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Impact of Socioeconomic Characteristics of Local Community On Forests Outside Protected Areas of Sudan

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Abstract

This study investigates the relationship between some respondent's socioeconomic characteristics and forests' uses in the Nuba Mountains region of Sudan. A total of 100 respondents were randomly selected from 4 localities. Data were obtained through interview schedule and observation. Frequency distribution, means and standard deviation, independent T-test, correlation and analysis of variance (ANOVA) methods were used for data analysis. On a 5 point scale, the study results revealed that 64% of respondents were highly dependent on forest to obtained fuel wood with mean 3.3 and SD 1.0702. There is a negative correlation statistically significant between respondent's income and forest's uses for building materials, grazing, hunting, and charcoal and beekeeping. No significant correlation between income level and forest's uses for fuel wood, furniture and entertainment. The findings also revealed significant and negative relationship between some forests' uses not significantly correlated to forest's distance. Independent T-Test results revealed statistically significant differences, and/or non-significance between male and female in for forests' such as fuel wood, building materials, furniture and others. Results also identified statistically significant and/or not significant differences between rural and urban residence in forests uses for some variables. One-way analysis of variance identified factors that are significantly and/or not significantly affect forests' uses regarding respondents' occupations. The study recommended introduction of relevant forestry management systems, extension activities on development and forest protection, adoption and dissemination of alternative energy sources such as cooking gas and others.

Key words: Local residence, forests, Nuba Mountains, Sudan

INTRODUCTION

Forests are invaluable resources to the continuous existence of the world and the mankind living therein (Olagnuju, 2015). Although forest is a term of common parlance, there is no universally recognized precise definition, with more than 800 definitions of forest used around the world (United Nations Environment Program, 2010). According to Kenneth (2013) a forest is usually defined by the presence of trees, under many definitions an area completely lacking trees may still be considered a forest if it grew trees in the past, will grow trees in the future was legally designated as a forest regardless of vegetation type. There are three broad categories of forest definitions in use: administrative, land use, and land cover. Administrative definitions are based primarily upon the legal designations of land, and commonly bear no relationship to the vegetation growing on the land: land that is legally designated as a forest is defined as a forest even if no trees are growing on it (http://en.wikipedia.org/wiki/Forest#Definition). Forests vary considerably in composition, structure and geographic distribution. It can be classified into different types based on the

following criteria: a. Based on spontaneity: natural and artificial forest b. Based on indications of human activity: primary/frontier and secondary forest c. Based on leaf longevity: evergreen and deciduous forest d. Based on leaf broadness: broadleaf tree, coniferous trees or mixed forest e. Based on geographic zone: temperate forest, sub-tropical and tropical moist forest, sub-tropical and tropical dry forest f. Based on physiognomy: old growth and second growth g. Based on dominant species (Olagnuju, 2015). Although forests are viewed as an important natural resource and a main source of wood yet they receive great importance as well due to their innumerable environmental, economic and social benefits (FAO, 2011). Forest are important to sustainability of the earth and hence the existence of man. Broadly, functions of the forest can be categorized as follows: a. Environmental function which include; biodiversity protection and conservation, moderation of weather elements e.g. rainfall, temperature etc., carbon sequestration and soil management. Socio-cultural function and economic function which include food security, provision of medicinal products, source of fuel wood, source of employment and income, source of raw materials for industries, source of national revenue and exchange income earnings, provision of religious and cultural sites and aesthetic and sporting (Olagnuju, 2015). The importance of forests and their role in sustainable development have also been worldwide recognized (FAO, 1998). Moreover, various studies also indicated that forests provide timber, non-forest timber products (NFTs), and habitats for wildlife and help in carbon sequestration, maintaining gene pool, serving as the rich source of food, stimulating rainfall, protecting soils from the erosion hazards and regulating and filtering the downward moving water into the soils while becoming the part of hydrological cycle (FAO 2011, Agbogidi and Eshegbeyi, 2008, Alberta Environment, 2003; Lipper, 2007; Rawat et al., 2008). Forests reduce and restrict moving dust particles and air pollution, primarily causing environmental issues (Alaska Department of Natural Resources, 2010). In-fact, in Sudan frequent dust storms are a common phenomenon to observe and protecting role of forests in mitigating the problem and reducing the wind velocity carrying the dust particles remains very obvious. FAO (2011) also stated that forests help in protecting from floods, increasing soil moisture, improving water quality, and maintaining reserves of underground water. Forests also improve air quality and do help in minimizing harmful emission effects of greenhouse gases, through CO2 absorption from the atmosphere and oxygen release. In addition forests do regulate climate, conserve biodiversity and wildlife (Schindler et al., 2011) and promote recreation and environmental and eco-tourism (Khamfeua and Tosuchiya, 2012). In spite of the various beneficial functions of forests, it is been threaten with deforestation, forest degradation and fragmentation. While deforestation is simply the conversion of forest areas to non-forest areas, forest degradation is the reduction in the density or structure of forest and forest fragmentation is the conversion of a continuous forest area into patches of forest separated by non-forest lands. Deforestation is a menace in many part of the world, highest in countries of Africa, then Latin America and part of Asia. Worldwide, Brazil has the highest annual net loss of forest areas but Nigeria has the highest deforestation rate of its primary forest and Comoros has the highest rate of annual reduction of forests of all sorts. The agents that bring about deforestation include slash-and-burn farmers, commercial farmers, cattle ranchers, livestock herders, loggers, commercial tree planters, firewood collectors, mining and petroleum industrialists and land settlement planners while the main causes of human-induced deforestation include logging, agriculture croplands and pasture expansion, urbanization, fuel wood collection, mining and resource extraction, hunting and, slash and burn practices (Olagnuju, 2015).

Forests in Sudan provide protection for variety of genetic resources of plants and animals. The country embraces diverse biological resources which present an important national assets and

heritage There are some 535 trees species in Sudan 25 of which are exotic(The Higher Council for Environment and Natural Resources-Sudan (2009). Harrison and Jackson (1958) estimated the tree cover in Sudan(Old Sudan). In 2011 Sudan was separated into two countries, namely Sudan and South Sudan. Country was) at 36-43%. Extrapolation from the Forest Resources Assessment by the FAO in 2005 indicated a tree cover of 29% (Forests National Corporation, 2006). According to Elsiddig et al (2011) the long experience of Sudan in development of forests in relation to out-growers is limited to gum gardens development and gum company partnerships within the production and marketing chain.

OBJECTIVES

The major objective of this study was to determine the factors affecting the uses of forests in the surrounding forests. The specific objectives are to:

1. Identify the socioeconomic characteristics of the respondents.
2. Study the relationship between some respondent's socioeconomic characteristics and uses of forests in the study area in particular and the Nuba Mountains in general.
3. Explore the attitudes of locals towards forests.

HYPOTHESIS

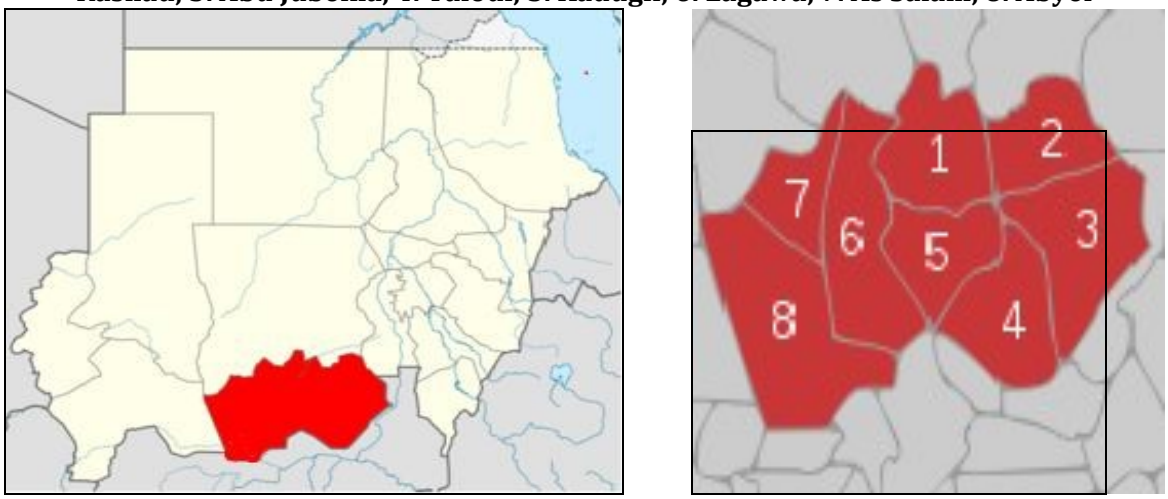
There is no significant relationship between respondent's monthly income, sex, occupations, type of residence, distance and the forests' uses.

METHODOLOGY

The study area

The Nuba Mountains region/South Kordofan State is considered one of the Sudan's regions that possess rich natural vegetation cover (Ballal et al 2014). The vegetation of this region ranges from semi-arid in northern part to sub-humid vegetation type in the southern part. Differences between vegetation cover in Eastern and Western Nuba Mountains were observed. The vegetation of the northern part of Eastern Nuba Mountains is composed of Acacia mellifera, Dalbergia melanoxylon, Albizia amara subsp sericocephala, Guiera senegalensis and Acacia senegal. The sandy clay soil, locally known as gardud soils, is dominated by Acacia mellifera, Acacia oerfota and Boscia senegalensis. Acacia seyal, Balanites aegyptiaca and Acacia mellifera thorn-land vegetation types with Acacia senegal as an important associate dominate the clay plains. Piliostigma reticulatum and Acacia nilotica are found along seasonal watercourses. The vegetation cover in the southern part of Eastern Nuba Mountains is dominated by Sterculia satigera, Grewia villosa, Boswellia papyrifera, Vangueria madagascariensis, Oxytenanthera abyssinica and Albizia anthelmintica. On the other hand, the vegetation in western Nuba Mountains is typical of the hill catena where Anogeissus leiocarpus, Combretum spp., Acacia senegal and Acacia polyacantha cover the high lands. Borassus aethiopum, Cordia africana and Terminalia laxiflora typifies the vegetation of the fertile low land areas while Oxytenanthera abyssinica and Diospyros mespiliformis are the most important species along seasonal watercourses. However, vegetation of the sub-humid zone (>750 mm rainfall) is restricted to some patches in the south - western part of the state around Talodi area where Khaya senegalensis, Combretum hartmanianum and Isoberlinia doka are the most prevailing tree species(Ballal et al 2014; Bello and Allajabu, 2016, and IFAD 2007)

Figure1. Map of South Kordofan State and its districts (Districts of S. Kordofan: 1. Dilling, 2. El Rashad, 3. Abu Jubeiha, 4. Talodi, 5. Kadugli, 6. Lagawa, 7. As Salam, 8. Abyei



Source: Ballal et al 2014

Sample selection and data collection

The study was conducted in four localities of Nuba Mountains region/ South Kordofan State, namely: Dallanj Goz, Talodi and El Rashad localities (figure 1). These localities were purposively selected out of eight localities of the State. Out of these, 20 villages were selected using the purposive sampling method also, 5 villages from each locality. A random sample method was adopted to select 100 respondents (25 respondents from each). Primary data was collected directly from the respondents through interview schedule. Frequency distribution, independent T-test, correlation and analysis of variance (ANOVA) methods were used for data management and analysis.

RESULTS AND DISCUSSION

Respondent's socio-economic characteristics:

Table 1 shows that 75% respondents were males, 73.9 have large family size (5-10 members), 41% were farmers 19%, 4% and 21% were work in public, private sector and other jobs respectively, while there are about 6% housewives women have no paid work. The table also indicates 91% of respondents use sue divers local materials such as straw, mud and/ others for housing construction. About 60% of respondents reside in or rural areas. Regarding monthly income the results reveal that 37% of respondents gained monthly income less than 500 SDG, 32% were gained monthly income range from 500 to 1500 SDG, only 15%) of respondents gained monthly more than 2500 SDG. Table 1 also indicates that 73% of commented that their residence is about less than 5 km from the nearest forest.

Table 1. Distribution of respondents according Socio-economic characteristics (N= 100)

Category	#	%	Category	#	%
Sex			**Occupations**		
Male	75	75.o	Governments employees	19	19.0
Female	25	25.o	Private sector employees	4	4.0
Family size* (n=92)			Military sector	2	2.0
5 and less	24	26.1	Merchants	12	12.0
5 – 10 persons	41	44.6	Farmers	41	41.0
More than 10	27	29.3	Wage labor	7	7.0
			Livestock breeders	9	9.0
			Housewives	6	6.0
Building materials			**Residence**		
Hut Grasses	36	36.0	Urban areas	40	40.0
Mud and straw	33	33.0	Rural areas	60	60.0
bricks	9	9.0	**Monthly income**		
Other local materials	22	22.0	No income	6	6.0
Forests distance from residential areas			Less than 500 SDG	37	37.0
Less than 5 km	73	73.0	500 - 1500	32	32.0
5 – 15 km	26	26.0	1501 – 2500 SDG	10	10.0
More than 15 km	1	1.0	More than 2500	15	15.0

*** The unmarried respondents not included**

Forest's uses:

Table 2 indicates 64% depend on forests to obtained fuel wood with mean 3.3 and SD 1.0702. Due to the lack of other energy sources like gas and electricity, fuel wood is widely used in region for many purposes such as cooking, bakery and ambushes bricks. This result is consistent with the Forests National Corporation (1996) which commented that the rural families in the country obtained about 82% of their energy needs direct from the nearest forests. National report to the convention on biological diversity (2009) also stated that Sudan depends mainly on forestry sector as energy source, forests contribute by a total of 4.11 million T.O.E representing 70 - 81 percent of energy supply in the country. Data in the table also revealed that 59% of respondents depend with high degree on forests as the main source of building materials which achieved the 2nd highest mean 3.2 and SD 1.1153. The dominant building styles in the region are characterized by simplicity and using local material for construction like dry straw and woods obtained from nearest forests (plates 1). The uses of forest for animal grazing gained the 3rd rank with the mean 3.1 and SD 1.2714, while uses of forest for charcoal obtained the 4th rank with the mean 3.03 and SD 1.2346. The Nuba Mountains region is considered as the main sources of charcoal to big towns and cities in the country especially the capital Khartoum (see plates 2).

Trees products collection was obtained the fifth position rank with the mean 2.7 and SD 1.1377. The collected fruit, seeds and other trees products such as leaves, branches, roots, and bark are used as food, medicine, raw materials for handicrafts like ropes and bedspreads. The National Report to the convention on Biological Diversity (2009) commented that more than 30 species indigenous to Sudan are used for fiber production, many of them grow in the wild, and the widely used is the Doum Palm (Hyphaene thebaica), as shown in plates 3. However, the region is considered as one of the main sources of gum Arabic. According to the Higher Council for Environment and Natural Resources-Sudan (2009), 19% of total household income in the Nuba Mountains is gained from activities related to gum Arabic. The entertainment achieved

the sixth position with the mean 2.6 and SD 1.057. Some respondents especially from urban areas utilized the forest for recreation particularly in weekends, religious and social ceremonies.

Plates 1. Charcoal Transportation of from Nuba Mountains to capital Khartoum

Charcoal sale points at ALsamaseem village, Kadugli – Khartoum tarmac road

Source: Allajabou's camera, April, 2015

Table 2. Respondent's distribution according to degree of dependency on forest products (N = 100)

Type of uses	Uses degree								Mean	SD
	Not at all		Low		Medium		High			
	#	%	#	%	#	%	#	%		
Fuel wood	13	13.0	7	7.0	16	16.0	64	64.0	3.3	1.07021
Building materials	16	16.0	5	5.0	20	20.0	59	59.0	3.2	1.11537
Animal grazing	23	23.0	5	5.0	7	7.0	65	65.0	3.1	1.27144
Charcoal	24	24.0	2	2.0	21	21.0	53	53.0	3.03	1.23464
Tress products	24	24.0	10	10.0	36	36.0	30	30.0	2.7	1.13778
Entertainment	16	16.0	39	39.0	18	18.0	27	27.0	2.6	1.057
Furniture	28	28.0	19	19.0	24	24.0	29	29.0	2.5	1.1842
Beekeeping	69	69.0	9	9.0	9	9.0	13	13.0	1.7	1.093
Grand total									**2.8**	**1.1454**

Relationship between incomes on forests' uses

Table3. reveals that there is a negative correlation statistically significant between respondent's income and forest's uses, degree for the purposes of building materials, grazing, hunting, charcoal and beekeeping (r = (-) 0.360, (-) 0.333, (-) 0.380, (-) 0.449, (-) 0.420 respectively, significant at 0.01, and also there is negative correlation between respondent's income and use of forest for trees products (r = (-) 0.228, significant at 0.05. This mean that the low income respondents are more dependent on above mentioned type of forest's uses either to meet their needs or to sell such products for income generation. The findings also indicate that there no significant correlation observed between income level and forest's uses for the purposes of fuel wood, furniture and entertainment.

Table 3. Correlation matrix showing relationships between respondent's income and degrees of use (n = 100)

Degree of uses	Respondent's income
Fuel wood	-0.195
Building materials	-0.360(**)
Animal grazing	-0.333(**)
Hunting	-0.380(**)
Charcoal	-0.449(**)
Trees products	-0.228(*)
Furniture	-0.047
Entertainment	-0.039
Beekeeping	-0.420(**)

****Correlation is significance at the 0.01 level (2-tailed)**
*** Correlation is significance at the 0.05 level**

Relationship between distance and forests' uses

Table 4 shows significant and negative relationship have been observed between the degree of forest's uses for fuel wood and forest's distances (r = (-) 0.300 significant at 0.01), this mean that the respondents settled around the forests are consuming a lot of amount of fuel wood, because there is no transportation costs. Also there is significant and negative relationship between the degree of use for beekeeping and forest's distance (r = (-) 0.232 significant at 0.05), this mean the respondents settled near forests have more tendency to practice bee-keeping, because for the reasons of close supervision and monitoring. The findings also

indicate that the degree of forest's uses for building materials, grazing, hunting, charcoal, trees products, furniture and entertainment was not significantly correlated to forest's distance.

Table 4. Correlation results showing relationships between forest's distance & degree of uses

Degree of uses	forest's distance
Fuel wood	-0.300(**)
Building materials	-0.160
Animal grazing	0.007
Hunting	-0.170
Charcoal	0.042
Trees products	0.164
Furniture wood	-0.104
Luxuries	0.114
Beekeeping	-0.232(*)

****Correlation is significance at the 0.01 level (2-tailed)**
*** Correlation is significance at the 0.05 level**

Relationship between Sex and forest's uses

Table 5 shows that there are statistically significant differences between the male and female (in favor of male) in uses of forests for the purpose of fuel wood, building materials, grazing, hunting and trees products collection, where the T value reached (3.598, 4.129, 3.995, 3.25, 2.95) respectively, these are statistically significant at level 0.05. This may be due to the nature of these uses which needs hard workers and this suitable for males because they have physical abilities. The table also shows no significant differences between males and females for their uses of forests in the purposes of charcoal, furniture, entertainment and beekeeping, at 0.05 level.

Table5. Independent T-Test results for significant differences in forests uses according to respondent's sex (N = 100)

Types of uses	Male (N=75)		Female (N=25)		T	Significance
	Mean	SD	Mean	SD		
Fuel wood	3.52	0.87549	2.68	1.34536	3.598	0.001
Building materials	3.46	0.84363	2.480	1.47535	4.129	0.000
Grazing	3.413	1.07921	2.320	1.46401	3.995	0.000
Hunting	2.346	1.03314	1.600	.866030	3.25	0.002
Charcoal	3.1200	1.17358	2.760	1.39284	1.266	0.208
Trees products	2.9067	1.04200	2.160	1.24766	2.95	0.004
Furniture	2.5333	1.14294	2.560	1.32539	-0.097	0.923
Entertainment	2.5333	1.05694	2.640	1.07548	-0435	0.664
Beekeeping	1.7467	1.14010	1.400	.912870	1.379	0.171

Relationship between Residence and forests' uses

Table 6 shows that there are statistically significant differences between the rural and urban respondents (in favor of rural respondents) in forest's uses for the purpose of fuel wood, building materials, grazing, charcoal, and furniture, where the T value reached (-8.251, -6.587, -4.490, -2.767, -2.588) respectively, these are statistically significant at level 0.05. This may be due to the fact that the livelihood patterns in rural areas is mainly depending on forest's products because the lacking of services. In this respect, the National report to the convention on biological diversity (2009) stated that the rural people have been worst affected by the

decline of the forests resources because their livelihood is much dependent on tree and forest. While there is significant difference in favor of urban respondents in use of forests for the entertainment purposes, (T value = -2.287 at level 0.05), this may be due to lack of green spaces in urban areas. Data in the table also show no significant differences between rural and urban respondents for their uses of forests for hunting, trees products and beekeeping, at 0.05 level.

Table 6. Independent T-Test results for significant differences in forest's uses according to residence variable (N = 100)

Type of uses	Urban areas (N=40)		Rural areas (N=60)		T	Significance
	Mean	SD	Mean	SD		
Fuel wood	2.475	1.24009	3.866	.342800	-8.251	0.000
Building materials	2.475	1.32021	3.716	.555150	6.587	0.000
Grazing	2.500	1.39596	3.566	.980600	4.490	0.000
Hunting	1.925	1.26871	2.316	.833450	1.865	0.065
Charcoal	2.6250	1.35282	3.300	1.07829	-2.767	0.007
Trees products	2.550	1.33877	2.833	.977140	-1.223	0.224
Furniture	2.1750	1.21713	2.783	1.10610	-2.588	0.011
Entertainment	2.8500	.97534	2.366	1.07304	-2.287	0.024
Beekeeping	1.5250	1.08575	1.750	1.09892	-1.008	0.316

The effect of respondent's occupations on forest's uses:

As shown in Table 7 a one-way analysis of variance (ANOVA) showed that respondent's occupations are significantly affect the uses of forests for the purposes of fuel wood, building materials, grazing, charcoal, trees products and entertainment (F= 8.400, 8.025, 5.180, 13.420, 2.790, 2.663 respectively, a = 0.05). These findings indicate that the respondents who work in occupations related to rural areas and natural resources (e.g. farmers, livestock breeders and wage laborers) are more widely use the forest's products. Table 8 also indicates that the respondent's occupations did not significantly affect the forest's uses for of hunting, furniture and beekeeping (F= 1.916, 1.449, 1.426 respectively, a = 0.05).

Plates 2. Local building materials trading at Dallanj town market

Plates 3. Trees products (fruits) trading at Dallanj town market

Source: Allajabou's camera, April 2015

Table7. ANOVA for significance variances in forest's uses according to occupations variable (N = 100)

Forest uses	Source of Variation	Sum of Squares	df	Mean Square	F	Sig.
Fuel wood	Between Groups	44.214	7	6.316	8.400	0.000
	Within Groups	69.176	92	0.752		
	Total	113.390	99			
Building materials	Between Groups	46.692	7	6.670	8.025	0.000
	Within Groups	76.468	92	0.831		
	Total	123.160	99			
Animal grazing	Between Groups	45.244	7	6.463	5.180	0.000
	Within Groups	114.796	92	1.248		
	Total	160.040	99			
Hunting	Between Groups	13.672	7	1.953	1.916	0.076
	Within Groups	93.768	92	1.019		
	Total	107.440	99			
Charcoal	Between Groups	76.241	7	10.892	13.420	0.000
	Within Groups	74.669	92	0.812		
	Total	150.910	99			
Trees products	Between Groups	22.445	7	3.206	2.790	0.011
	Within Groups	105.715	92	1.149		
	Total	128.160	99			
Furniture	Between Groups	13.784	7	1.969	1.449	0.196
	Within Groups	125.056	92	1.359		
	Total	138.840	99			
Entertainment	Between Groups	18.642	7	2.663	2.663	0.015
	Within Groups	91.998	92	1.000		
	Total	110.640	99			
Beekeeping	Between Groups	11.594	7	1.656	1.426	0.204
	Within Groups	106.846	92	1.161		
	Total	118.440	99			

CONCLUSION AND RECOMMENDATIONS

In general the forests are played viable and important social and economic roles in the region. Such roles including inter alia provision food (hunting and trees products collection), employment, fuel wood and charcoal, building materials, grazing, and sources of income to local economy. To sustain the households' subsistence needs and income generation opportunities in the region, the study proposed the following recommendations:

1. Development and introduction of suitable forestry extension programs for the education of the locals on forest management, development and protection.
2. Reservation and conservation of Federal, State and community forests' to ensure forest; sustainability in the region.
3. Promotion of local communities' participation in natural forests conservation and management.
4. Development and dissemination of alternative energy sources such as cooking gas and others.

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