



# Importance of socio-economic factors in the collection of NTFPs: The case of gum arabic in Kenya



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## ABSTRACT

Collection of wild non-timber forest products may improve the livelihoods of communities through their direct consumption or marketing. Gum arabic is one of these products by 'Acacia senegal' trees that are found in Kenya. It is a source of additional income for rural households. The study explores – household decisions to collect gum arabic in the forest using the two stage Heckman selection model. The data for the analysis come from the 213 randomly sampled collectors from the north-eastern and western regions of Kenya. The findings show that live-stock ownership, possession of skills, insecurity and price obtained from the previous season impact on decision making to collect gum arabic. Furthermore, household's age, experience in collecting gum arabic and topography increase the quantities collected while gender negatively impacts amounts of collection. The research concludes by emphasizing that collection of the non-timber forest products including gum arabic would be attractive if the returns from collection justify the risk and cost to go to the forest.

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## 1. Introduction

Non-timber forest products (NTFP) act as a safety net for the purpose of consumption smoothing and can protect against poverty through improved nutrition and income generation (Neumann and Hirsch, 2000; Arnold and Ruiz Pérez, 2001). A 2000 report by the World Health Organization (WHO) showed that 80% of the population inhabiting the developing world utilize wild products to meet some of their health and nutritional needs (Muzayen, 2009). The safety net function of wild products is also well established through the reduction of poor people's vulnerability to risk by satisfying periodic food or income shortages and providing a buffer during difficult times (Ruiz Pérez, 1995; World Bank, 2001; Shackleton and Shackleton, 2004). According to Delacote (2007), NTFPs are critical in rural parts of many developing countries because of their risk management role, especially given that agricultural crops encounter many types of shocks, including seasonal flooding, crop diseases, and price shocks. Wild products also generate cash resources and help increase living standards. These products are traded in formal and informal markets (Taylor et al., 1996; Arnold and Ruiz Pérez, 2001; Shackleton and Shackleton, 2004; Warner et al., 2008).

Delacote (2008) indicated that the low capital and skill requirements of the extraction of non-timber products as well as the open or semi-open access to the forest resources constitute additional advantages

for rural households. However, given the low quantities collected in the forest and sold in the market, it should be noted that there exist some constraints to the collection and marketing as listed by Taylor et al. (1996), Scherr et al. (2004), Ruiz and Arnold (2005), Shackleton et al. (2007), and Lilieholm and Weatherly (2010). These constraints include the remoteness or landlockedness of the collection area, limited availability of local buyers and local purchasing power, low prices, poor infrastructure, limited access to markets, high transportation costs, communication problems, periodicity of harvest, unreliable quality and low level of education, and poor organization of trade among producers and traders.

Gum arabic is the dried exudation obtained from the trunks and branches of *Acacia senegal* trees that grow in abundance in the gum belt of Sub-Saharan Africa, of which Kenya is a part. It is common in the arid and semi-arid lands of Kenya. These dry lands cover 80% of Kenya's total land area and support 25% of the population and 50% of the livestock (Ngugi and Nyariki, 2005). Livestock is the most important resource to the people in these areas. However, due to recurrent droughts coupled with erratic rainfalls, the scarcity of water and of grazing areas, and soil degradation and erosion leading to desertification, a diversification of income sources became a priority for improving or at least sustaining the welfare of rural households (Ellis, 2000; IFAD, 2008; Adhikari, 2011).

Such diversification undertaken in order to reduce dependency on highly variable resources takes different forms, including the collection of gums and resins. In Kenya, gum arabic is collected from the wild on communally owned land with no organized system of tapping of gum as practiced in Sudan or Senegal; instead, stones or knives are used to

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make the incisions for gum exudation (Okatahi and Onyibe, 1999; Gachathi et al., 2009; Vellema et al., 2013). As explained by Vellema et al. (2013), after making the incisions, there is potential risk that the gum will be collected by another person because it takes several days (up to 14 days) for gum to exudate and dry.

There are two seasons of collection each year, corresponding to the dry months of the year. The first collection season follows the short rains; it usually begins in January and ends in March. The second collection season follows the long rains; it usually begins in June and ends in September. The average yield per tree in each season is between 0.25 and 2 kg. The prices earned from selling gum arabic by the collectors are generally low, ranging between 33 and 43 KSh/kg in the gum collection zone (i.e., between approximately 0.30 and 0.50 USD/kg<sup>1</sup>), as shown in Fig. 1.

Although the export prices fluctuate a lot, they are a bit higher—on average 0.92 USD/kg (Fig. 2).

For the collecting households, gum arabic is rarely the sole income generator; it is generally the second source of income, after livestock (Vellema et al., 2013; Wekesa et al., 2013). In their study, Wekesa et al. (2013) found that the monthly income from gum arabic in the collection season is on average 2250 KSh, or about 25 USD, whereas the average monthly income from livestock is almost double that amount (i.e., 4000 KSh, or about 46 USD). Other sources of income include the collection of other non-wood products, including resins, wage occupation, charcoal production and wood products, and commerce and relief support.

Gum arabic has multiple uses in the modern food and non-food industry as an emulsifier, stabilizer, thickener, flavoring and coating agent (Wickens et al., 1995). Due to its various functions, current global consumption of gum arabic is estimated to be 45,000 tons, with the main users being France (40%), the US (21%), and the UK (12%) (Touré, 2008). Kenya's production potential is estimated to be 3000 tons of gum arabic per year; however, very little is being collected as observed from the statistics that show an average of 75 tons of exports and domestic sales per year in the 2004–2010 period (Somo, 2007; COMTRADE, 2012). China is the leading importer of Kenya's gum arabic, followed by Pakistan, India, the UK, and Germany.

Kenya's low production/collection of gum arabic is thought to be due to the poor organization of the sector, lack of capital, and unreliable supplies (Chrétin et al., 2008; Somo, 2007). The small quantities observed also seem to indicate that collection is not widely done. Taylor et al. (1996) stressed that the collection of wild products, including gum arabic, is not always undertaken despite the fact that inhabitants are readily able to collect it in order to increase their income. This study examines this issue in two steps. In the first stage, the study looks at the decision made by a household to go to the forest to collect gum arabic; in the second stage, it investigates the factors that determine the actual amount that the household who decided to collect subsequently obtained from the forest.

## 2. Methodology

The decision and outcome processes are investigated through a Heckman selection model. In the two-stage model, determinants of collectors' actual decision to collect gum arabic or not and the quantity of gum collected by households are analyzed.

### 2.1. The Heckman selection model

The decision was made to analyze the household's decision to collect gum arabic and quantity collected through a two-stage Heckman selection model because of a potential sample selection bias. Two types of

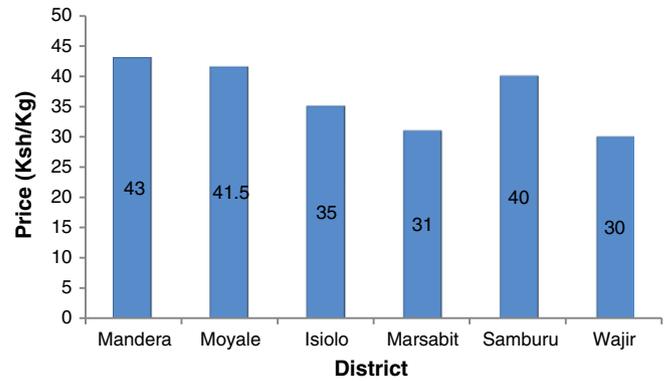


Fig. 1. Gum arabic sale price by collectors in Kenya. Source: Gachathi et al. (2009).

bias were encountered in the current study. The first bias concerns the omission of a category of non-collectors—namely, either the pastoralists or farmers. Although their responses would have greatly contributed to the understanding of the negative attitude towards collection, at the same time, given that the collection of gum arabic is currently a secondary and perhaps minor activity, including this category would have added much weight to the group of non-collectors. However, the focus was on those who had at least collected gum arabic in the past so that their experiences would help provide information about the constraints and issues related to collection.

The second bias relates to the selection whereby the quantity was observed only for a non-random sample (collectors chose whether to collect or not; for those who chose to collect, the quantity of gum collected was observed) such that the quantity collected depended first on the positive choice of going to the forest to collect. It is assumed that a collector who knows the activity cannot go to the forest and come back empty-handed given that he knows the right time to collect and the trees are productive. In econometric terms, this bias implies that the error term in the quantity equation is more likely to be correlated with the decision to collect.

The sample selection model's mathematical form is presented in Eqs. (1) and (2). The model includes the outcome and the sample selection equations. Eq. (1) demonstrates the outcome equation piece of the model:

$$Y_i = X_i\beta + u_i. \quad (1)$$

Here, it is assumed that the quantity collected ( $Y_i$ ) is a function of the covariates' vector for unit  $i$  ( $X_i$ ).  $\beta$  is the coefficients' vector defining the volume of quantities.  $u_i$  is a random disturbance term.

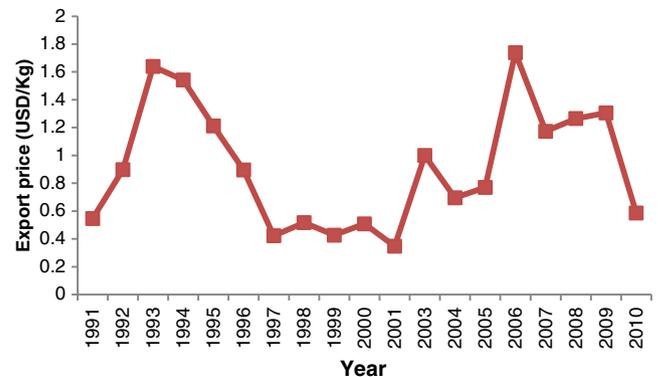


Fig. 2. Export price of gum arabic from Kenya. Source: FAOSTAT, 2008; COMTRADE, 2012.

<sup>1</sup> The September 2009 average currency exchange rate is used for all conversions.

Eq. (2) observes the positive outcome for decision to collect ( $z_i$ ), as a dummy variable, and is expressed as follows:

$$z_i^* = \gamma D_i + v_i \quad (2)$$

with

$$z_i = \begin{cases} 1 & \text{if } z_i^* > 0 \\ 0 & \text{otherwise} \end{cases}$$

$\gamma$  is a vector of coefficients determining the decision to collect.  $v_i$  is a random disturbance.

The exclusion restrictions were purposely imposed in order to have a robust identification as can be noted from using certain variables in the decision to collect equation that are not used in the quantity equation.

## 2.2. Variable description

The variables included in the study are classified into two groups: variables that determine the (1) decision to collect and (2) quantity collected by the household. The first category includes the collector's age (older collectors who are knowledgeable about gum arabic and its benefits might be attracted by collection; hence, age has a positive effect on collection); gender (in the dry lands where gum arabic is collected, pastoralism is male-dominated; thus, collection is attractive to women, whose control over the activity implies a source of income and a contribution towards fulfilling the household's needs); livestock ownership (livestock ownership as a sign of wealth implies that the household might be food sufficient such that collection of gum arabic is not important as a source of income); possession of skills and tools to collect gum arabic (for a collector who knows how to collect gum arabic and has the appropriate collection tools, the activity is always more attractive compared to the case of a novice collector or a collector who needs to make some investment in the purchase of tools); insecurity (refers to physical insecurity from wildlife, ethnic conflicts and threats related to cattle rustling and boundary disputes that might prevent collectors from venturing into forests to collect gum arabic); price obtained in previous season (a higher price obtained in the previous season makes gum arabic collection an attractive option for generating income); and distance to market (gum arabic is collected by inhabitants of remote villages located in proximity to natural forests, but who might have to walk long distances to the market centers; the lack of information on the existence of buyers and prices in addition to these long distances further discourages collection). In addition, a regional variable is added to control for variability in the study zones.

The second category of variables that determine the amount of gum arabic collected included age (in quadratic form because it is expected that quantity harvested increases at a diminishing rate as collectors gain experience but later become less energetic); gender (women were found to be more knowledgeable about the collection techniques than men [e.g., Wekesa et al., 2010a]); livestock ownership (this wealth indicator implies the availability of the means to hire labor provided that the activity of collection is sufficiently profitable); and insecurity (restricts the territory that the collector can explore in search for gum arabic). The restriction variables include the variables that unequivocally determine the quantity which the collector takes home—namely, his experience (acquired through continuous use and sharpening of the acquired skills; more experienced collectors better know how and where to collect, meaning the collector can collect a lot of gum arabic, although experience was not found to be correlated with age); topography (hilly and mountainous areas produce better and larger quantities of gum arabic than plains [Wekesa et al., 2010b]); and rivalry (collection is—both culturally and for security reasons—organized in groups of 10 to 15 individuals; collection is individual, but the large size of the group can lead to low individual harvests).

## 2.3. Data

The dataset used in the study includes survey responses on characteristics of gum arabic collection and marketing in Kenya. The survey was conducted between August and September 2009. It covered households involved in the collection of gum arabic either on a regular basis (i.e., during each harvest season) or intermittently. The districts<sup>2</sup> surveyed were purposely selected based on whether *A. senegal* trees are existent and gum arabic is actively grown and marketed, following Gachathi et al. (2009). These districts are Mandera, Marsabit, Samburu, and Isiolo in the north-eastern region as well as Turkana and Loima in the western region. The study population of gum-collecting households or the exact number of collecting villages in districts was not known because of the migrating behavior of the pastoralists, who are the persons most involved in collection. Hence, the survey adopted a multi-stage quota sampling of 4 random villages per district and 10 random gum-collecting households per village, such that the sample comprised 240 respondents. During the survey, due to migrations, only 20 villages were found, and 218 collectors were interviewed; some villages included larger proportions of gum collectors than others. This implies a response rate of about 89%. However, due to missing responses, only 213 observations were used in the analysis. Data were gathered through the use of a questionnaire: The survey questions were administered in a verbal interview conducted in the household. Household responses were obtained from the principal collecting person in the household (i.e., not necessarily the household head as in some instances the women of the households were the ones involved in collection while men specialized in animal husbandry). Key characteristics of the sample of the respondents are summarized in Table 1.

More than half of the sample was obtained from the north-eastern region; the Turkana made up the largest ethnic group in the sample (they are concentrated in the western region). The proportion of female respondents was also larger compared to the group of males, reflecting the general sex distribution of collectors as described in the previous section; this will be further discussed in our results. Finally, almost all the interviewed collectors were non-educated or at the most had only a few years of primary-level schooling.

The collected data were quantitatively analyzed with the help of Stata 10 following the methodological steps described at the beginning of this section.

## 3. Results

The determinants of the decision to collect and quantity collected are described in Table 2.

Currently in Kenya, the quantities of gum arabic collected are very small, and the price is also low. The low price might constitute one of the reasons why some collectors choose not to collect gum in certain seasons. This option limits the prospects of gum collection as a contributor to household incomes. Collectors are on average young, in their mid-thirties. Collection is undertaken as a secondary activity next to small-scale pastoralism and is done in remote villages located at long distances from markets. This perhaps explains the low prices paid in the villages, as traders face large transport and transaction costs. Gum collection is essentially done in hilly areas and mostly by experienced women, implying that insecurity is a pertinent issue. To ensure protection and support, they therefore travel into the forest in groups of 10 to 15 women. However, the group poses a problem of rivalry in terms of competition over the quantities to collect.

Tables 3 and 4 present the results of the Heckman two-stage selection model for the decision to collect gum or not (first step) and the amount of gum collected (second step).

<sup>2</sup> Districts were reorganized as counties after 2009.

**Table 1**  
Key characteristics of the sample of the respondents.

Characteristic	Attribute	Frequencies	Valid percentage
Region	North-eastern	126	59.4
	Western	87	40.6
Ethnic group	Samburu	46	22.8
	Turkana	88	43.6
	Rendille	59	29.2
	Somali	9	4.5
Gender	Male	70	32.1
	Female	148	67.9
Education	No formal education	182	90.1
	Formal education	20	9.9

In the analysis of the decision to collect, four variables were significant: livestock ownership, possession of skills and tools, insecurity, and price obtained in the previous season. Coefficients were as expected: Livestock ownership and insecurity have a significant negative effect on the likelihood of collection whereas the possessions of skills and tools and price obtained in the previous season have a significant positive effect on the likelihood of collection.

In the analysis of the quantity to collect, five variables were significant. These included age (and its squared term), gender, livestock ownership, experience, and topography. Except for the gender variable, the signs of the other significant variables were as expected: Age has a positive but diminishing effect on the quantity of gum collected; livestock ownership, experience, and topography have a positive effect on the quantity of gum collected. The LR test statistic of the independence of equations is significantly different from zero, thereby justifying the use of the Heckman model due to the correlation of errors. In addition, the statistic of the Hausman test of the validity of the exclusion variables is significant, implying that these variables in the quantity equation have no correlation with the decision to collect. Following Puhani (2000), the potential collinearity of the structural variables of the quantity equation with the collection equation is tested through a regression of these exclusion variables on the inverse Mills ratio (IMR). This is computed, and its estimation results are shown in Table 5.

None of the structural variables are found to be significant, nor is their joint F test; these results imply that these exclusion factors were correctly chosen.

#### 4. Discussion

The collection of gum arabic, similar to the collection of other non-timber forest products in particular or agricultural production in general, is attractive when collectors/producers expect to obtain a positive

**Table 2**  
Description of determinants of the decision to collect and quantity collected (n = 213).<sup>a</sup>

Variable	Mean	SD
Quantity collected (kg) <sup>a,b</sup>	27.1	34.95
Age (years)	36.8	12.073
Experience (years)	6.4	7.466
Livestock ownership (TLU) <sup>c</sup>	6.3	12.24
Village price in previous season (KSh)	43	11.038
Village distance to market (km)	4.3	9.59
Collection (1: collected in the current season) <sup>a</sup>	0.61	0.034
Topography (1: hills)	0.86	0.023
Skilled (1: has acquired some skills and has the tools)	0.51	0.034
Gender (1: female)	0.68	0.032
Insecurity (1: feels insecure)	0.13	0.023
Rivalry (1: feels strong competition)	0.09	0.02
Zone (1: western Kenya)	0.41	0.034

<sup>a</sup> Dependent variable.

<sup>b</sup> Average quantity is calculated only for those who collected.

<sup>c</sup> Total Livestock Unit (TLU) values are 1.4 – camel, 1.0 – cattle, 0.5 – donkey, 0.1 – sheep, and 0.1 – goat (FAO, 2004).

**Table 3**  
First-stage Heckman results (collection (1: collected in the current season)) (n = 213).

	Coeff.		SE
Constant	−2.673	*	−1.392
Age (years)	−0.012		−0.008
Gender (1: female)	0.119		−0.203
Livestock ownership (TLU)	−0.024	**	−0.01
Skilled (1: has some skills and tools)	0.511	***	−0.163
Insecurity (1: feels insecure)	−0.635	**	−0.276
Price in previous season (log)	0.919	**	−0.37
Distance to market (km)	−0.012		−0.009
Zone (1: western Kenya)	−0.256		−0.188

\*\*\*Significant at 1%; \*\*significant at 5%; and \*significant at 10%.

return on their effort. Hence, the price received from the market is very important. The study found that a high price received in the previous season makes collection in the current season attractive because it creates the expectation for high returns. This is important as it should be sufficiently large to justify the trade-off between collection and other economic activities. One of these activities is pastoralism or livestock rearing.

The current study found that households owning livestock are less likely to collect gum, implying that wealthy households are relatively more income-sufficient and do not need to depend on gum collection. For pastoralists, livestock tending occupies a majority of the household, especially the men, who at times migrate with cattle in search of pastures. Collecting gum arabic is therefore not an attractive source of income for these “wealthy” households, especially when collection does not generate substantial income. Although this finding confirms the assessment of gum collection as a secondary category by almost all collectors interviewed, it also confirms earlier studies that linked poverty to the harvesting of non-timber forest products.

Shackleton (2006) and Escobal and Aldana (2003) found that poor inhabitants benefit more from the collection of wild forest products than the wealthy households. These authors observed a decreasing dependence on natural resources as wealth increases. Neumann and Hirsch (2000) and Mulenga et al. (2011) further explained that poor households are more likely to harvest these products because they face more frequent food shortages and lack alternative income sources. This is particularly relevant in the dry lands, where employment opportunities are rare and collection is done to supplement the household incomes. Where supplementary sources are present, the incentive to collect is lessened. Poor households benefiting from cash transfers paid by organizations such as DFID were less inclined to engage in economic activities given that their primary necessities were satisfied (Chrétin, 2007; DFID, 2011). Furthermore, it is important to note that, to be a success for poor households, collection has to be associated with good prices. In fact, IFAD reported that collection activities are

**Table 4**  
Second-stage Heckman results (quantity collected(log)) (n = 213).

	Coeff.		SE
Constant	1.473	*	−0.898
Age (years)	0.07	*	−0.04
Age squared	−0.001	*	0
Gender (1: female)	−0.433	*	−0.229
Livestock ownership (TLU)	0.037	**	−0.015
Insecurity (1: feels insecure)	−0.163		−0.327
Experience (years)	0.022	*	−0.014
Topography (1: hills)	0.457	*	−0.282
Rivalry (1: feels strong competition)	−0.127		−0.356
Inverse Mills ratio (lambda)	−0.929		−0.265
Rho	−0.799		−0.144
Sigma	1.164		−0.135
LR test (rho = 0)	6.68	***	
Hausman test	42.87	***	

\*\*\*Significant at 1%; \*\*significant at 5%; and \*significant at 10%.

**Table 5**  
Regression results of structural variables on IMR (n = 213).

	Coeff.		SE
Constant	2.359	***	−0.085
Experience (years)	−0.002		−0.004
Topography (1: hills)	−0.101		−0.089
Rivalry (1: feels strong competition)	0.098		−0.098
F test	0.88		
Adjusted R-squared	0		

\*\*\*Significant at 1%.

attractive to the poor people, but warned that the low returns yielded from these activities offer few prospects for the accumulation of the capital needed to escape poverty (IFAD, 2008).

From the discussion thus far, it is evident that the decision to collect depends on incentives and trade-offs. However, other factors reinforce the collector's decision either positively or negatively. One factor is the possession of skills and tools to collect gum arabic. The current study found that collectors who have acquired some collection skills and appropriate tools are more likely to collect compared to less-skilled collectors. This is especially relevant where no large investment is required nor other heavy inputs are used, and the collector is just required to go to the forest and harvest.

A second issue limiting harvest is insecurity. At the macro level, different studies (e.g., Stewart et al., 1997; Luckham et al., 2001; Messer and Cohen, 2006) have found that insecurity causes large economic dislocations, including inhibiting economic activity. This has severe consequences on income, agricultural output, and trade. At the local level in Kenyan communities, insecurity is caused by conflicts over resources between poor pastoralist groups which involve cattle rustling and even homicide (Umar, 1997). Such conflicts are not uncommon in western Kenya (between Turkana and Pokot) and north-eastern Kenya (Samburu). Insecurity implies that collectors cannot go to the forest unless they have some form of protection or are in groups. Formal protection in the area is virtually impossible: Not only would it be costly, but these conflict zones are also publicly acknowledged as “no go arid areas” (Umar, 1997). Hence, collectors are left with the second choice of going as groups.<sup>3</sup> Yet the group organization poses a problem of competition because of the reduced individual quantities when collectors are in a group competing for harvesting in a common area. This perhaps explains why women, who were perceived as better collectors because “they have a deep understanding of the resource” (Wekesa et al., 2010a,b), ultimately obtained lower quantities from collection. This calls to mind again the IFAD (2008) remark about the prospect for accumulation of the capital needed to escape poverty which will be absent, especially because of the low price–low quantity combination.

With experience, collectors are able to increase the quantities of gum arabic they collect. Generally, the lack of knowledge related to managing the wild forest products and lack of technical assistance are among the many constraints limiting their collection, as remarked by Muzayen (2009). This is particularly important for gum arabic as collection requires some good knowledge about gum arabic trees. Yet, as Wekesa et al. (2010a) observed, collectors use stones to induce gum arabic exudation, but this practice results in low quality gum arabic and causes injury to the trees. Koenig and Mohamed (2010) cautioned that improper harvesting and the tapping of gum trees seriously deteriorate the stock of gum.

As expected, collector age has a diminishing effect on the quantity collected. This reflects the hardships associated with collection, such as long distances to collection places (Maisharou and Nourou, 2004; Chr  tin et al., 2008; Mulenga et al., 2011) and harsh, dry, and hot environments (S  ne and Ndione, 2007). Although livestock ownership makes collection a less attractive activity, wealthy households were

found to collect larger quantities because they could afford to hire others for the production costs and even the cost of transporting to better markets as evidenced by studies, such as Cavendish (2000), Getachew et al. (2007), and Muzayen (2009). Environmental factors are important in the production of gum arabic. The study included a simple environmental indicator named topography (relief/elevation) and found that hilly areas are more productive. This finding is consistent with ecological studies, such as Wekesa et al. (2010b), that link better gum yields to hills. Other environmental factors are important as well, including soil type, temperatures, rainfall, and vegetation. For instance, Wekesa et al. (2010b) found a positive relationship between soil temperature and gum arabic productivity. Moreover, Ballal et al. (2005) found a positive correlation between gum yield and rainfall.

## 5. Conclusion

There is a critical need to reduce poverty levels in rural Kenya. As the collection of forest products serve to improve the livelihoods of resource users who live in the high-risk dry lands, where income streams are uncertain, there is a need to explore and extend the diversification of livelihood sources as well as off-forest sources in order to reduce over-dependence on resources. Although each wild product and production area has their own peculiarities, the current study suggests that the collection of wild products, including gum arabic, would be attractive if the returns from collection outweigh the risk and cost to harvest the resource. These returns could be in the form of better prices. Such prices can be obtained by identifying markets where the product is most appropriate. To be able to find these markets, better access to market information is necessary; otherwise, increased production in a stagnant market might depress prices and reduce income generated from gum arabic sales.

As gum arabic is collected from forests located in remote areas, resource benefits can be improved through the development of infrastructure, including roads and communication. Similarly, efforts should be made to make production areas more secure as poor infrastructure and insecurity hinder the sector development by limiting production/collection and the market profitability of trading agents.

There is no immediate danger of exhausting the resource, as the productive capacity of the forests in Kenya is far from being reached. However, this does not mean that production levels should be increased by creating negative externalities to the forest. The sustainable collection of gum arabic can be achieved by applying appropriate techniques which increase the tree productivity but do not harm the tree itself. Such sustainable techniques can be mastered through trainings that can be organized for producers/collectors with the aim of improving their knowledge and skills as well as sensitizing them to resource sustainability issues. The government should not overlook this fact and include it in its forest sector priority agenda.

Agricultural extension organizations currently provide services to crop-growing farms. Given the growing importance of NTFPs, establishing extension services that can provide support for NTFP collectors is required within a broader policy of improved natural resource management and rural livelihoods. In this regard, forming informal or formal harvester cooperatives could prove to be a favorable practice. The aim of establishing such cooperatives is the hope that collective decisions made by members with similar interests can enhance the group's market power in sales and simultaneously improve the resource management and conservation of forests.

Similarly, fair trade and other certification criteria could also be useful tools to foster sustainable harvests to contribute to and diversify local household incomes through improved prices and stable market relations while taking into account the cost of such certification scheme. As certification efforts are generally led by both local and transnational non-governmental organizations, policy decisions should focus on supporting and creating a legal basis for the operation of such organizations.

<sup>3</sup> Women reported that they hire men to accompany them to the forest and pay them in terms of gum tithes.

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