

1. *Unrevealed economic benefits from forests in Cameroon*

Julius Chupezi Tieguhong and Janusz Zwolinski

Forestry, Faculty of Science & Agriculture, University of KwaZulu-Natal, P Bag X01, Scottsville
3209, South Africa. chupezi@yahoo.co.uk or 204523366@ukzn.ac.za
zwolinskij@ukzn.ac.za Tel. +27-33-2606007 Fax +27-33-2606005

Abstract

A study was established to investigate the value of forest contributions to income portfolios of local populations living in villages near the Lobeke National Park (LNP) in Cameroon. The LNP forms a part of the Sangha Trinational Park (28000 km²), a forest conservation area established by three African countries, namely Cameroon, the Central African Republic and the Republic of Congo, with the objective of protecting the native tropical rainforests with their diverse flora and fauna. Five out of the fourteen villages located within a distance of 50 km from the LNP were randomly identified with 22-23 study households in each. Incomes (in-cash and in-kind) and other socio-economic characteristics of each household were recorded, by an enumerator, quarterly over a year-long period. Logistic regression was used to study the relationship between forest dependency (households with over 49% of income from forests) and various socio-economic variables. The results showed that the forest-derived income totaled US\$ 36347 compared to the US\$ 45439 for all the other income of the investigated households combined. There were significant differences between the villages, with the higher income in larger villages predominantly due to better cash generation opportunities. The income in-kind remained similar irrespective of the village size and wealth. The dependence on forest products was also not related to individual household incomes, with wealthier households remaining dependent on forest-derived products. This could indicate that the traditional link to forests cannot be easily changed through subsidies and compensations. The value of forest-derived income was the highest, significantly higher than any other source of income including the second highest income generated by agriculture. The most important forest products were wild fruits, bushmeat and fuelwood, followed by wild vegetables, medicinal plants, woven products, honey, nuts and poles. A mean forest dependency index ranged from 0,10 to 0,82 for the sample households. The logistic regression was significant and explained 90% of the variation of the forest dependency in the study area. The level of education was the only social characteristic significant in explaining the forest dependency. International efforts to prevent deforestation and degradation of forest resources in the tropics will remain ineffective unless other means of subsistence are developed for the currently forest-dependent poor. Cultural and traditional values need to be recognized to prevent any conflicting interests.

Keywords: poverty, deforestation, forest valuation, Africa

Introduction

For a long time it has been an established practice to value forests based on the price of the commercial timber they produce. Only relatively recently efforts have been made to quantify the values of their other functions such as carbon sequestration, balancing of global climates or soil conservation. Little is known, however, about their roles in providing for immediate needs of poverty stricken households in many developing and cash constrained countries. Any underestimation of such functions may impact negatively on land use policies resulting in devastating consequences, not only to forest cover but primarily to the food security and life quality of forest-dependent communities.

The second largest contiguous area of tropical rainforests is located in the Congo Basin of Central Africa. These forests extend over 228 million ha, storing 36.815 billion tons of carbon and

providing habitats for over 11000 species of plants (many of which are endemic to the area) and associated fauna, including endangered species such as gorillas and chimpanzees (FAO, 2007). Because of these attributes the local governments are under international pressures to establish forest conservation areas by restricting the harvesting of timber and other forest products.

In 2003 there were almost 80 million inhabitants in the region with 62% of them living in rural areas and deriving their livelihoods from natural resources (FAO, 2005). That number includes an estimated 500 000 Pygmies who refer to themselves as 'people of the forest' and see themselves as distinct from their settled farming neighbours whom they call the 'village people' (Abega, 1998). The Pygmies and Bantus are commonly known as Baka and Bangando or Baweke in south-eastern Cameroon and Ba'aka, Bayaka and Bilos in the south-western Central African Republic (Jackson, 2004). The various ethnic groups have different perceptions of the values associated with forests and modern society. The Pygmies are characterised with distinctive social structures and lifestyles. Their livelihood strategy is based on the continued existence of forests and their ecological functions thereof (Tieguhong and Ndoye, 2007). According to Jackson (2004), Pygmies have extensive traditional knowledge about the forests - their ecology, wildlife and plants - giving a holistic meaning to the forest and themselves as intimately connected. There are however, differences between the various groups. Compared to the Ba'aka, the Baka Pygmies in Cameroon are more inclined to send children to schools, successfully undertake employment for wages, appreciate the value of money, learn and communicate in French, and participate in community activities. They are less dependent on the forest compared to other Pygmies living in the neighbouring countries. Contrary to the Pygmies, the Bantu people transform forestlands to agriculture through slash-and-burn practices (Jackson, 2004; Abega, 1998).

The official regional GDP per capita was estimated at US\$ 411 per annum (FAO, 2005). Despite a relatively low population density (20 persons/km²), population pressures escalate not only due to a relatively high population growth (2,5%) but also due to an increasing penetration of the previously inaccessible areas by logging and mining companies as well as a desire of the locals to improve their standards of living. Despite the fact that the forest-dependencies of the people are commonly recognized, no reports have been found quantifying their scale (Tieguhong and Ndoye, 2007; Ndoye and Tieguhong, 2004; Blom, 2001; Wilkie *et al.*, 2001). Any further policy development and implementation will depend on accurate estimates of the importance of these forests to the people who depend on them for shelter, food, medicine and other critical aspects of their livelihoods (Wollenberg and Nawir, 1998). No conservation approach can be successfully implemented without addressing the well-being of the affected people (Masozera and Alavalapati, 2004; Hedge and Enters, 2000; Gunatilake, 1998). This principle has already been accepted by international funding agencies which are increasingly interested in projects with simultaneous development and conservation components (Brown, 1998).

The objective of this study was to examine the income structure of the communities living around the Lobeke National Park (Cameroon) with special reference to the income component derived from the forests of this area.

Study area and methods

The Lobeke National Park (LNP) forms a part of the Sangha Tri-National Park (TNS) established on an area of 2.8 Mha (Figure 1). The TNS is a trans-boundary park declared by the governments of Cameroon, the Central African Republic and the Republic of Congo. It is an internationally acclaimed conservation area and expected to become a model for the future protection of forests at a global level.

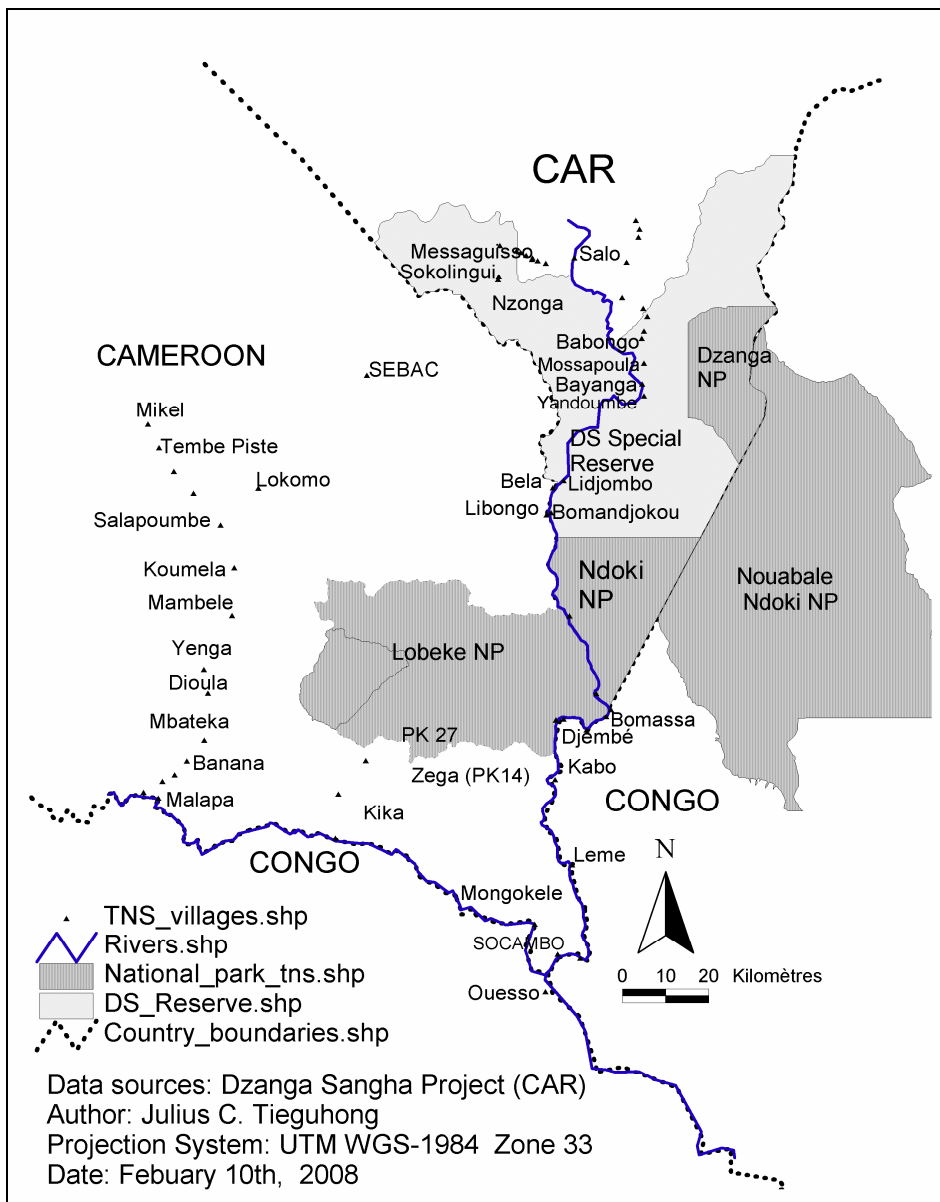


Figure 1. Components of the Sangha Tri-National Park and the location of villages around the Lobeke National Park in Cameroon.

In June 1998 the LNP was declared by the government of Cameroon in a response to international interests as a “Gift to the Earth”. The LNP covers an area of 217 854 ha rich in forest resources and habitats of diverse and unique wildlife on which generations of indigenous communities have depended for millennia. This truly generous gesture is of high importance to the conservation, maintenance of biodiversity and life on Earth. However, its success will depend on finding the compromise between forest conservation and the needs of forest-dependent communities.

Five out of the existing fourteen villages located within a distance of 50 km from the LNP were randomly identified with 22-23 indiscriminant study households in each. These villages were: Koumela, Mambele, Libongo, Zega and Socambo which were inhabited by 825, 1153, 4032, 227, and 249 people, respectively. In total 111 households were investigated. Their income in cash and in-kind and other socio-economic characteristics of each household were researched in person by an enumerator after introducing the involved families to the purpose of this survey and gaining their support and cooperation. This survey was repeated quarterly over a period of 12 months based on a questionnaire translated into local languages for easy communication. Guided by some other studies (Vedeld *et al.*, 2007; Angelsen and Wunder, 2003; Campbell and Luckert, 2002; Campbell *et al.*, 2002; Luckert and Campbell, 2002; Campbell *et al.*, 2000) the respondents were asked to report all

items that they collected from the forest and their quantities which they sold and consumed at a household level. This information was supplemented with the respondents' gender, education, age, duration of residence, household size and other socio-economic information, including their land ownership, crops grown on their lands and the yields (value) thereof.

The results were captured into Microsoft Access for checking and correcting thereof and later transferred by Stat-Transfer 5.0 to SPSS version 12.0 and STATA version 8 for further analysis. Microsoft Excel 2003 was also used for analysing the data, in particular to produce the descriptive statistics. A forest dependency index was calculated as a ratio between the forest-derived income and the total income. The conditions associated with the analysis of variance (normal distribution and homogeneity of variance) were investigated and since they were violated the Kruskal-Wallis test was used to study the difference of the income between the villages or income sources (SPSS User Guide, 1999). Significantly different means were separated with the Games-Howell test. This is a multiple comparison test applicable where the conditions of variance homogeneity were violated (SPSS User Guide, 1999). Finally logistic regression was used to study the relationship between forest dependency (households with over 49% of income from forests) and various other socio-economic variables.

Results and discussion

There were 693 people of diverse ethnic origin living in the 111 households studied. Household size ranged from 1 to 13 people and males were recognized as household heads in 86.5% of the households. The households were lead by married people (88.3%) and only 3.6% of the households were run by divorcees. In general the level of education was low with an average of 5.72 years of schooling whilst 11.7% of the population were without any education. Some households owned up to 14 ha of agricultural land but the average area of agricultural farms was 3.33 ha.

The results showed that the forest-derived income totaled US\$ 36347 (44.4%) compared to US\$ 45439 (55.6%) for the other sources of income in all the households. A mean annual income per household ranged from the smallest of US\$ 567 in Socambo to the highest of US\$ 1212 in Mambele (Figure 2). Agricultural farms were larger in Mambele (3.91 ha) and Koumela (3.82 ha) compared to the other villages. Mambele was also one of the largest villages what may provide for diverse employment and business opportunities. The opposite was true for the lowest income villages of Socambo and Zega. The mean total incomes of the villages differed significantly ($df=4$, $\alpha= 0.008$, $p \leq 0.05$) with Mambele, Koumela and Libongo ranked among the wealthier villages while Zega and Socambo among the poorest ones. The results (Figure 2) also showed that the poorer the village, the larger the proportion of the overall livelihood value was derived from the in-kind benefits. The difference in the total annual income was mainly due to the access to cash income.

The villagers derived their income from eight different activities: (i) consumption and sale of forest products, (ii) agriculture and food production, (iii) fishing and aquaculture, (iv) livestock rearing and animal products, (v) prospecting for gold and minerals, (vi) employment for wage income, (vii) small business enterprises, and (viii) grants and donations (Figure 3).

Clearly goods associated with shelter and food security dominated the income generated by the households with forest products being the major and the most valuable source of them. The most important forest products were wild fruits, bushmeat, woodfuels, followed by wild vegetables, medicinal plants, woven products, honey, nuts and poles (Table 1).

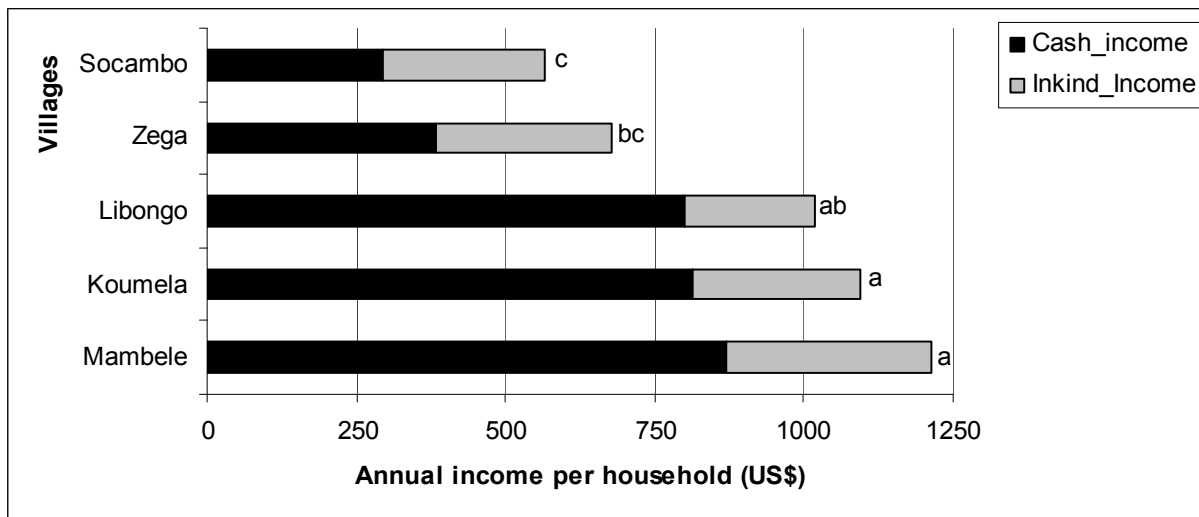


Figure 2. Mean cash and in-kind (goods) annual income per household in villages near the Lobeke National Park in Cameroon (means identified with different letter index are significantly different at $p \leq 0.05$).

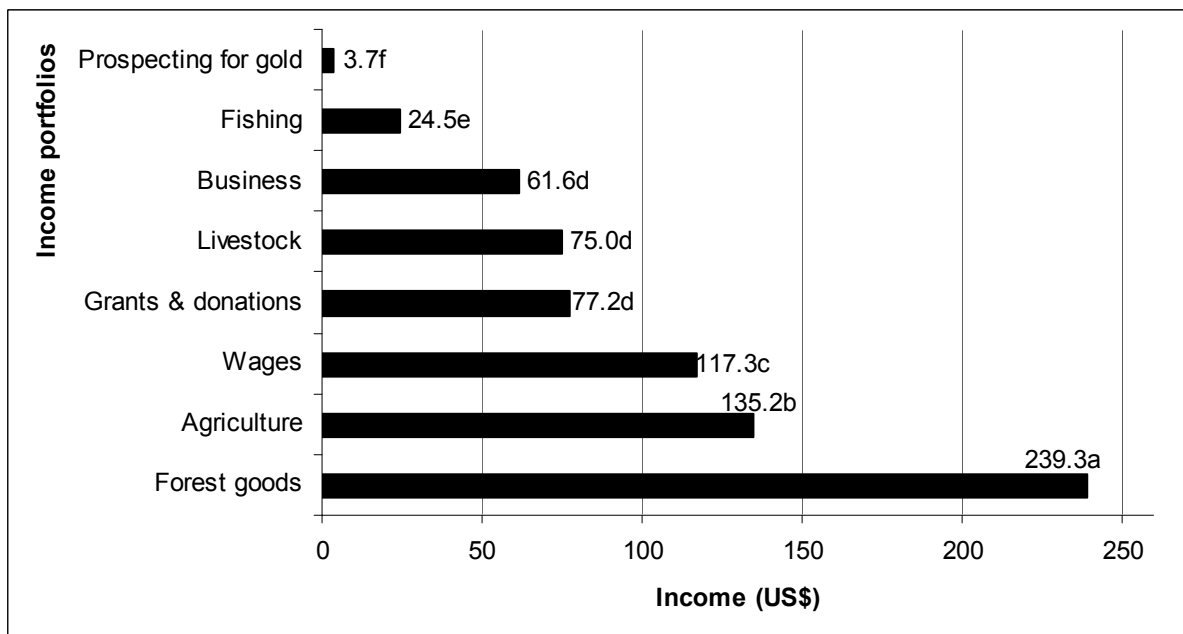


Figure 3. Mean annual household income by activities registered in villages near the Lobeke National Park in Cameroon (means identified with a different letter index are significantly different at $p \leq 0.05$).

Of all the sources of forestry-derived income (US\$ 304.61 per household), the wild fruits provided the highest value to the households of the forest dwellers in the region. This combined with bushmeat and woodfuels gave the villagers 78% of all the value in the forest product category and 61% of all the income derived from the forests.

Correlation analysis showed that there was no association ($r = 0.026$, $p = 0.788$) between the values of the forest-derived products and the other types of income combined. This is an important finding, showing that, within the income range of the studied rural households, the dependence on natural forest resources cannot be easily altered by simply providing alternative means of subsistence. It is uncertain if this is due to the traditional habits and beliefs of the forest dwellers or due to an insufficient income even at higher income levels.

A mean forest dependency index ranged from 0.10 to 0.82 for the sample households (mean=0.49 and sd=0.18). The average forest dependencies were the highest (0.56) in Socambo and the lowest (0.42) in Koumela. Zega (0.50), Libongo (0.45) and Mambele (0.49) yielded intermediate values. An attempt to explain forest dependency (forest dependency index >0.49) only with the social characteristics of the households was unsuccessful. Only when the other sources of income were incorporated, the model was significant and explained 90% of the probability of forest dependency (Table 2).

Table 1. Components of the forest-derived annual income (US\$/household) in villages near the Lobeke National Park in Cameroon (means identified with different letter index were significantly different at $p \leq 0.05$).

Type	Income (US\$/household)			
	Minimum	Maximum	Mean	Std deviation
Products:				
Wild fruit	0.00	310.00	82.63 ^a	57.55
Bushmeat incl. insects	0.00	142.00	61.26 ^{ab}	29.11
woodfuels	7.20	85.60	42.18 ^b	13.92
Wild vegetables	0.00	24.80	7.73 ^c	4.83
Medicinal plants	0.00	34.00	7.50 ^c	7.09
Woven products	0.00	58.00	6.78 ^c	8.84
Honey	0.00	48.00	6.32 ^c	9.69
Nuts	0.00	43.00	6.22 ^c	8.53
Poles	-3.80	50.00	5.01 ^{cc}	6.08
Bamboo	0.00	29.00	3.83 ^e	7.13
Rattan	0.00	30.00	3.63 ^e	5.88
Mushroom	0.00	16.30	2.84 ^e	3.16
Maranthaceae leaves	0.00	27.40	1.78 ^e	3.27
Roots and tubers	0.00	18.00	1.26 ^e	3.44
Sub total 1	85.80	581.60	238.96	80.30
Source of wages:				
Timber various	0.00	672.00	35.62 ^a	94.97
Timber processing	0.00	490.00	28.57 ^b	88.84
Timber logging	0.00	75.00	0.68 ^c	7.12
Timber transport	0.00	18.00	0.16 ^c	1.71
Sub-total 2	0.00	672.00	65.03	130.02

Table 2. Coefficients and elasticity of the significant ($p \leq 0.05$) independent variables in logistic regression of forest dependency among households neighbouring the Lobeke National Park in Cameroon.

Independent variables	Coefficient	Elasticity
Education	0.423	0.106
Income from fishing	-0.033	-0.008
Prospecting for gold & minerals	-0.053	-0.013
Non forest wage income	-0.016	-0.004
Business income	-0.015	-0.004
Agricultural income	-0.017	-0.004
Income from livestock	-0.016	-0.004
Other non-forest income	-0.014	-0.003
Constant	6.452	

The following variables were insignificant in explaining forest dependency of the households: duration of residence, ethnicity, household size, age and gender of household head, area of land owned, memberships of forest user groups. It is possible that the households were too homogenous and insufficient social differences existed as some of the variables, e.g. the ethnicity, was expected to be significant. Only "education" was significant and included in the final model. It is possible that the educated people were more successful in attracting income. This being due to their higher mobility and efficiency in generating income from the collection and trade in forest products as well as from forestry services and employment. Obviously the higher the income from the other sources the lower the chance of a household becoming forest dependent. Therefore all the respective coefficients were negative. The elasticity index indicates the percentage change in the probability of forest dependency at 1% change of the respective value (e.g. income). For instance, 1% increase (or decrease) in the income from fishing (US\$ 25/household/annum) will decrease (or increase) the probability of a household forest dependency by 0.008%.

Conclusions

In 2004, the International Fund for Agricultural Development (IFAD) asserted that about 80% of the population in developing countries uses forest products on a daily basis and about 75% of poor people that live in rural areas depend on forests for subsistence (IFAD, 2004). According to Dubois (2003) over 1.6 billion people of the world depend heavily on forest resources for their livelihoods. In this study the 693 people were found to be dependent on forest resources and services valued at US\$ 36347 per annum, i.e. 52.45 US\$/person/annum. With 80 million people in the Congo Basin and 62% of them living in forest-dependent communities, this can translate to 2602 million US\$ of generally unaccounted contribution of forests to rural livelihoods. These results clearly demonstrate the level of poverty in this region and therefore the dependence of the rural communities on forest products for survival.

International efforts to prevent deforestation and the degradation of forest resources in the tropics will remain ineffective unless other means of subsistence are developed for the currently forest-dependent poor. These actions must take into account traditional value systems.

Acknowledgements

We are deeply indebted to Victor Amougou, the Coordinator of CEFAID and the field enumerators, Didier Nnanga, Eloi Djenda, Gilbert Nzie Ndtoungou, Jean-Louis Kemani, Franckline Abedine and Aldophe Mbio for assisting in data collection. The warm welcome and collaboration by the local chiefs, Bonaventure Ndokanda Wandjo, Nicolas Djokou, Jean Pierre Mokoakilli, Robert Melo and Michel Mossaidjambe is also greatly appreciated as it was essential to the success of this study. Guy-Paulin Tekombong, Eric Kamgnia, Bruno Bokoto, and Paolo Cerruti are thanked for sharing with us their ideas and knowledge that was invaluable in analysing complex datasets as well as producing maps. We acknowledge, appreciate and thank the French Cooperation, the International Foundation of Science (IFS) and the African Forestry Research Network (AFORNET) for funding all field research work, as well as CIFOR and the University of KwaZulu-Natal for efficiently managing the funds.

References

- Abega S.C. 1998. Pygmées baka: Le droit a la différence. Inades Formation. Yaoundé. Université Catholique d'Afrique centrale.
- Angelsen A. and Wunder, S. 2003. Exploring the forest-poverty link: Key concepts, issues and research implications. Occasional Paper # 40. CIFOR. Bogor, Indonesia. 95 pp.

- Blom A. 2001. Ecological and economic impacts of gorilla-based tourism in Dzanga-Sangha, Central African Republic. PhD Thesis. University of Wageningen, Wageningen, Netherlands. ISSN: 0926-9495. pp 142-156.
- Brown D. 1998. Participatory biodiversity conservation: rethinking the strategy in the low tourist potential areas of tropical Africa. *Natural Resource Perspective*, number 33. Overseas Development Institute. ISSN: 1356-9228. 19 pp.
- Campbell B.M. and M.K. Luckert eds. 2002. Uncovering the Hidden Harvest. Valuation Methods for Woodlands and Forest Resources. London. Earthscan. 264 pp.
- Campbell B.M., Frost P., Goebel A., Standa-Gunda W., Mukamuri B. and Veeman M. 2000. A conceptual model of woodland use and change in Zimbabwe. *International Tree Crops Journal* 10: 347-366.
- Campbell B.M., Sayer J., Kozanayi W., Luckert M., Mutamba M. and Zindi C. 2002. Household livelihoods in Semi-Arid Regions: Options and constraints. CIFOR. Bogor, Indonesia. 154 pp.
- Dubois O. 2003. Forest-based poverty reduction: A brief review of facts, figures, challenges and possible ways forward. In Oksanen, Pajari and Tuomasjukka (eds.) Forest in Poverty Reduction Strategies: Capturing the potentials. EFI Proceedings No. 47. Pp 65-85.
- FAO 2005. State of the World Forests 2005. FAO-Rome. ISBN: 92-5-105187-9. 153 pp.
- FAO. 2007. State of the World's Forests 2007. Rome. ISBN: 978-92-5-105586-1.144pp.
- Gunatilake H.M. 1998. The role of rural development in protecting tropical rainforests: evidence from Sri Lanka. *Journal of Environment and Management* 53: 273-292.
- Hedge R. and Enters T. 2000. Forest products and household economy: case study from Mudumalai Wildlife Sanctuary, Southern India. *Environmental Conservation* 27: 250-259.
- IFAD 2004. Commerce et développement rural: enjeux et perspectives pour les ruraux pauvres. 31 pp.
- Jackson D. 2004. Implementation of international commitments on traditional forest related knowledge: Indigenous peoples' experiences in Central Africa. FPP. 100 pp.
- Luckert M.K and B.M. Campbell. 2002. Expanding our conceptual and methodological understanding of the role of trees and forests in rural livelihoods. In Campbell B.M. and M.K. Luckert (eds.): Uncovering the Hidden Harvest: Valuation methods for woodland and forest resources. Pp. 228-253.
- Masozera M.K. and J.R.R. Alavalapati. 2004. Forest dependency and its implication for protected areas management: A case study from Nyungwe Forest Reserve, Rwanda. *Scand.J. For. Res.* 19(Suppl. 4). 85-92. Taylor & Francis ISSN 1400-4089.
- Ndoye O., Tieguhong J.C. 2004. Forest resources and rural livelihoods: The Conflict between timber and Non-timber forest Products in Congo Basin. In *Scand. J. For.* 19(suppl. 4): 36-44.
- SPSS User Guide. 1999. SPSS Base 9.0. User Guide. SPSS Inc. Marketing Department. Chicago. USA. ISBN: 1-56827-832-2. pp. 276-394.
- Tieguhong J.C. and O. Ndoye. 2007. The impact of timber harvesting in forest concessions on the availability of Non-Wood Forest Products (NWFP) in the Congo Basin. FAO Forest Harvesting Case Study 23. ISBN: 978-92-5-105709-4.
- Vedeld, P.; Angelsen, A.; Bojo, J.; Sjaastad, E.; Berg, G.K. 2007. Forest environmental incomes and the rural poor. *Forest Policy and Economics* 9: 869-879.
- Wilkie D.S. Carpenter J.F. and Q. Zhang. 2001. The under-financing of protected areas in the Congo Basin: So many parks and so little willingness-to-pay. *Biodiversity and Conservation* 10: 691-709.
- Wollenberg E. and Nawir A.S. 1998. Estimating incomes of the people who depend on forests. In Wollenburg, E. and Ingles A. (Eds). Incomes from the Forests. Methods for development.