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Full Length Research Paper

Sources of natural dyes and tannins among the Somali community living in Garissa County, Kenya

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This study was undertaken in Garissa County to document the trees and other plant species used as sources of natural dyes and tannins. A survey involving a total of 71 respondents was conducted in six divisions of Garissa County. The respondents were randomly selected and interviewed using a semi-structured questionnaire and analyzed using Microsoft Office Excel 2007 and SPSS computer packages (Version 11.5). The findings showed that the main sources of livelihood included livestock production, sale of dye and tannin products and businesses in that order. Natural dyes were a major input on woodcarvings, mainly utensils used for milking and storage of milk and water. Both men and women in the community used *Lawsonia inermis* L for hair dyeing and skin decoration. The main plant sources for dyes and tannins were enumerated as *Commiphora holtziana* (Haggar), *Acacia bussei*, *L. inermis* L (Elan) and *Commiphora campestris* Engl, among others. The mordant used were Magadi soda and ashes from specific trees/shrubs such as *Salsola dendroides* Pall. Var Africana Brenan (Durte). All the dyes and tannins, except for *L. inermis*, were extracted locally from inner and/or outer bark. The processes involved include de-barking, pounding the bark, boiling and adding the mordant and application to wooden utensils and to fibers used for weaving. There exists a potential in the natural dyes and tannins industry, making it necessary to strengthen the capacity of the local community to conserve the dye producing plants, encourage collaboration and networking amongst the stakeholders and improving the marketing environment.

Key words: Livelihood, natural dyes and tannins, plant sources, mordant, extraction, conservation, bark.

INTRODUCTION

Arid and Semi Arid Lands (ASALs) cover over 80% of total land area in Kenya and are characterized by low and erratic rainfall and poor and degraded soils that cannot support agriculture. The vegetation cover is dwindling mainly due to over exploitation for expanding agriculture, charcoal production and overgrazing due to increasing population and influx of settlers from high potential areas. High poverty levels among communities in the ASALs (Muok et al., 1998) have forced the communities to look for alternative sources of livelihood to supplement farming and livestock production. Dyes and tannins play a major role in people's economic growth and cultural values. Use of dyes has been recognized in leather industries, textiles and cosmetics and to a lesser extent in food industries (Jansen and Cardon, 2005). Traditional use of natural dyes and tannins has been under threat by synthetic products, and thus reduced the dependants on plant-based products and also creating a potential health risk.

Some of the species the local communities use for natural dyes in some parts of Kenya include; *Ekebergia capensis, Syzygium cuminii, Euclea divinorum, Azanza gackeana, Albizia amara* and *Erythrina abyssinica*, among others (Musyoki et al., 2007; Beentje, 1994). Increased demand in the international market for

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handcrafts with natural colors has led to over-exploitation of some of these indigenous species through uprooting, de-barking and plucking their leaves to extract different colors, leading to death of the plants. Kenya has been cited to export dyes and tannins from *Acacia mearnsii* and *Bixa orellana* L. (annatto), though the community based dye and tannin industry is not well developed as in West Africa. Some communities in West Africa have perfected an art of dyeing, such as the Bogolan techniques in Mali whose products are in high demand globally. They export their textiles products to Senegal, Ghana, South Africa, France, Germany, Switzerland and Belgium, Japan, U.S.A and Canada. This has led to heavy reliance on some species such as for Bamako, which export 520 tons of dyed clothes and products corresponding to 430 tonnes of dried leaves of *Anogeisuss leicarpa*. The use of these products promotes African cultural values; support cottage industries or livelihood options, which indirectly promote related ventures like cotton and leather sectors (Jansen and Cardon, 2005).

The use of natural dyes and tannins is an old practice not only in Kenya, but also all over the world. Though the use of synthetic dyes has become a common feature in most commercial applications, most craft, spinners, knitters and weavers still use natural dyes to maintain unique features of their work. In the developing world, natural dyes have a high potential of providing many diverse source of dyes and enhancing income of the local people through 'sustainable harvest and sale of these dyes (ITDG, 2003). Despite the fact that the use of synthetic dyes is being threatened by the use of natural dyes for over a century, the natural dyes have never been eroded completely and they are still being used in diverse parts of the world (Samanta and Konar, 2011). Research gaps on priority species have been identified and they include resource conservation and availability, quality efficacy, husbandry, products diversification, markets and developmental gaps, among others (Mukonyi and Gachathi, 2004).

Research questions

This research aimed at answering the following questions:

(i) What tree species do the local community members and groups use as sources of dyes?
(ii) How do they extract and use the dyes and tannins?
(iii) How do they directly or indirectly make livelihood out of plants producing dyes and tannins?
(iv) What are the current conservation status of the dye and tannin producing tree species?
(v) What challenges do the community members face in conservation of the species?
(vi) How can the government address these challenges to enhance conservation and utilization of these plants?

Objectives of the study

This study was aimed at documenting the tree species used as traditional sources of natural dyes and tannins among the Somali community members in Garissa district. Its specific objectives were:

(i) To identify the tree species used as source of natural dyes in the study site
(ii) To document the traditional methods and processes used in extraction of dyes from plants.
(ii) To identify the conservation status of the dye producing plants in the study site

RESEARCH METHODOLOGY

Study area and sampling of respondents

This study was conducted in Garissa County, which covers an area of 33,620 km^2 and is divided into 11 divisions, 42 locations and 60 sub-locations. The county borders Isiolo district to the northwest, Wajir to the north, Republic of Somalia to the East, Tana River district to the West and Lamu district to the south. The county hosts over hundred thousand refugees from Somalia, Ethiopia, Sudan and Uganda who have a negative impact on the environment (GoK, 2002), mainly in Dadaab area. The district population was projected to increase from 329,868 in 1999 to 460,215 in the year 2008 at an annual growth rate of 4.7%, one of the highest in the country. A survey was conducted in Central, Bura, Shantaabak, Modogashe, Dadaab and Sankuri divisions (Figure 1) of Garissa County using a semi-structured questionnaire. A total of 71 randomly selected respondents from the selected sites were interviewed. Out of the 71 respondents, 57.7% were males and 42.3% were females with their ages ranging between 15 and 90 years. The respondents included individual farmers and randomly selected members of organized community groups involved in the handicraft activities that utilize dyes and tannins.

Data collection methods and instruments

Primary data was obtained through formal and informal interviews using a semi-structured questionnaire and field observations. Secondary data were obtained through a review of relevant literature from libraries and Internet, including resource materials such as journals, annual reports, books, workshop proceedings and district reports. Secondary data sources and observations supplemented the primary data sources. The objectives of this study were mainly achieved by the use of semi-structured household survey. Photography was used for illustration of the field realities (Lelo et al, 2000). Plant species were identified from vernacular names with the help of various taxonomic literatures such as 'Kenya trees, shrubs and lianas' (Beentje, 1994) and 'a selection of useful trees and shrubs for Kenya (ICRAF, 1992). A checklist of household survey questions used for household survey is attached herein showed in Appendix 1.

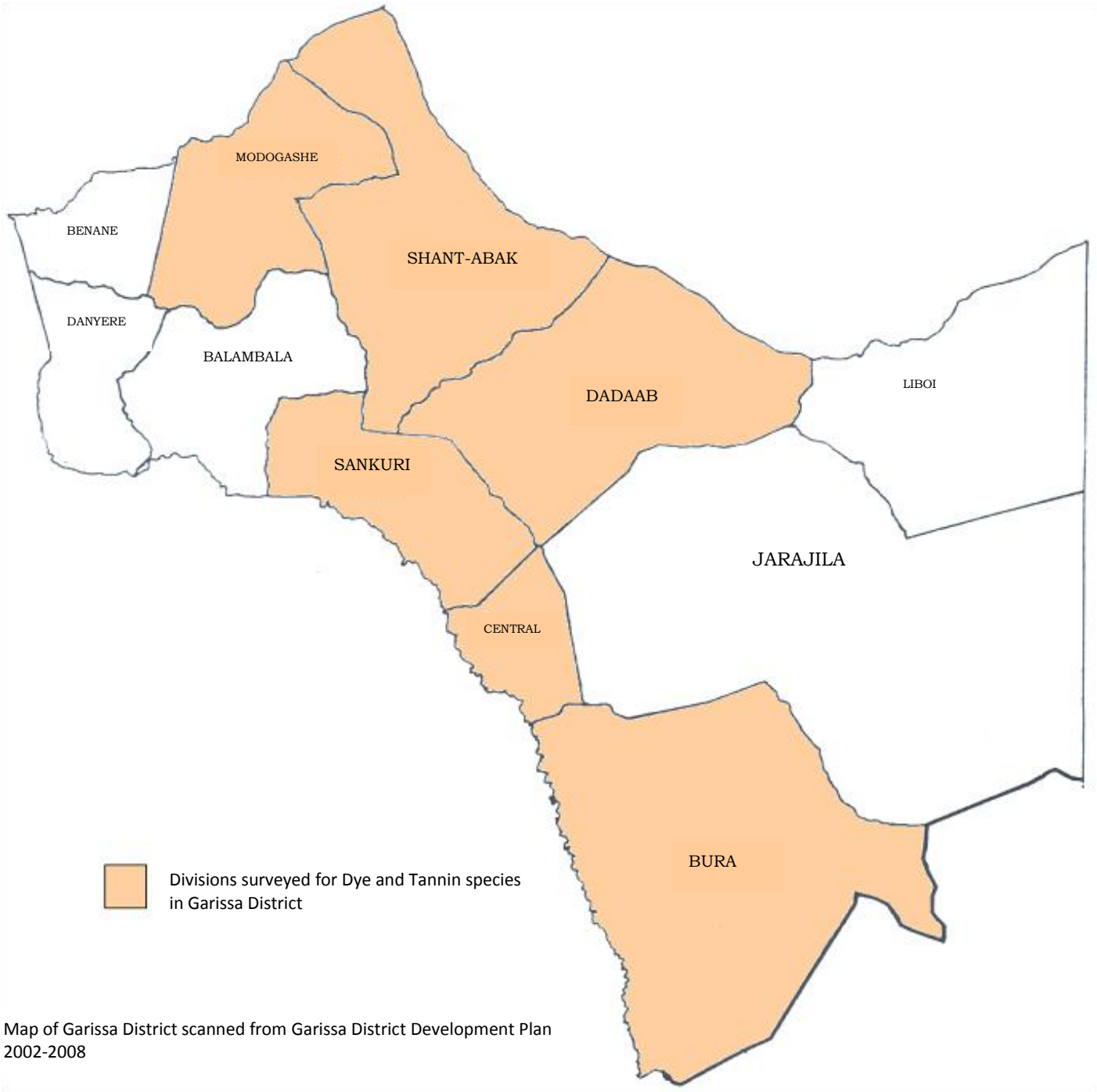

Figure 1. Geographical location of the study areas.

Data analysis

This study generated quantitative data from semi-structured questionnaires administered through household surveys and qualitative data from participatory rural appraisal (PRA) tools such as focused group discussions and direct observation. The qualitative data obtained through focused group discussions were subjected to in-depth analysis and used to complement the discussion of analyzed quantitative data. The quantitative survey data was sorted, cleaned, entered into computer using Excel computer package and analyzed using SPSS computer package. The research findings were verified during the community feedback workshop held in Kamuthe and Madahgisi. The data is presented in forms of charts and tables where necessary.

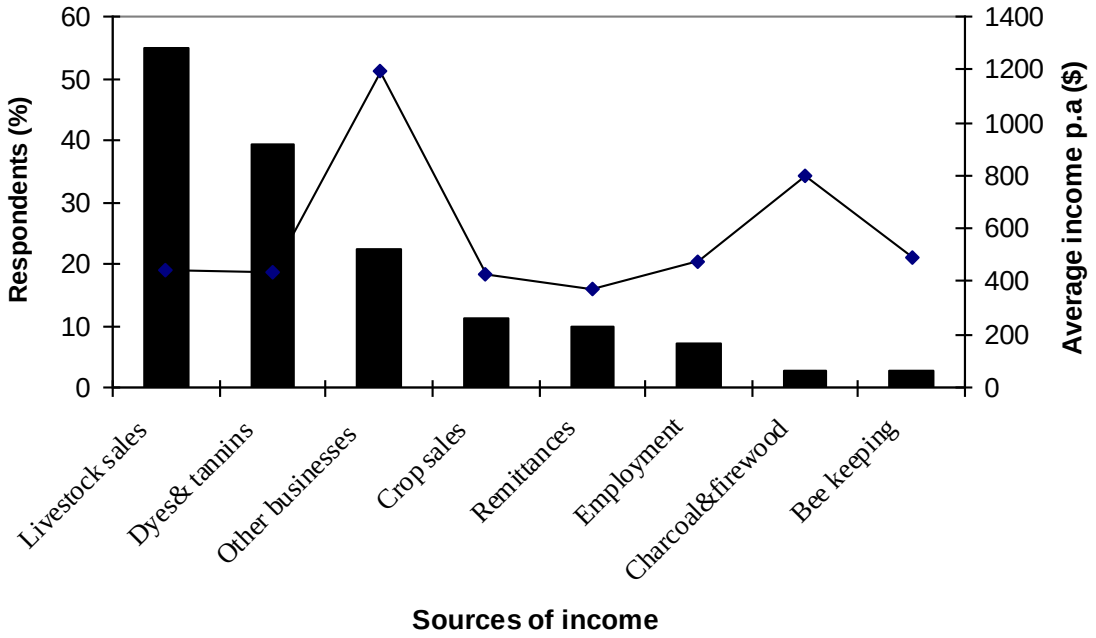

Figure 2. Sources of income and average income per annum.

RESULTS

Community socio-economic characteristics

Income generation

Majority of the respondents generated income from livestock sales and dyes and tannins handicrafts. Although other businesses provided the highest average income per annum, only a fewer members of the community were involved. Livestock sales and dye and tannin products rated lower in terms of average income per person per year (Figure 2).

Gender and age distribution

Interviews were done among 71 members of the community, out of whom 57.7% were males with an average age of 47.4 years and 42.3% were females with an average age of 36.6 years. For all the respondents, the average age was 43.3 years. Both men and women were involved in activities requiring collection or use of dyes. Although majority of the respondents (97.2%) were using products that required collection or use of dyes and tannins, only 39.4% were generating income from dye and tannin-related activities.

Majority of respondents generating some income from dye and tannin related activities were females (64.3%). There was a positive and significant association between gender and generation of income from dye and tannin related activities (χ^2 = 9.198, p=0.002; γ=0.646, p=0.002). Majority of respondents generating income from livestock sales (66.7%) were males the few respondents generating income crop sales were all males. There was some significant negative association between gender and income generation from livestock (χ^2 =2.822, p=0.09; γ=-.388, p=0.09) and crop sales (χ^2 =6.597, p=0.002, γ=-1.000, p=0.01). The average age of respondents generating income from dyes and tannin related activities (37.3 years) were lower than for those who were not generating such income (47.2 years) and the difference was highly significant (F=7.365, p=0.008). For other means of livelihood, there was no gender relationship observed. Majority of the respondents were illiterate (59.2%) and there was no significant association between level of education and generation of income from dyes and tannin related activities.

Management and exploitation of dye/tannin producing plants

There existed traditional believes that hindered conservation, and these included trees as a gift of nature, cheap and easily available. They believed that these plants are renewable and hence no need for conservation. Despite the low conservation efforts (36.6%), the respondents felt that domestication of dye and tannin plants was very important (92.9%). This is because majority of the

Table 1. Problems faced in conservation of dye plants as prioritized in focused group discussion and proposed solutions.

No.	Problem hindering	Proposed solution
1	Communal land ownership	Land adjudication by government
2	Drought	Proper management of rain water
3	Over exploitation of dye resources	Training (Provide knowledge on appropriate utilization and conservation methods)
4	Diseases and pests	Training on appropriate harvesting methods/pest control
5	Lack of Knowledge and Technical skills on tree planting and management	Training in silvicultural management
6	Lack of seeds and propagates	Training on seeds' collection and nursery operation
7	Refugee influx in Dadaab	Government and UNHCR to take action
8	Lack of Knowledge on seed pre-treatment methods	Research/Training
9	Traditional believes	Awareness creation

respondents had an observation that the density of dye producing plants in the study site was decreasing (53.4%). Only a few respondents (6.9%) indicated an increase in density, while 39.7% had observed no change at all in the dye plants' density. From the household survey, challenges faced in conservation, propagation and management of dye plants were indicated as lack of knowledge and skills (55.7%), lack of propagation materials/seeds (38.6%), pests and diseases (1.4%), drought (28.6%), over-exploitation (1.4%) and influx of refugees (2.9%). Furthermore, during the Focused group discussions with community members, more aspects hindering their efforts in conservation, propagation and management of dye and tannin plants were mentioned and prioritized and possible solutions proposed (Table 1). The influx of refugees was a more serious hindrance to conservation of dye plants in Dadaab area due to over exploitation of the plants as sources of energy in form of firewood and charcoal by the both the refugees and the local community members. In addition, during the focused group discussions, communal land ownership was prioritized as a major problem contributing immensely to lack of conservation efforts. It was considered to be a disincentive because of free grazing practiced by the pastoral community and the fact that they had no title deeds indicating ownership of any piece of land where they could conserve desired plants.

There were very few organizations assisting the community members in propagation, management and exploitation of dye/tannin producing plants as indicated by 10% of the respondents. The organizations that offered assistance were: Ministry of Agriculture and Forest departments (provision of seeds and seedlings for some plants, tree planting and management), private entrepreneurs (cultural promotion) and Department of Social Services (marketing of dye products). The respondents indicated that the issues that require external support include technical support (4.3%), capacity building (71.4%), markets for finished products (20%), enforcement of tree protection of regulations (12.9%), improvement of extraction technologies (15.7%), provision of microcredit facilities (2.9%), provision of propagation materials (10%), introduction of exotic dye producing species (2.9%) and finally provision of farm inputs (10%).

Dye and tannin tree species

Twenty different trees and shrubs were identified by their botanical names as having potential for natural dye production (Appendix 2). The key plant species used traditionally as sources of dyes and tannins were prioritized as *Commiphora holtziana* (Figure 3) (Haggar-90%), *A. bussei* sjQsted (Gollol/galol-72.9%), *Lawsonia inermis* L. (Elan-52.9%), *Commiphora campestris* Engl. (Kuro-41.4%), *Commiphora confusa* Vollesen (Hajola-32.9%), *Commiphora candidula/incisa* Sprague (Damaja-27.1%), *Acacia zanzibarica* (S. Moore) Taub (Fulai-25.7%) and *Boswellia neglecta* S. Moore (Murfur-20%) among other species (Appendix 3).

Collection, extraction and use of dyes and tannins

The economic importance of dye and tannin plants was acknowledged by 97.2% of the respondents. This was associated with its role in adding value to carvings and skins and hides hence enhancing income generation. Dyes applied on woodcarvings were reported to protect the wood against beetles and borers while the tannin plants softened the skins and hides while preserving

Figure 3. The tree of *Commiphora holtziana*.

Figure 4. The use of natural dyes in handicraft.

them against rotting (Figure 4). The main dye and tannin types used were natural dyes (67.1%) and both natural and artificial dyes (30%). The natural dyes sources were accessible to 44.3% respondents who could harvest and collect them within one hour or less walking distance, while the rest had to walk more than an hour. The natural dyes were used mostly on handicraft products (92.9%) and mainly on carvings (85.7%), construction (61.2%), Mats (57.1%), cosmetics (54.3%), ropes and brooms (18.6%), hides and skins (17.1%), clothing (8.6%) and food (2.9%). The artificial dyes were mainly used in production of mats (4.3%). While natural dyes were obtained through self-harvesting, the artificial dyes were obtained from vendors in the local markets. Natural dyes

Figure 5. Debarked trees used in dye production.

play an important role in adding value to the handicraft products of these people hence enhancing their income while maintaining their cultural values.

Preference for the natural dyes and tannins as compared to the artificial dyes were based on the following factors: low cost (70%), easy accessibility/ availability (68.6%), effectiveness and high quality (51.4%), high value product (25.7%), safety for human use and cultural value/beauty (21.4%) and their use as wood preservative (7.1%). The respondents indicated that marketing of dye and tannin handicrafts was mainly affected by wildlife threats in efforts to access the dye plants, lack of transport, drought, lack of ready markets, labor scarcity, charcoal burning depleting the dye plant resources and lack of modern equipment for dye extraction and processing.

Effects of dye collection on plants

Stem debarking (32.9%) during extraction and uprooting of plants (1.4%) as shown in Figure 5, were some of the negative impacts on the dye and tannin plants. Selective harvesting and avoiding uprooting and complete debarking of the plants (47.1%) were indicated as the remedial actions. The economic and ecological impact of over harvesting the plants include: death of trees, withering, infection by diseases and pests, retarded growth, reduced fruiting and flowering ability, hence reduced production of fodder (pods). The strategies used by the local community to minimize the effects of harvesting included avoiding ring debarking, controlled/ sustainable harvesting and promoting natural regeneration.

Intervention strategies

The respondents felt there is need for the following strategies for sustainable resource conservation:

(i) Collective responsibility in conservation of dye plants in the area that requires community involvement in conservation and protection of the areas where these plants grow.
(ii) Domestication of the dye plants to enhance sustainable supply of dyes and provide future seed stands.
(iii) Establishment of community tree nurseries to raise seedlings of dye plants for provision of planting material for establishment of conservation/demonstration plots.
(iv) Provide forestry extension staff in all locations and involve local community members as forest guides.
(v) Training the community on forestry management techniques.
(vi) Establish producer associations to market dyed /tanned products / promotion of products to shield the local communities against exploitation by the middlemen who purchase their dye and tannin products at low prices and sell them expensively abroad.
(vii) Control exploitation of dye plants in accessible areas in order to conserve existing resources /species.
(viii) Introduce modern equipments for dye extraction to promote commercial production for sale while reducing waste of harvested plant parts.
(ix) Introduce energy conserving stoves to local communities and refugees to reduce deforestation through energy conservation.
(x) Provide dye/ tannin seedlings for establishment of conservation/demonstration plots.
(xi) Provide loans to expand dye/tannin related businesses
(xii) Improve security within the communities to encourage communities exploit resources far from their settlements.

DISCUSSION

Social and economic importance of dyes

The use of natural dyes and tannins from plants is of high economic and cultural importance to Garissa community despite the low level of income generated from it compared to other means of livelihood. This is because dyes and tannin add value to handicrafts such as carving, baskets and hide and skins which are an important alternative source of livelihood not only for this community under study, but also for other dry land communities especially in times of drought (Muok et al, 1998; Musyoki et al., 2007). Rana and Gera (2011) noted that forest biomass can be used for the production of dyes on cottage scale, generating employment for the people through value addition to the non-wood forest product and creating an additional source of revenue.

Dyes have a very important cultural role among the

Somali community because in the rural areas of Garissa district, most of the people use wooden utensils for milking and storage of the milk and water. Such utensils are decorated and preserved against bettles and borers using plant dyes. Plant dyes and pigments have been used for centuries for coloring various things. Natural dyes have also been used widely and for many years in the food and ink industry and as hair and body colorants. This is because they are considered to be safer and better than synthetic dyes. Most commercial dyers and textile export houses have currently been seeking for maximum possibilities of using natural dyes for dyeing and printing different textiles for targeting niche markets. Natural dyes produce very uncommon, soothing and soft shades as compared to natural dyes (Samanta and Konar, 2011). Increased interest in these forms of utilization resulted in to formulation of new products with natural extracts (Mary, 1997). Other communities have similarly indicated to have preference for natural dyes because they have no itching effects on their hands compared to artificial dyes, which have allergic effects on the skin (Musyoki et al., 2007). Some of the elements used in manufacture of synthetic dyes such as sulphuric acid and various combinations of chrome can be harmful to human. Processes for extraction of natural dyes from some abundantly occurring plant materials of forest origin and methods of using dyes on silk, wool and cotton have been developed. These dyes can be used by handloom as well garment designing industries, which export their products to developed countries like Germany and Denmark, where the use of azo dyes have been banned.

The preference for natural dyes obtained from plants and animals is expected to increase in the 21st century due to environmental awareness (Rana and Gera, 2011), resulting in increased production, use and marketing. Azo dyes cause harmful effects during their production and subsequent use. In India, the Union Ministry of Environment and Forests have banned the use of azo dyes. Generally, the use of most synthetic dyes involves release of large amounts of hazardous chemicals in to the environment during their production and use hence they are not eco-friendly (NRDC, 2012; Samanta and Konar, 2011). National Research Development Corporation (2012) have also indicated that under the "European Community (EC) control of Substance Hazardous to Health Act, 1989", the European Economic Community has published a 'red list' outlining several chemicals that should not be used at all on any type of fabric. Some natural dyes are used for preparation of traditional human medicine as observed in this study. The local and world market demand for naturally dyed products is high. In most countries, the artificial dyes can only be purchased expensively from abroad as compared to the natural dyes, which are easily accessible and fairly cheap to obtain (Tekayev and Batyrov, 2003).

The active participation of women in dye and tannin activities is due to their roles in this community as homemaker among other productive and reproductive roles. It was clearly observed that it is women who dye the withies for building houses for newly married couples and tan the leather skins used for making beds for the new couples as required traditionally, hence the significance of the relationship between gender and use of dyes. In similar studies in Manipur, the Meitei women were noted to be practicing dyeing of threads and clothes using varieties of flowers and barks of different trees species (Singh et al., 2009). As noted in this study and other similar studies, natural dyes are extracted from different plant parts such as leaves and stems, twigs and prunes, flower heads, barks, roots, outer skins, hulls and husks among other parts. The processing of plant dyes can take one or more forms such as soaking or boiling the plant to extract the dye. Some plants such as indigo, need special preparation for use. Some plants may require boiling or soaking for extended periods (ITDG, 2003). Traditional processes of extracting dyes from plants identified in this study were similar in various ways to traditional extraction processes used by other communities around the world. For instance, preparation of dark red dye from *Pasama pachyphylla* in Manipur involved boiling the plant bark using a metal pot (Singh et al., 2009). A similar process is used for obtaining a dark red dye from *C. holtiziana* by boiling the tree bark using water in metallic saucepans.

Most of the dyes identified in this study could be classified as adjective dyes because they require mordants to enhance adsorption and fixing, while preventing bleeding and fading of colors. The substantive dyes do not require any form of mordants because they get adsorbed and fixed within the fibers by chemical bonds (Mary, 1997). Mordants do improve the take up quality of the fiber and enhance color and light fastness (ITDG, 2003). It was also noted that dyeing of natural sisal fibers used for weaving baskets and mats among the Somali community involved the use of natural mordants such as ashes of specific plants such as *Salsola dedroide* (Durte) and in very minimal cases, the use of normal salt and soda ash. This was similarly observed in other studies where ashes of rice straws were used as mordants (Singh et al., 2009). Mordants are usually applied before dyeing (pre-mordanting), during dyeing (simultaneous mordanting) and after dyeing (after mordanting) as emphasized by Mary (1997). In this study, it was observed that this community was doing simultaneous mordanting in the dyeing process.

CONCLUSION AND RECOMMENDATION

The main source of dyes and tannins for Garissa local community members were trees and shrubs. There was high demand for dye and tannin products for use as

source of income and for cultural and beauty value. The use of natural sources of tannins has, however, reduced with the reduction in livestock in the region and purchase of skins and hides by individual entrepreneurs who usually use artificial tanning methods. Meanwhile, the level of conservation of plant sources of dyes and tannins is very low, hence the need to enhance the planting of species such as *C. holtiziana* and *L. inermis*. There is a lot of land degradation and most of the valuable species were few and overexploited as observed during the field survey. During discussions with various women groups in the community, it was revealed that they had to move long distances in order to access these plants compared to earlier times when they were readily available in their surrounding. There is need to provide skills and knowledge required to enhance conservation and domestication of dye and tannin tree species and conduct research on tree species which may have difficulties in germination to provide seedlings of the dye and tannin plants.

Additionally, there is need to enhance the quality of dye and tannin producing plants while improving the efficacy of the extraction process. The various ways of extracting and packaging the dyes such that they can be sold locally and internationally need to be developed. Natural dyes have a great potential for improving the livelihoods of the ASAL communities, hence the need to promote their use, management and conservation of their sources.

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APPENDIX

Appendix 1: Check list of household survey questions

1. What are your alternative sources of income?
2. Are you involved in handicraft work?
3. Do you use dyes in your work?
4. What is your source of knowledge about the use of natural dyes?
5. How do you obtain your dyes?
6. What kind of handicraft do you use your dyes for?
7. Which dye sources do you prefer (plants or artificial sources)?
8. Give reasons for the preferred dye sources and estimated cost of obtaining them.
9. If you use plants as sources of dyes please provided information on
a. Tree species used
b. Part of the tree used
c. Method of harvesting
d. Extraction process
e. Color extracted
f. Does the extraction process affect the plant?
10. Where are plants affected after extraction specify the effects?
11. In what ways can the effects be minimized?
12. Comment on the change in density of the plats used as dye sources.
13. Mention the conservation strategies being undertaken.
14. What problems do you encounter in you conservation, propagation, management and utilization of the dye producing plants?
15. Mention organizations that assist in propagation, management and utilization of dye plants and the kind of assistance they provide.
16. Do you think the natural dye-producing tree species are of any economic importance to you and your community? Specify the importance.
17. Mention any action the government should undertake to promote sustainable use and management of natural dye producing plants.

Appendix 2. List of indigenous dye plant species used in Garissa County.

No.	Somali name	Botanical name	Color	Part used
1	Haggar	*Commiphora holtiziana*	Dark red	Outer bark
2	Gollol	*Acacia bussei*	brown	Outer bark
3	Ilan	*Lawsonia enermis*	brown	roots
4	Kuro	*Commiphora campestris*	Red	Outer bark
5	Hanjole	*Commiphora confusa*	Red	Outer bark
6	Damaja	*Commiphora candidula*	Black	Outer bark
7	Fulai	*Acacia zamibarika*	Red	Outer bark
8	Mirafur	*Boswellia neglecta*	Black	Outer bark
9	Abak	*Acacia horrida*	Red	Outer bark
10	Dibirikh	*Commiphora.barviana*	Black	Outer bark
11	Waanari	*Lannea triphyla*	Red fiber	Fiber
12	Durte	*Salsola dedroide*	Mordant	-
13	Mulukisa	*Euclea natalensis*	Black	Outer bark of roots
14	Dumedere	*Cassia abbreviate*	Red	Outer bark
15	Gandimar	*Gendimar*		-
16	Tumer	*Acacia nilotica*	Black	Roots
17	Kamuthe	*Lannea elata*	Red	Bark
18	Kuro	*Acacia tortilis*		-
19	Karari	*Sterculia rhynchorpa*	Brown fiber	Bark
20	Bura	*Erthima melanacantha*	Brown	Fiber
21	Rik	*Acacia melifera*	Red	Bark
22	Maner	*Cordia Spp.*	Red	Bark

Appendix 3. Ten priority dye species as ranked by Garissa County community.

Somali name	Botanical names	Alternative uses	Rank		
			Kamuthe	Madadgisi	Overall
Haggar	*Commiphora holtiziana*	Medicinal (Snake bite, Pneumonia-resins and injuries) and beverage	2	3	2.5
Gollol	*Acacia bussei*	Charcoal, medicinal (removes placenta from both human and animals after birth)	3	2	2.5
Hanjole	*Commiphora confusa*	Chewing gum for cleaning teeth and fodder	4	1	2.5
Shoke		Charcoal, Fodder and timber	1	8	4.5
Kuro	*Commiphora campestris*	Fodder and chewing gum	6	7	6.5
Ilan	*Lawsonia enermis*	Charcoal/Fuel wood, fragrance when burned, medicinal (Stomach pains) and fodder	5	9	7
Damaja	*Commiphora candidula*	Gum for chewing for cleaning teeth and fodder	8	6	7
Mirafur	*Boswellia neglecta*	Edible wild fruits and fodder	10	4	7
Rik	*Acacia mellifera*	Fodder	11	5	8
Mulukisa	*Euclea natalensis*	Fodder (Leaves) and repellant for wild pigs and termites	7	11	9
Fulai	*Acacia zamibarika*	Fodder and gum for chewing	9	10	9.5