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Socio-economic factors affecting sustainable utilization of woody species in Zegie Peninsula , northwestern Ethiopia

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Abstract: Zegie Peninsula contains a remnant dry Afromontane forest, where about 90 % was previously classified as dense forest. Recently, the forest cover is significantly reduced. Zegie has a high density of 643 persons km^{-2}, predominantly inhabited by religious people, priests and monks. The aim of the study was to understand the dynamics of socioeconomic and resource management factors affecting the sustainable use of woody species in the peninsula and gain a window into the world of isolated religious communities and their complex and evolving relationships with forests. A formal survey of 60 households (4 % of population) was conducted where cross-section data were gathered through a pre-coded (structured) questionnaire. The results revealed that household characteristics, household endowment (farm resources ownership), choice of livelihood strategy and farming constraints affect attitudes and behaviours towards sustainable use of tree resources. Poorer households had smaller resource ownership, were female-headed and illiterate. They also had younger and smaller family sizes and a desire to have more children. Hence, they are not likely to practice family planning contributing to increasing overpopulation. They experienced acute shortage of land and also felt tenure insecurity. Perhaps because they cannot afford fertilizers and pesticides, soil fertility as well as pests and diseases are serious constraints for them. Owing to shortage of land and tenure insecurity, among other things, they have not planted trees in the past and are not likely to plant trees in the future. Much of their income comes from wood selling, therefore, are likely to engage in deforestation. They have diversified their livelihood into artisanship, cloth weaving, and fishing but are limited by low skill, capital, and access to market. The strategy to save the remaining forests in the peninsula, therefore, should include reducing the proportion of poorer households. In order to achieve this objective, a three pronged approach is required: (1) improving access to resource ownership; (2) removing or minimizing farming constraints; and (3) creating enabling environment for families to engage in diversified livelihood strategies.

Resumen: La Península Zegie alberga un remanente de bosque seco afromontano, del que cerca de 90 % fue clasificado previamente como bosque denso. En fechas recientes la cubierta forestal se ha reducido notablemente. Zegie tiene una densidad alta de 643 personas km^{-2} y está habitada sobre todo por gente religiosa, sacerdotes y monjes. La meta del estudio fue entender la dinámica de factores socioeconómicos y de manejo de los recursos que afectan el uso sostenible de especies leñosas en la península, así como asomarse al mundo de las comunidades religiosas aisladas y sus relaciones complejas y dinámicas con los bosques. Se hizo un sondeo formal de 60 hogares (4 % de la población) en el que se obtuvieron datos transversales por medio de un cuestionario precodificado (estructurado). Los resultados revelaron que las características de los hogares, el patrimonio familiar (propiedad de los recursos agrícolas), la selección de

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estrategia de vida y las limitaciones agrarias afectan las actitudes y los comportamientos hacia el uso sostenible de recursos arbóreos. Los hogares más pobres y con menos recursos son analfabetas y tienen una mujer como cabeza de familia; también tienen familias más pequeñas y jóvenes y el deseo de tener más hijos. Por lo tanto, es improbable que practiquen la planificación familiar, contribuyendo así a la sobrepoblación. Ellos sufren una carestía aguda de tierra y también sienten inseguridad de su propiedad. Quizás debido a su incapacidad para adquirir fertilizantes y plaguicidas, la fertilidad del suelo, las plagas y las enfermedades son limitantes serias para ellos. Debido a la insuficiencia de tierra y la inseguridad de la propiedad, entre otras cosas, no han plantado árboles en el pasado y es improbable que los planten en el futuro. Mucho de su ingreso proviene de la venta de madera, por lo que es probable que causen deforestación. Ellos han diversificado sus actividades hacia la producción de artesanías, tejido de ropa y pesca, pero están limitados por habilidades, capital y acceso al mercado bajos. La estrategia para salvar los bosques remanentes en la península, por lo tanto, debe incluir una reducción de la proporción de los hogares más pobres. Para alcanzar este objetivo se requiere un enfoque de tres frentes: (1) mejorar el acceso a la posesión de los recursos; (2) eliminar o minimizar las limitantes agrarias; y (3) crear un ambiente que permita que las familias se involucren en estrategias diversificadas de obtención de su sustento.

Resumo: A Península deZegie contém uma floresta Afromontana seca remanescente, da qual cerca de 90 % foi previamente classificada como floresta densa. Recentemente, a cobertura florestal foi reduzida significativamente. Zegie tem uma elevada densidade populacional de 643 pessoas km^{-2}, é predominantemente habitada por pessoas religiosas, sacerdotes e monges. O objectivo do estudo foi compreender a dinâmica de factores socioeconómicos e de gestão de recursos que afectam o uso sustentável das espécies lenhosas na península e abrir uma janela para o mundo daquelas comunidades religiosas isoladas e das suas relações complexas e em evolução com as florestas. Conduziu-se um levantamento formal de 60 famílias (4 % da população) tendo-se colhido informação transversal através de um questionário pré-codificado (estruturada). Os resultados revelaram que as características do agregado familiar, a propriedade dos recursos da exploração agrícola,a escolha da estratégia de meios de subsistência e as limitações da agricultura afectam as atitudes e os comportamentos em relação uso sustentável dos recursos arbóreos. As famílias mais pobres tinham menor posse de recursos, eram encabeçadas por mulheres e analfabetas. Elas também tinham famílias mais jovens e de menor tamanho menores e um desejo de ter mais filhos. Por isso, esses agregados não são propensos a praticar o planeamento familiar, contribuindo assim para aumentar a sobrepopulação. Eles experimentam escassez aguda de terra e também sentem insegurança fundiária. Talvez porque não podem pagar fertilizantes e pesticidas, a fertilidade do solo, bem como as pragas e doenças constituem para eles restrições graves. Devido à escassez de terras eà insegurança fundiária, entre outras coisas, essas famílias não plantaram árvores no passado e não são susceptíveis de as plantar no futuro. Grande parte do seu rendimento provem da venda de madeira, significando isto, que são naturalmente propensos a se envolverem no desmatamento. Estas famílias têm diversificado os seus meios de subsistência com o artesanato, tecelagem, e pesca, mas encontram-se limitadas pela baixa qualificação, capital e acesso ao mercado. A estratégia para salvar asflorestas remanescentes na Península, deve incluir,portanto, a redução da proporção de famílias mais pobres. A fim de alcançar este objectivo é necessária uma abordagem de três pontos: (1) melhorar o acesso à propriedade dos recursos; (2) eliminar ou minimizar os constrangimentos da exploração agrícola; e (3) criar um ambiente propício para que as famílias desenvolvam estratégias diversificadas de subsistência.

Key words: Afromontane forest, deforestation, farming constraints, livelihood, resource ownership, sustainable use.

Introduction

Tropical forests, which cover 7 % of the earth's land surface (Wilson 1988), are famous for being the most species rich ecosystems (Gentry 1992; Mooney *et al*. 1995a). They house a wide array of biological diversity, which provides a wide range of products and services for humans (Gaston & Spicer 1998). Despite their importance, the threat to these valuable forest ecosystems is severe and widespread, and especially, tropical dry forests are the most endangered ecosystems of the world (Janzen 1988). The threats to the components of biodiversity involve factors such as habitat change, introduced species, pollution, unsustainable harvesting of woody species and direct competition for living species and other resources between people and wild species (Caldecott *et al.* 1996).

Inspite of these threats, tropical forests are the least studied ecosystem in the world (Mooney *et al.* 1995b). There is an urgent need for studying, conserving and restoring tropical dry forests. The challenge related to forest ecosystem degradation could be met only if efforts are made to maintain the remaining remnant forest and restore the degraded ones (Teketay 1996).

One of the areas containing a remnant dry Aformontane forest is the Zegie Peninsula at Lake Tana, the largest lake in Ethiopia (Alelign *et al.* 2007). Religious people, priests and monks predominantly inhabit Zegie. There are six Ethiopian Orthodox monasteries in the peninsula with considerable tourist attraction owing to their centuries old existence. The church assumes the role of custodian and leader of the community, largely prescribing values, traditions, and the local economy in the peninsula. One such influence is a five-century old ban on crop farming and livestock rearing.

The main economy, as a result, has been coffee farming. But due to combination of factors ranging from population increase to decreasing productivity of coffee farms and the resultant increasing poverty, the community has diversified its livelihood strategy. While newer sources of income included farm-based (cultivation of *Rhamnus prinoides*[1] L'Herit, hereafter referred to as 'buckthorn', and fruit farming) and off farm strategies (artisanship, weaving, casual labour, etc.), it also increasingly became wood poaching from natural forests for sale at nearby town, Bahr Dar. Of the total area of the peninsula, about 90 % was previously classified as dense forest (Deriba 1993). However, the current situation is so adverse that it is estimated within the next 15 years the peninsula might be without forest cover.

Beyond what is mentioned above, little is known about the process and dynamics that lead to loss of forest in the peninsula. Studies conducted so far (Friis 1986, 1992; Pichi-Sermolli 1957; Sebald 1968) have been extremely sparse and old. More up-to-date and conclusive studies in this peninsula can give a window into the world of isolated religious communities and their complex and evolving relationships with forests.

The aim of the study was, therefore, to understand the dynamics of socio-economic and resource management factors affecting the sustainable use of woody species in the peninsula and draw some insight from it. Specifically, the study sought to find out whether household characteristics, household endowment (farm resources ownership), choice of livelihood strategy, and farming constraints affect attitudes and behaviors towards sustainable use of tree resources.

Materials and methods

Study area

The study was conducted at Zegie Peninsula (hereafter referred to as Zegie), north-western Ethiopia (11° 40' to 11° 43' N and 37 °19' to 37 °21' E) (Alelign *et al.* 2007). The peninsula has an elevation that ranges from 1770 m along the banks of the Lake to 1975 m at its summit known by the name Ararat. Its population is estimated at about 8363 (CARE-Ethiopia 1999). The area is densely populated, 643 persons km^{-2}, as compared to the national average, 34 persons km^{-2} (Anonymous 1988). It has mean annual minimum and maximum temperatures of 10.3 and 27.7 °C, respectively while the average annual rainfall is about 1415 mm. The soils of Zegie are predominantly Nitosols followed by Luvisols and Vertisols having pH values of 5.05 - 6.07 (Deriba 1993). Two villages, namely 'Ura' and 'Yiganda', were investigated in the study.

[1] The species is also known as 'gesho' in the local language (Amharic) as well as 'buckthorn' and 'dogwood' in English (Kelecha 1987). Its leaves and branches are used to add flavour to local drinks known as 'tej' and 'tela' (Vollesen 1989).

Although there has been no direct study of the vegetation particularly dealing with Zegie, it has been studied as part of the vegetation at Lake Tana by foreign scholars (Friis 1986, 1992; Pichi-Sermolli 1957; Sebald 1968). The vegetation at Lake Tana has been considered as a transition type to humid evergreen forests of southwestern Ethiopia (Sebald 1968) and also classified as upland dry evergreen forest (Friis 1986) and a special subtype of undifferentiated Afromontane forest (Friis 1992). Of the total area of Zegie, 1219 ha is believed to have been covered once by densely growing forest trees and shrubs (Deriba 1993). Currently, the community is cultivating about 1132 ha of coffee under the shade of the forest trees. The whole forest area is divided among members of the communities.

Methods

The study utilized a three-stage sampling approach wherein the first stage involved a reconnaissance visit and background data collection. The second stage was a PRA-type group interview wherein key stakeholders such as village leaders, NGO representatives, District Administration, Lake Tana Transport Enterprise, Office of Agriculture, and Office of Culture & Tourism participated. The questionnaire for the formal survey was also pretested in this stage. In the final stage, a formal survey was conducted where data was gathered through a pre-coded (structured) questionnaire.

The sampling unit for the study was the household. The reason for this is because a household is: a dominant social and economic unit in rural Ethiopia, the primary unit of resource holding, production, distribution and consumption, and a locus of decision making regarding most economic and social functions. The size of sample households for the formal survey was 60 representing close to 4 % of the total population households. The sampling intensity of 3 - 5 % was deemed acceptable due to the fairly homogeneous population in the peninsula. The study considered both villages in the Peninsula. These villages have an estimated combined population of 8,363 persons or 1,859 households. To distribute the 60 sample households, a stratified sampling approach was employed wherein 30 households were randomly selected from each village.

Data were collected for a wide range of variables, identified based on previous exploratory studies of the area, personal experience from working in the study site and from general experience of socio-economic research in the country. These variables included household characteristics (age, literacy and family size), household endowment (total farm size, coffee plot size, number of own fruit trees and number of own buckthorn trees, total income, forest income and non-forest income), on-farm livelihood strategies [sale of coffee, fruits, vegetables, and leaves of *Catha edulis*[2] (Vahl) Forssk. ex Endl. (Celastraceae), hereafter known as 'khat'], animal-based livelihood strategies (fishing, apiculture and poultry), off-farm livelihood strategies (artisanship, cloth weaving, brewery, casual labor and small trader), farm constraints (shortage of water, shade trees, disease and pests, soil fertility, poor management skill, access to improved germplasm, tenure insecurity and shortage of land) as well as attitude and behaviour towards sustainable use (have planted trees, want to plant trees, use existing forest, use own trees on farm, practice family planning and want more children).

Data analyses

For a simple summary of data, descriptive statistics such as frequencies and percentages for categorical variables and mean and standard deviation for continuous and ordered variables was employed. To analyze variables measured on nominal scale, statistics for nominal data, Phi (coefficient) and Cramér's V were selected (SPSS 1999). The assumption for the Chi-square-based statistics (Phi, Cramér's V and contingency coefficient), that the data should be a random sample from a multinomial distribution was not violated. Phi is a Chi-square based measure of association. For 2 x 2 tables only, the Phi coefficient is equal to the Pearson correlation coefficient and ranges from -1 to +1. For tables in which one dimension is greater than 2, the value of Phi can exceed an absolute value of 1. For general purposes, if either variable has more than two categories, the significance value is more important than the actual value of the statistics. Cramer's V is also a measure of association based on Chi-square. The value ranges between zero and 1, with zero indicating no association between the row and column variables and values close to 1 indicating a high degree of

[2] The species is also known as 'chat/cat' in the local language (Amharic) and 'khat' in English (Wolde Michael Kelecha 1987, Hedberg & Edwards 1989). The leaves are chewed as a mild stimulant and form an important source of income for small farmers (Robson 1989).

Table 1. Distribution of respondents by household (HH) categories.

Village	Age of head of HH	Education of head of HH	Gender of head of HH		Total
			Female	Male	
Ura	19-40	Illiterate	1	1	2
		Can read and write	0	4	4
		Total	1	5	6
	41-60	Illiterate	7	4	11
		Can read and write	0	8	8
		Total	7	12	19
	Greater than 60	Illiterate	1	0	1
		Can read and write	0	4	4
		Total	1	4	5
	All ages	Illiterate	9	5	14
		Can read and write	0	16	16
		Total	9	21	30
Yiganda	19-40	Illiterate	4	0	4
		Can read and write	2	0	2
		Total	6	0	6
	41-60	Illiterate	5	1	6
		Can read and write	0	8	8
		Total	5	9	14
	Greater than 60	Illiterate	4	2	6
		Can read and write	0	4	4
		Total	4	6	10
	All ages	Illiterate	13	3	0
		Can read and write	2	12	16
		Total	15	15	14
All villages	All ages	Illiterate	22	8	30
		Can read and write	2	28	30
		Total	24	36	60

association between the variables. Cramer's V can attain a value of 1 for tables of any dimension.

To analyze variables measured on ordinal scale statistics for tables in which both rows and columns contain ordered values, Kendall's tau-b, Kendall's tau-c and Gamma (zero-order for 2-way tables and conditional for 3-way to 10-way tables) were selected (SPSS 1999). Kendall's tau-b is a non-parametric measure of association for ordinal or ranked variables that take ties into account. The sign of the coefficient indicates the direction of the relationship, and its absolute value indicates the strength, with larger absolute values indicating stronger relationships. Possible values range from -1 to 1, but a value of -1 or +1 can only be obtained from square tables. Kendall's tau-c is also a non-parametric measure of association for ordinal variables but ignores ties. The sign of the coefficient indicates the direction of the relationship, and its absolute value indicates the strength, with larger absolute values indicating stronger relationships. Possible values range from -1 to 1, but a value of -1 or +1 can only be obtained from square tables.

Results and discussion

The results showed that the sample households were split equally between the two villages considered in the study, Ura and Yiganda (Table 1). Female-headed households made up 40 % (N = 24) of the sample. Half of the sample

Table 2. Respondents by household categories.

Household Categories	Family Size			Total Income (ETB)*			Forest Based Income (ETB)*		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Ura village	30	7.60 [a]	2.74	30	2085.97 [a]	904.89	30	260.00 [a]	244.39
Yiganda village	30	4.50 [b]	2.56	30	1896.37 [b]	719.65	30	480.00 [b]	425.85
Male-headed	36	6.97 [a]	2.62	36	2346.44 [a]	784.47	36	481.66 [a]	415.91
Female-headed	24	4.67 [b]	3.19	24	1458.25 [b]	527.55	24	202.50 [b]	153.26
Literate	30	6.73 [a]	2.64	30	2355.93 [a]	798.26	30	505.00 [a]	434.58
Illiterate	30	5.37 [b]	3.33	30	1626.40 [b]	665.34	30	235.00 [b]	198.84
Total	60	6.05	3.06	60	1991.17	816.15	60	370.00	361.66

* Exchange rate: 1USD = 8.2 ETB, means followed by the same letter in each column are not significantly ($P < 0.05$) different.

household heads could read and write. The mean family size was 6.05 (SD = 3.06), while the mean annual income was ETB 1991.17 (approximately USD 145.27) where forest-based livelihood contributed 18.5 % of the total income (Table 2).

The mean farm size of sample households was 0.73 ha (SD = 0.4652 ha) of which, on average, 93.1 % was allocated for coffee orchards. Sample households also owned, on average, 2.5 fruit trees, 4.4 buckthorn trees, 3.3 chicken and 0.12 beehives (Table 3). Of the several farm constraints mentioned by respondents (Table 4) shortage of water was by far the most important (96.7 %) followed by shortage of shade trees for coffee (60 %), low productivity of farms owing to poor management skills (41 %), disease and pest (33.3 %) and shortage of land (26.7 %). Other constraints of somewhat less importance included poor soil fertility, access to good quality germplasm and tenure insecurity.

The results on the assessment of livelihood strategy indicated a serious attempt to diversify. The most important livelihood, by far, was coffee-based (98.3 %) followed by wood-based livelihood (61.7 %) and fruits (60 %). The rest were not as common but included animal-based livelihoods such as apiculture, fishery and poultry. Farm-based livelihood included vegetable selling. Off-farm livelihoods included trading, casual labor, artisanship, homemade brewery and cloth weaving.

Of the total sample households, 57.9 % (N = 33) claimed to have planted trees in the five years preceding this study. Moreover, 78.9 % (N = 45) wanted to plant trees in the future. Only 7.0 % (N = 4) of sample households insisted on using existing natural forest rather than using or in conjunction with on-farm trees. With regards to limiting family sizes, 38.6 % (N = 22) reported having practiced or practicing family planning, but 8.8 % (N = 5) wanted to have more children.

The relationships of farm resources variables with household characteristics variables revealed that there was a statistically significant difference in resource endowment between the two villages. Ura appeared to have larger mean farm size and coffee orchard. But Yiganda had more fruit and buckthorn trees on the average. Yiganda had more chicken and beehives as well. In general, bigger families had more income, larger farms and bigger coffee orchards. Younger families seemed to have higher forest-based income. Female-headed households had significantly smaller ownerships of virtually every resource. Literate households had bigger ownerships of resources than illiterate ones (Table 3). As a whole, the communities in both villages had very limited resource endowment (mean annual income of approximately USD 221.00 and mean land holding of 0.73 ha). The fact that the standard deviations are high indicates that there is a high variability in resource ownership, a section of the community being even in a direr situation.

Farm constraints cited by respondents were also correlated with household characteristics (Table 4). Households in Yiganda village were more affected by most farm constraints, especially poor soil fertility, low productivity and tenure insecurity. Poor soil fertility, tenure insecurity and shortage of land were felt more by female-headed households while shortage of water, diseases and pests, and limited access to superior germplasm were reported more by male-headed households. Literate households appeared to be more acutely

Table 3. Farm resources of respondents by household categories.

Household Categories	Total Farm Size (ha)			Coffee Plot Size (ha)			No. of Fruit Trees			No. of Buckthorn Trees			No. of Chicken			No. of Beehives		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Ura village	30	0.8267[a]	0.56	30	0.7267[a]	0.43	30	0.67[a]	3.13	30	3.40[a]	5.05	30	2.37[a]	2.31	30	0[a]	0
Yiganda village	30	0.6250[b]	0.33	30	0.6250[b]	0.33	30	4.33[b]	4.50	30	5.40[b]	5.80	30	4.17[a]	3.71	30	0.23[a]	0.73
Male-headed	36	0.8764[a]	0.52	36	0.8069[a]	0.41	36	3.14[a]	5.10	36	5.14[a]	5.89	36	3.86[a]	3.39	36	0.19[a]	0.67
Female-headed	24	0.5000[b]	0.22	24	0.4792[b]	0.24	24	1.54[a]	2.34	24	3.29[b]	4.72	24	2.38[a]	2.70	24	0[a]	0
Literate	30	0.9000[a]	0.52	30	0.8167[a]	0.38	30	2.93[a]	4.71	30	4.70[a]	5.94	30	3.53[a]	2.85	30	0.13[a]	0.51
Illiterate	30	0.5517[b]	0.33	30	0.5350[b]	0.34	30	2.07[a]	3.80	30	4.10[a]	5.07	30	3[a]	3.53	30	0.10[a]	0.55
Total	60	0.7258	0.47	60	0.6758	0.38	60	2.50	4.26	60	4.40	5.48	60	3.27	3.19	60	0.12	0.52

Means followed by the same letter in each column are not significantly ($P < 0.05$) different.

Table 4. Farm constraints of respondents by household (HH) categories.

Farm Constraints	Villages		Gender of HH		Literacy		Row total
	Ura	Yiganda	Female	Male	Illiterate	Can read/write	
Shortage of water	29 (48.3)[a]	29 (48.3)[a]	22 (36.7)[a]	36 (60.0)[b]	28 (46.7)[a]	30 (50.0)[a]	58 (97.7)
Shortage of shade tree	14 (23.3)[a]	22 (36.7)[a]	15 (25.0)[a]	21 (35.0)[a]	18 (30.0)[a]	18 (30.8)[a]	36 (60.0)
Disease and pest	12 (20.0)[a]	8 (13.3)[a]	8 (13.3)[a]	12 (20.0)[b]	8 (13.3)[a]	12 (20.0)[a]	20 (33.3)
Poor soil fertility	1 (1.7)[a]	7 (11.7)[b]	5 (8.3)[a]	3 (5.0)[b]	4 (6.7)[a]	4 (6.7)[a]	8 (13.3)
Low productivity	4 (6.7)[a]	21 (35.0)[b]	10 (16.7)[a]	15 (25.0)[a]	12 (20.0)[a]	13 (21.7)[a]	25 (41.7)
Access to germplasm	3 (5.0)[a]	1 (1.7)[b]	1 (1.7)[a]	3 (5.0)[b]	1 (1.7)[a]	3 (5.0)[b]	4 (6.7)
Tenure insecurity	0 (0)[a]	4 (6.7)[b]	2 (3.3)[a]	2 (3.3)[a]	1 (1.7)[a]	3 (5.0)[b]	4 (6.7)
Shortage of land	6 (10.0)[a]	10 (16.7)[b]	9 (15.0)[a]	7 (11.7)[a]	9 (15.0)[a]	7 (11.7)[a]	16 (26.7)
Column total	30 (50.0)	30 (50.0)	24 (40.0)	36 (60.0)	30 (50.0)	30 (50.0)	60 (100)

60 valid cases; 0 missing cases, values are frequencies, values in parentheses are percent of respondents, frequencies followed by the same letter in each row are not significantly ($P < 0.05$) different.

Table 5. Livelihood strategy of respondents by household categories.

Livelihood strategy	Villages		Gender of HH		Literacy		Row total
	Ura	Yiganda	Female	Male	Illiterate	Can read/write	
Selling coffee	29 (48.3)[a]	30 (50.0)[a]	23 (38.3)[a]	36 (60.0)[b]	29 (48.3)[a]	30 (50.0)[a]	59 (98.3)
Selling wood	9 (15.0)[a]	28 (46.7)[b]	15 (25.0)[a]	22 (36.7)[a]	19 (31.7)[a]	18 (30.0)[a]	37 (61.7)
Selling fruit	14 (23.3)[a]	22 (36.7)[b]	11 (18.3)[a]	25 (41.7)[b]	13 (21.7)[a]	23 (38.3)[b]	36 (60)
Selling vegetable	8 (13.3)[a]	1 (1.7)[b]	1 (1.7)[a]	8 (13.3)[b]	3 (5.0)[a]	6 (10.0)[b]	9 (15.0)
Trading	2 (3.3)[a]	3 (5.0)[a]	1 (1.7)[a]	4 (6.7)[b]	0 (0)[a]	5 (8.3)[b]	5 (8.3)
Casual laborer	3 (5.0)[a]	0 (0)[b]	0 (0)[a]	3 (5.0)[b]	1 (1.7)[a]	2 (3.3)[a]	3 (5.0)
Artisan	3 (5.0)[a]	0 (0)[b]	1 (1.7)[a]	2 (3.3)[a]	2 (3.3)[a]	1 (1.7)[a]	3 (5.0)
Beverage selling	1 (1.7)[a]	1 (1.7)[a]	2 (3.3)[a]	0 (0)[b]	1 (1.7)[a]	1 (1.7)[a]	2 (3.3)
Apiculture	0 (0)[a]	0 (0)[a]	0 (0)[a]	2 (3.3)[b]	1 (1.7)[a]	1 (1.7)[a]	2 (3.3)
Cloth weaving	1 (1.7)[a]	0 (0)[a]	1 (1.7)[a]	0 (0)[a]	1 (1.7)[a]	0 (0)[a]	1 (1.7)
Fishery	0 (0)[a]	1 (1.7)[a]	1 (1.7)[a]	0 (0)[a]	1 (1.7)[a]	0 (0)[a]	1 (1.7)
Column total	30 (50.0)	30 (50.0)	24 (40.0)	36 (60.0)	30 (50.0)	30 (50.0)	60 (100)

60 valid cases; 0 missing cases, values are frequencies, values in parentheses are percent of respondents, frequencies followed by the same letter in each row are not significantly ($P < 0.05$) different.

Table 6. Household (HH) categories of respondents by attitudes towards sustainability of woody perennials.

Attitudes towards sustainable use	Villages		Gender of HH		Literacy		Row total
	Ura	Yiganda	Female	Male	Illiterate	Can read/write	
Have planted trees in the last 5 years	20 (35.1)[a]	13 (22.8)[a]	5 (8.8)[a]	28 (49.0)[b]	10 (17.5)[a]	23 (40.4)[b]	33 (57.9)
Want to plant trees in the future	22 (38.6)[a]	23 (40.4)[a]	15 (26.3)[a]	30 (52.6)[b]	21 (36.8)[a]	24 (42.1)[b]	45 (78.9)
I prefer to use existing forest	1 (1.8)[a]	3 (5.3)[b]	1 (1.8)[a]	3 (5.3)[b]	1 (1.8)[a]	3 (5.3)[b]	4 (7.0)
I practice family planning	15 (26.3)[a]	7 (12.3)[b]	6 (10.5)[a]	16 (28.1)[b]	8 (14.0)[a]	14 (24.6)[b]	22 (38.6)
I would like more children than I have	2 (3.5)[a]	3 (5.3)[a]	3 (5.3)[a]	2 (3.5)[a]	2 (3.5)[a]	3 (5.3)[a]	5 (8.8)
Column total	28 (49.1)	29 (50.9)	21 (36.8)	36 (63.2)	27 (47.4)	30 (52.6)	57 (100)

57 valid cases; 3 missing cases, values are frequencies, values in parentheses are percent of respondents, frequencies followed by the same letter in each row are not significantly ($P < 0.05$) different.

Table 7. Farm resources of respondents by attitudes towards sustainability of woody perennials.

Farm Resources		Total Farm Size (ha)			Coffee Plot Size (ha)			No. of Fruit Trees			No. of Buckthorn Trees			Total Income (ETB)*			Forest-Based Income (ETB)*		
		N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Have planted trees in the last 5 years	Yes	33	0.88[a]	0.53	33	0.81[a]	0.41	33	2.76[a]	4.71	33	5.33[a]	5.94	33	2232.09[a]	892.00	33	485.15[a]	426.64
	No	27	0.54[b]	0.27	27	0.52[b]	0.29	27	2.19[a]	3.71	27	3.26[a]	4.74	27	1696.70[b]	607.07	27	229.26[b]	188.11
Want to plant trees in the future	Yes	45	0.76[a]	0.51	45	0.71[a]	0.40	45	3.07[a]	4.65	45	5.18[a]	5.54	45	2101.48[a]	849.36	45	436.44[a]	384.31
	No	15	0.62[a]	0.30	15	0.58[a]	0.33	15	.80[a]	2.11	15	2.07[a]	4.76	15	1660.20[b]	619.16	15	170.67[b]	174.01
I prefer to use existing forest	Yes	4	0.63[a]	0.43	4	0.63[a]	0.43	4	2.50[a]	3.79	4	2.50[a]	5.00	4	2197.00[a]	336.20	4	290.00[a]	234.09
	No	56	0.73[a]	0.47	56	0.68[a]	0.38	56	2.50[a]	4.33	56	4.54[a]	5.53	56	1976.46[a]	839.69	56	375.71[a]	369.89
I practice family planning	Yes	22	0.83[a]	0.43	22	0.78[a]	0.35	22	1.23[a]	2.65	22	2.18[a]	4.04	22	2166.14[a]	1006.80	22	369.55[a]	365.44
	No	38	0.67[a]	0.48	38	0.61[a]	0.40	38	3.24[a]	4.85	38	5.68[b]	5.84	38	1889.87[a]	676.83	38	370.26[a]	364.38
I would like more children than I have	Yes	5	0.70[a]	0.74	5	0.50[a]	0.31	5	0.40[a]	.89	5	1.00[a]	2.24	5	2314.00[a]	1912.84	5	320.00[a]	249.00
	No	55	0.72[a]	0.44	55	0.69[a]	0.39	55	2.69[a]	4.40	55	4.71[a]	5.60	55	1961.82[a]	667.99	55	374.54[a]	371.57
Total		60	0.7258	0.47	60	0.6758	0.38	60	2.50	4.26	60	4.40	5.48	60	1991.17	816.15	60	370.00	361.66

*Exchange rate: 1USD = 8.2 ETB, means followed by the same letter in each column are not significantly ($P < 0.05$) different.

Table 8. Farm constraints of respondents by attitude to sustainable forest management.

Farm constraints	Have planted trees in the last 5 years	Want to plant trees in the future	I prefer to use existing forest	I practice family planning	I would like more children than I have	Row total
Shortage of water	33 (57.9)**	45 (78.9)**	3 (5.3)**	22 (38.6)*	5 (8.8)**	56 (98.2)
Shortage of shade tree	17 (29.8)*	26 (45.6)	2 (3.5)	14 (24.6)	4 (7.0)	35 (61.4)
Disease and pest	9 (15.8)*	10 (17.5)**	3 (5.3)**	11 (19.3)*	3 (5.3)**	19 (33.3)
Poor soil fertility	3 (5.3)**	6 (10.5)**	1 (1.8)	3 (5.3)**	1 (1.8)	8 (14.0)
Low productivity	13 (22.8)	20 (35.1)**	3 (5.3)**	5 (8.8)*	2 (3.5)	24 (42.1)
Access to germplasm	2 (3.5)	2 (3.5)	1 (1.8)	1 (1.8)	0 (0)	4 (7.0)
Tenure insecurity	1 (1.8)	1 (1.8)	1 (1.8)	1 (1.8)	1 (1.8)	3 (5.3)
Shortage of land	7 (12.3)*	11 (19.3)**	2 (3.5)	1 (1.8)	1 (1.8)	14 (24.6)
Column total	33 (57.9)	45 (78.9)	4 (7.0)	22 (38.6)	5 (8.8)	57 (100.0)

57 valid cases; 3 missing cases, values are frequencies, values in parentheses are percent of respondents, *statistically significant at 5 % level, **statistically significant at 1 % level.

aware of the farm constraints. Shortage of water, disease and pest, access to germplasm, tenure insecurity and shortage of land were reported more by literate households. Tenure insecurity and shortage of land were felt more by smaller families.

Livelihood strategies of respondents differed significantly by household categories (Table 5). The Yiganda villagers were engaged in selling wood and fruits while Ura villagers were engaged in selling vegetables, casual labor and artisanship. Female-headed households were engaged in home-made brewery and fishing, while male-headed households preferred selling coffee, vegetables, trading, and casual labour. Literate households were more engaged in selling fruits and vegetables as well as in casual labour. Illiterate households were engaged in artisanship, cloth weaving and fishery.

Statistical analyses to discover relationships among variables for household categories against attitude and behaviour towards sustainable use of woody perennials indicated that literate and male-headed households with bigger family sizes are likely to have planted trees in the five years preceding this study (Table 6). Literacy and bigger family size were also positively related to the desire to plant trees in the future. Interestingly, literate and male-headed households are likely to want to use existing forest as well. Those living in Ura village and those households that are male-headed are likely to practice family planning. Literate household heads and female-headed households desire to have more children, as do smaller families.

The relationship between resource ownership and attitude toward sustainable use of forest resources indicated that those that had planted trees in the five years preceding this study had significantly bigger farm sizes and coffee orchards (Table 7). The income of those who planted trees in the same period was also much higher. Interestingly, their forest-based income was also much higher. Those with bigger forest-based income wanted to plant more trees in the future. Households with higher income were more likely to have been practicing family planning. The sustainability of trees and forests in the peninsula depends on the extent to which households have planted trees and are willing to plant in the future. It also depends to the extent the population size is limited through family planning practices. Invariably, wealthier families have such attitude and behaviour compared to poorer families.

There was significant relationship between farm constraints and attitude towards sustainable use (Table 8). Those who had planted trees on their farms during the five years preceding this study, including those who would like to plant trees in the future, experienced water shortage and shortage of shade trees more than those who did not plant trees in the past and do not plan to plant trees in the future. But, those who did not plant trees, including those who do not plan to plant trees, were affected more by diseases and pests, poor soil fertility, tenure insecurity and shortage of land. Those who insisted in using the existing forest experienced more shortage of water, diseases and pests and low productivity of farms.

Table 9. Livelihood strategy of respondents by attitude to sustainable forest management.

Livelihood strategy	Have planted trees in the last 5 years	Want to plant trees in the future	I prefer to use existing forest	I practice family planning	I would like more children than I have	Row total
Selling coffee	33 (57.9)*	45 (78.9)*	4 (7.0)*	22 (38.6)**	5 (8.8)**	57 (100.0)
Selling wood	20 (35.1)*	29 (50.9)**	3 (5.3)**	12 (21.1)*	4 (7.0)*	36 (63.2)
Selling fruit	24 (42.1)*	31 (54.4)*	2 (3.5)*	10 (17.5)*	3 (5.3)*	36 (63.2)
Selling vegetable	8 (14.0)**	9 (15.8)**	0 (0)	2 (3.5)*	1 (1.8)	9 (15.8)
Trading	5 (8.8)*	5 (8.8)**	0 (0)	4 (7.0)*	0 (0)	5 (8.8)
Casual laborer	2 (3.5)	2 (3.5)	1 (1.8)	1 (1.8)	1 (1.8)	3 (5.3)
Artisan	1 (1.8)	1 (1.8)	0 (0)	2 (3.5)	1 (1.8)	2 (3.5)
Beverage selling	1 (1.8)	2 (3.5)	0 (0)	1 (1.8)	0 (0)	2 (3.5)
Apiculture	1 (1.8)	2 (3.5)	0 (0)	1 (1.8)	0 (0)	2 (3.5)
Cloth weaving	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3.5)
Fishery	0 (0)	0 (0)	1 (1.8)	0 (0)	0 (0)	1 (1.8)
Column total	33 (57.9)	45 (78.9)	4 (7.0)	22 (38.6)	5 (8.8)	57 (100.0)

57 valid cases; 3 missing cases, values are frequencies, values in parentheses are percent of respondents, *statistically significant at 5 % level, ** statistically significant at 1 % level.

The majority of those who practice family planning were also affected by shortage of water. Those reporting shortage of water as well as diseases and pests as problems wanted to have more children.

Livelihood strategy was also correlated with attitude towards sustainable use of resources (Table 9). Those that had planted trees in the five years preceding this study and households who desired to plant trees in the future were engaged in coffee and fruit businesses. The rest were engaged in vegetables, trading, casual labor, artisanship and homemade brewery. Interestingly, those who insisted on using the existing forest were engaged in coffee, fruit, and wood selling. The same can be said for practicing family planning and wanting to have more children.

The foregoing results indicate that wealthier families are older, have larger resource ownership, are male-headed households and are literate. They also had bigger family sizes and were practicing or would like to practice family planning. They heavily depended on coffee farming even though they also depended on the forest-based income to a larger extent. They had diversified their livelihood through off-farm labour, trading and vegetable selling. They were acutely aware of water shortage and shortage of coffee shades and would like to see better productivity of their farms, in part, through accessing superior germplasm.

Poorer households, on the other hand, had smaller resource ownership, were female-headed and illiterate. They also had younger and smaller family sizes and desired to have more children. Hence, they are not likely to want practicing family planning. They experienced acute shortage of land and also felt tenure insecurity. Perhaps, because they cannot afford pesticides and fertilizers, soil fertility, including pests and diseases, are serious constraints for them. Owing to shortage of land and tenure insecurity, among other things, they have not planted trees in the past and are not likely to plant trees in the future. Much of their income comes from wood selling. They have diversified their livelihood into artisanship, cloth weaving and fishing.

As reported in our earlier report (Alelign *et al.* 2007), the unsustainable exploitation of the forest by the local communities has critically affected species evenness of the woody plants and population structure of the forest. This is evidenced by the very low density of not only many species but also the forest as a whole as well as the dominance of individuals at lower diameter and height classes. Despite the escalating exploitation of the forest, diversity of woody plants in Zegie is still relatively high compared with other similar forests. In addition, the presence of a large number of seedlings of woody species in the forest indicates the great potential source for sustainable future regeneration of the forest, provided that appropriate management regimes can be employed. This could help Zegie Peninsula to remain a unique area in the region with its beautiful environment and cultural heritage.

Our previous findings (Alelign *et al.* 2007) also indicated that the production of coffee, fruits

and *Rhamnus prinoides*, absence or insignificance of crop cultivation and prohibition of animal husbandry are factors that have contributed to a relatively low level of deforestation or clearing of the forest resources in Zegie. The huge untapped potential of fish resources and bee forage plants, the relatively high literacy level, awareness of the majority of the people about family planning and the need to conserve the forest are promising factors for the future sustainability of the forest in Zegie. On the contrary, high dependency of the people on wood from the forest for generation of income, high population density and shortage of land coupled with moisture stress are the major problems that could pose serious threat to the forest resources.

Therefore, in addition to the recommendations forwarded in our previous report (Alelign *et al*. 2007), the strategy to save the remaining forests in the peninsula should also include reducing the proportion of poorer households. In order to achieve this objective, a three pronged approach is required: (1) improving access to resource ownership; (2) removing or minimizing farming constraints; and (3) creating enabling environment for families to engage in diversified livelihood strategies.

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