicting students' intentions to use bioenergy in Finland, and Borges et al (2016) work on identifying psychological factors that determine cattle farmers' intention to use improved

natural grassland in Brazil, where all three constructs: SN, AB and PBC were observed to have significant positive influence on behavioural intention (BI). Nevertheless, some studies; Yazdanpanah et al., 2014 work on understanding farmers' intention and behaviour regarding water conservation in the Middle-East and North Africa; Knussen et al., 2004 work on predicting intentions to recycle household waste in a Glasgow, Scotland; and Tonglet et al., 2004 work on understanding determinants of recycling behaviour in Brixworth, all reported that at least one of the three TPB constructs do not have significant positive influence on behavioural intention.

The high influence of subjective norm on behavioural intention indicates the important role that social pressure can play in promoting sustainable forest use and management practices in South Africa's rural communities. There is a strong likelihood that rural people behaviour towards forest management can be shaped by the opinion of influential people in their lives, e.g. local leadership, tribal authority, family members etc. either because they seek the approval of these people, have to conform to expected behaviour or because they want to show commitment to their cultural values (Borges et al., 2016). Thus forest management will have to be inclusive, encompassing all relevant social groups at both household and community level for it to be impactful and sustainable. This notion has gained wider acceptance in literature and practice, and is being promoted through the concept of "inclusive forest management" by several organisations (McLain, 2008; DWARF, 2007). Not only is the inclusion of relevant social groups at household and community level, essential for sustainable forest management (Sikora & Thanh, 2007), evidence from this study indicates additional need for local influential people to play lead role in forest management activities. This notion is supported by the insights emanating from the discussions around the concept of devolution, and co-management in the debate on reformation for effective forest governance (Zulu 2013; Berkes, 2009). Devolution in forest governance is being implemented using the lens of inclusiveness, capacitation and empowerment of local people as a means of promoting sustainable forest management at local level (Counsell, 2009).

Furthermore, due to the communal nature of South Africa's rural communities, cultural and social context in most cases are very influential of individual actions (Turpie and Visser, 2013). Therefore, there is a strong likelihood that exploitation of subjective norm influence may provide an important strategy for promoting sustainable forest management in South Africa rural communities. Thus forest management actions will have to be inclusive, and recognise the existing role and power of leadership structure at both household and community level. This is because, if this structure is not recognised, it may trigger social pressure to disregard the management action. The non-recognition of local leadership structure at both household and community level have been cited as one of the factors underlying the weak cooperation between government agencies in charge of forest management and local leadership in administering sustainable forest management (Gugushe et al., 2008; Geldenhuys, 2002; Obiri & Lawes, 2002). There is therefore a need for a targeted and improved partnership between forest management authority and local leadership in fostering sustainable forest management in South Africa's rural communities. In this regard, national led forest management actions have to be adaptive to local leadership

structure. In addition, the capacity of rural people and local leadership will need to be enhanced to enable them play role in the implementation of forest management actions.

Although subjective norm was the main influencing factor of behavioural intention, attitude to behaviour also influenced respondents' behavioural intention towards adoption of sustainable forest management practices. However, given the low rate of adoption of sustainability practices and consideration in forest exploitation and management by residents in the study area, it can be inferred that the people are more interested in the immediate benefits of forest use. This is compounded by widespread poverty and unemployment in the communities (Turpie and Visser, 2013; Chigavazira, 2012). Hence initiatives designed to highlight the long term favourable outcomes of adopting sustainability practices and consideration in forest use and management may lead to implementation of sustainable forest management program in South Africa's rural communities (Menozz et al., 2015). An example such initiative is the use of 'demonstration plots'. This type of approach has been used successfully to promote community driven sustainable forest use and conservation in Liberia through the GEF small grant programme (Boakai & Zarbupoo, 2016).

The non-significance of the influence of PBC on behavioural intention indicates that the respondent's perceptions of their capacity to engage in sustainable forest use and management practices is not a significant factor in determining their behaviour towards sustainable forest management actions. Rural peoples' perceptions of their poor capacity, in terms of educational status and skill level, to participate in sustainable forest management programmes has often been cited as reason for unsustainable forest management practices in rural South Africa (Holmes-Watts & Watts, 2008; Holmes, 2007; Fabricius, 2004; CoGTA, 2012). However, results from this study indicate otherwise. This could be because rural people rely more on tacit and indigenous knowledge when engaging in forest management activities and less on explicit/formal knowledge. Hence there is a strong likelihood that poor capacity in terms of formal educational training and acquired skill cannot be a limiting factor to the implementation of sustainable forest management programmes in rural communities of South Africa.

Conclusion

This study demonstrated how the various components of TPB (Attitude to behaviour, subjective norm, and perceived behavioural control) influence rural people intention towards adoption of sustainable forest use and management practices. This demonstration provides important insight for agencies working on forest management projects in Africa. To promote adoption of sustainable forest use and management practices at rural community level in South Africa and enhance rural livelihood sustainability and resilience to climate and socioeconomic risks, government must better understand what drives households' behavioural intention. The findings of this study showed that subjective norm i.e. opinions of influential people at household and community level can play a major role in fostering adoption of sustainable forest use and management practices. Attitude to behaviour, via demonstration that expounds the long term benefits of sustainable forest use practices, has a slight significant influence. Such initiative can help poor rural people understand the long

term benefits in adopting sustainability principles in forest use and management actions. Thus initiatives that make use of these channels will likely be impactful in fostering adoption of sustainable forest use and management practices in South Africa's rural communities. While this study focussed on three psychological constructs: attitude to behaviour, subjective norm, and perceived behavioural control to capture respondents' behavioural intention towards forest management practices, they did not capture other non- psychosocial factors that may influence rural people behaviour. To this end, an investigation of the influence of factors such as social differentiation, the role of historical processes on access to and control of forest resources as well as the role of institutions, in influencing rural people forest use and management behaviour is necessary.

References

Ajzen, I . (2013). Theory of Planned Behaviour Questionnaire. Measurement Instrument Database for the Social Science. Retrieved from www.midss.ieAjzen, I., 1991. The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes 50, 170–211.*

Ajzen, I. (2011). Constructing a theory of planned behaviour questionnaire, from http://people.umass.edu/aizen/pdf/tpb.measurement.pdf.

Ajzen, I. (1991). The theory of planned behaviour. Organizational Behaviour and Human Decision Processes, 50(2), 179-211. doi:10.1016/0749-5978(91)90020-T

Bagozzi, R.P., & Yi, Y., (1988). On the evaluation of structural equation model. *Journal of Academy of Marketing Science 16, 74-94.*

Berkes, F. (2009). Evolution of co-management: role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management 90, 1692–702*

Berliner, D. (2005). Systematic conservation planning for the forest biome of South Africa: Approach, methods and results of the selection of priority forests for conservation action*. Department of WaterAffairs and Forestry (DWAF).Pretoria, South Africa.*

Bless, C., Smith, C.H. (1995). *Fundamentals of social research methods: An African perspective*. 2nd edition. South Africa: Juta & Co.

Boakai, S. & Zarbupoo, G.B. (9. September 2016). *The GEF Small Grant Programme- Community Action Global Impact*. Von Promoting community driven sustainable land use and conservation of biodiversity through the strengthening of women's economic empowerment.: https://sgp.undp.org/index.php?option=com_sgpprojects&view=projectdetail&id=227 42&Itemid=272 abgerufen

Borges, J.A.R., Alfons, G.J.M., Lansink, O. (2016). Identifying psychological factors that determine cattle farmers' intention to use improved natural grassland. *Journal of Environmental Psychology 45* , 89-96.

Borges, J.A.R., Alfons, G.J.M., Lansink, O., Ribeiro, C.M., & Lutke, V. (2014). Understanding farmers' intention to adopt improved natural grassland using the theory of planned behavior. *LivestockScience 169*, 163–174.

Bourke, L., & Luloff, A.E. (1994). Attitudes Towards the Management of Non-Industrial Private Forest Land. *Society and Natural Resources, Volume 7*, 445-457.

Chia, E.L., Somorin, O.A., Sonwa, D.J., Tiani, A.M. (2013). Local vulnerability, Forest communities and Forest carbon conservation: case of southern Cameroon. *International Journal of Biodiversity and Conservation, Vol. 5(8)*, 498-507.

Chidumayo, E., Okali, D., Kowero, G., & Larwanou, M. (eds.). (2011). Climate change and African forest and wildlife resources. African Forest Forum, Nairobi, Kenya.

Chigavazira, B. M. (2012). *Adapting to Climate Change to achieve Household Food Security: A Case Study of Small-Scale Farmers at Dzindi Smallholder Irrigation Scheme in the Limpopo Province of South Africa).* Alice: MSc Thesis; University of Fort Hare.

Cooperative Governance and Traditional Affairs: CoGTA (2012) Vhembe District Municipality Profile. *Department of Cooperative Governance and Traditional Affairs.Pretoria, South Africa*

Counsell, S. (2009). *Forest Governance in Africa. occasional paper no 50.* Johannesburg: The South African Institute of International Affairs . https://www.saiia.org.za/occasional-papers/96-forest-governance-in-africa/file [27 July, 2017].

Department of Agriculture Forestry and Fisheries, (DAFF). (2016). *Woodlands and Indigenous Forest Management*. Von Sustainable Forestry: http://www.daff.gov.za/daffweb3/Branches/Forestry-Natural-Resources-Management/Woodlands-and-Indigenous-Forest-Management/Sustainable-Forestry abgerufen [2nd August 2016]

Department of Agriculture Forestry and Fisheries, (DAFF). (2010). *Policy Principles and Guidelines for Control of Development Affecting Natural Forests.* Pretoria, South Africa: Department of Agriculture , Forestry and Fisheries.

Department of Environmental Affairs, (DEA) .(2013). Long-term adaptation scenarios flagship research programme (LTAS) for South Africa. Climate trends and scenarios for South Africa. Pretoria, South Africa: DEA.

Department of Environmental Affairs and Tourism, (DEAT) .(2004). A national climate change response strategy for South Africa. Department of Environmental Affairs and Tourism. Pretoria: DEAT.

Department of Water Affairs and Forestry (DWAF) (2007). *Forest sector transformation charter.* Pretoria, South Africa. http://www.nda.agric.za/doaDev/sideMenu/ForestryWeb/webapp/Documents/FinalDraftCharterNov07.pdf

Department of Water Affairs and Forestry (DWAF). (2005). *Draft Key Issue Paper on Forestry and Poverty in South Africa.* Pretoria: Department of Water Affairs and Forestry.

Department of Water Affairs and Forestry (DWAF). 1997. Sustainable Forest Development in South Africa: The Policy of the Government of National Unity-White Paper. http://www.daff.gov.za/doaDev/sideMenu/ForestryWeb/dwaf/cmsdocs/25___Forestry%20White%20Paper.htm [5th December 2014]

Division of Statistics and Scientific Computation. (2012). *Structural Equation Modeling Using AMOS.* Austin, USA: The University of Texas at Austin.

Dlamini, C.S. (2014). African forests, People and Climate change Project: Forest and Climate Changes Policies, Strategies and Programmes in the SADC and COMESA regions. African Forest Forum, *Working Paper Series, Vol. 2(17), 39 pp*

Fabricius, C. (2004). The fundamentals of community-based natural resource management. In: Fabricius, C., Coch, C., Magome, H., Turner, S. (Eds.), Rights, Resources and Rural Development: community-based natural resource management in southern Africa. Earthscan, London, pp. 3–43

FAO. (2015a). *FAO, Forests and Climate Change: Working with countries to mitigate and adapt to climate change through sustainable forest management.* Rome, Italy: Food and Agriculture Organisation of the United Nations.

FAO. (2015b). *Forest resources Assessment Working Paper 180.* Rome, Italy: Food and Agriculture Organisation of the United Nations. http://www.fao.org/docrep/017/ap862e/ap862e00.pdf   [2 August 2016]

Gefen, D., Straub, D.W., Boudreau, M.C. (2000). Structural equation modelling and regression: guidelines for research practice. Communications of the Association for Information Systems 4, 1-70.

Geldenhuys, C.J. (2002). Concepts and approach towards development of sustainable resource use of non-timber forest products: the example of bark harvesting for traditional medicine. In: Seydack, A.H.W., Vorster, T., Vermeulen, W.J. and Van der merve, I.J. (eds). Multiple use management of natural forests and savanna woodlands: Policy refinements and scientific progress. Proceedings of Natural Forests and

Savanna Woodlands Symposium III 6-9 May (2002), Berg-en-Dal, Kruger National Park. pp. 91-104.

Gugushe, N.M., Grundy, I.M., Theron, F., & Chirwa, P.W. (2008). Perceptions of forest resource use and management in two village communities in the Eastern Cape province, South Africa. *Southern Forests 2008, 70(3):* 247–254

Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). Multivariate Data Analysis. Prentice-Hall, Upper Saddle River, NJ

Hajost, S., Zerbock, O. (2013). *Lessons Learned from Community Forestry and Their Relevance for REDD+.* Arlington, VA 22209: United States Agency for International Development.

Ham, C., Theron, F. (2001). Community forestry resource: A case study of selected woodlots in the Eastern Cape Province. *Southern African Forestry Journal* **191**:65-74.

Heirman W., and Walrave M. (2012). Predicting adolescent perpetration in cyberbullying: An application of the theory of planned behavior. *Psicothema 2012. Vol. 24, nº 4*, 614-620.

Holmes, T.N. (2007) Contribution of the Participatory Forest Management (PFM) intervention to the socio-economic development in the Southern Cape Forests: a retrospective approach. PhD Thesis: University of Stellenbosch, Stellenbosch, South Africa.

Holmes-Watts, T. & Watts, S. (2008). Legal frameworks for and the practice of participatory natural resources management in South Africa. *Forest Policy and Economics 10, 435-443.*

Infield, M. (1988). Attitudes of a Rural Community towards Conservation and a Local Conservation Area in Natal, South Africa. Biological Conservation 45 , 21-46.

Isaacs, M, & Mohamed, N. (2000). Co-managing the commons in the 'new' South Africa: room for manoeuvre? Paper presented at the 8th Biennial Conference of the International Association for the Study of Common Property entitled, *Constituting the Commons*, May 31 – June 4, 2000

Karim-Ghani, WA, Rusli, I.F., Biak, D.R., Idris, A . (2013). An application of the theory of planned behaviour to study the influencing factors of participation in source separation of food waste. Waste Management (2013), http://dx.doi.org/10.1016/j.wasman.2012.09.019

Karppinen, H. (2005). Forest owners' choice of reforestation method: an application of the theory of planned behaviour. Forest Policy and Economics 7(3): 393-409

Knussen, C., Yule, F., MacKenzie, J., & Wells, M. (2004). An analysis of intentions to recycle household waste: The roles of past behaviour, perceived habit, and perceived lack of facilities. *Journal of Environmental Psychology 24* , 237–246.

Linkd.(2013). Climate Change Risk and Vulnerability Assessment for Rural Human Settlements. Report from spatial Planning and Facilitation, Directorate of the South African Department of Rural Development and Land Reform http://www.ruraldevelopment.gov.za/phocadownload/spatial_Planning_Information/Climate_Change/Latest_Risk_and_Vulnerability_july_2013_09072013.pdf [11 September 2013]

Locatelli, B., Brockhaus, M., Buck, A., Thompson, I., Bahamondez, C., Murdock, T., Geoff, R., Webbe, J.A. (2010). In : Mery Gerardo (ed.), Katila Pia (ed.), Galloway Glenn (ed.), Alfaro René (ed.), Kanninen Markku (ed.), Lobovikov Maxim (ed.), Varjo Jari (ed.). Forests and society : responding to global drivers of change. *Vienne : IUFRO, p. 21-42. (IUFRO World Series, 25).*

Meijer,S.S., Catacutan, D., Sileshi, G.W., Nieuwenhuis, M. (2015). Tree planting by smallholder farmers in Malawi: Using the theory of planned behaviour to examine the relationship between attitudes and behaviour. *Journal of Environmental Psychology 43* , 1-12.

Menozzi, D., Fioravanzi, M., & Donati, M. (2014). Farmer's motivation to adopt sustainable agricultural practices. *Bio-based and Applied Economics 4(2): 125-147*

Naidoo, S., Davis, C., & Van Garderen, E. A. (2013). *Forests, rangelands and climate change in southern Africa* . Rome: Food and Agriculture Organization of the United Nations (FAO).

National Planning Commission, (NPC). (2011). *National development plan 2030: Our future makes it work.* Pretoria: The Presidency, Republic of South Africa. ISBN: 978-0-621-41180-5

Obiri, J.A.F., & Lawes, M.J. (2002). Attitudes of coastal-forest users in Eastern Cape Province to management options arising from new South African forest policies. Environmental Conservation 29 (4), 519–529.

Ofoegbu, C., Chirwa, P.W., Francis, J., Babalola, F.D. (2016). Assessing forest-based rural communities' adaptive capacity and coping strategies for climate variability and change: The case of Vhembe district in South Africa. Environmental Management 18. 36-51.

Ole-Meiludie, R.E., Mwihomeke, S.T. (2006). *Existing situation of forest and wildlife resources in Limpopo Province*. Department of Forestry, 49876134/SUA, Sokoine of University of Agriculture.

Olorunniwo, F., & Hsu, M.K. (2007), "Structural Equation Modeling with IBM SPSS Amos: A methodology for predicting behavioural intentions in the services sector," IBM Software Business Analytics http://www.pse.pt/wp-content/uploads/2011/08/Brochura-IBM-SPSS-Amos.pdf

Rebecca J. McLain, R.J. (2008). Inclusive Community Forest Management: Lessons from Mali, West Africa. *Journal of Sustainable Forestry, Volume 13, 2001 - Issue 1-2, 195-203*

Rosmarin, J. (2013) Vhembe biosphere reserve. www.environment.gov.za/?q=content/projects_programmes/manand_thebiosphere_reserves/list/vhembe. Retrieved 1 August 2014

Shackleton, C.M., Shackleton, S.E, Buiten, E., Bird, N. (2007). The importance of dry woodlands and forests in rural livelihoods and poverty alleviation in South Africa. *Forest Policy and Economics 9,* 558 – 577

Shackleton, S., Campbell, B., Wollenberg, E., Edmunds, D. (2002). Devolution and community-based natural resource management: creating space for local people to participate and benefit*? ODI Natural Resource perspectives. Number 76, March 2002. ISSN: 1356–9228.* www.odi.org.uk/nrp

Sikora, T & Thanh, N.T. (2007). Exclusive versus inclusive devolution in forest management: Insights from forest land allocation in Vietnam's Central Highlands. *Land Use Policy, Volume 24, Issue 4, 644-653*

Swanepoel, H., Beer, F. (2006). *Community development: Breaking the cycle of poverty*. 4th edition. South Africa: Juta & Co.

Tonglet, M., Philips, P.S., Read, A.D. (2004). Using the theory of planned behaviour to investigate the determinants of recycling behaviour: a case study from Brixworth, UK. Resources, *Conservation and Recycling 41, 191–214*

Turpie, J., & Visser, M. (2013). The impact of climate change on South Africa's rural areas. In F. a. Commission, *Submission for the 2013/14 Division of Revenue* (pp. 100-162). Cape Town: Financial and Fiscal Commission.

Yazdanpanah, M., Hayati, D., Hochrainer-Stigler, S., Zamani, G.H. (2014). Understanding farmers' intention and behavior regarding water conservation in the Middle-East and North Africa: A case study in Iran. *Journal of Environmental Management 135, 63-72*

Zulu, L. (2013). Bringing people back into protected forests in developing countries: Insights from co-management in Malawi. *Sustainability 5, 1917–1943*