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Quantitative Review and Distribution Status of Mangrove Forest Species in West Africa (Pp 80-89)

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Abstract

This paper statistically evaluated the distribution of mangrove forest distributions in Nineteen (19) countries of Africa where eight major species of mangrove exist. Secondary data about mangrove forest coverage from literature were obtained in respect of 19 countries of West Africa where mangrove forest exists for six years. The data were subjected to ANOVA statistical analysis using STATISTICA software package. The results indicated highest estimates of mangrove coverage in Nigeria with highest total mangrove coverage of 7386km² and Sao Tome Principe with lowest estimates of 1.4km². The results indicated that most West African mangroves forests suffer progressive decline particularly the countries that have large mangrove forests. The results also suggest that most West African countries are yet to evolve conservation ethics for their mangrove forests. Of all the countries, the Nigerian mangrove forest is the most threatened by fragmentation, isolation and surface drainage alteration that could be traced

to indiscriminate logging, urbanization and recent oil and gas activities in the Niger Delta.

Keyword: Mangrove forests, West African Forests, Forest evaluation

Introduction

Mangroves are notably special plants that have developed and are surviving in the region between land and ocean in many humid climates of the tropics and subtropics. Various descriptions and definitions of their compositions portray them as coastal woodland, tidal forests and mangrove forests tide. They possess pnuematophores (arch-like formation with many breathing pores) on the stilt roots; and with these mechanism, they can cope with the high concentrations of salt and regular inundation of their root system by incoming tide (UNEP, 2007).

Mangroves demand freshwater inflow which brings silt with it as substrate for support and nutrients from upstream. Mangroves do not thrive in stagnant water (FAO, 1994; Kathiresan and Bingham, 2001 and AFORL, 2002). There are about 70 species of mangroves recorded in the world (Spalding *et.al.* 1997), of which 17 species are found in many Sub-Saharan countries of Africa including Nigeria.

UNEP (2007) indicated West African mangroves as widely spread along west coast from Senegal to the Congo, and occur locally in East Africa, interlinked with highly productive coastal lagoons, tidal estuaries and deltas. Similarly, Shumway, 1999 reported that mangroves provide area of their occupancy with essential organic nutrients as well as sustainable breeding grounds with nurseries for larval and juvenile stages of important fish species.

Mangroves are found in 19 West African countries extending from Mauritania in the North to the southernmost stands in Angola (UNEP-WCMC 2006). Connotatively, the origin of the term for mangrove are derived from the word mangue which emanates from Senegal, Gambia and Guinea; and eight (8) true mangrove species (Table 1), were reported to be found across the nineteen countries (Tomlinson, 1986). Tables 3 and 4 show the distribution of mangrove species, number of species, coastline distance and the total mangrove area coverage in kilometers by country. This correlates with Tomlinson (1996) that reported that Eight (8) true mangrove species are found in West Africa. This according to Shumway (1999) was enunciated to be same following the extensive riverine systems in the West

African coastline area which is also attributed to its extensive mangrove coverage.

Though many studies have been carried out on mangrove status of the world (Duke 2006; Jimenez 1985; Ajonina and Usongo 2001), there are sparse or minimal researches on statistical distribution and status of West African countries. This study therefore gives the quantitative assessment of the distribution and the trend of the mangroves of the West Africa which in turn will promote pertinent contribution to the sustainable management of mangrove species of West African coastlines.

Methodology

Nineteen (19) African countries were evaluated in the study. The data on mangroves forests were collected from literatures and web-based secondary data about the countries of study. The countries included Mauritania, Senegal, Gambia, Guinea Bissau, Guinea, Sierra Leone, Liberia, Cote d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Equatorial Guinea, San Tome Principe, Gabon, Congo, DR Congo and Angola (Figure 1).

Data collected on each country were presented using descriptive statistics while analysis of variance (ANOVA) was used in showing the levels of significance differences among countries' mangrove total coverage area in Kilometer square (Km²) using STATISTICA software (StatSoft, 2001). A test of significance was carried out to show the differences in the area coverage estimates among the countries.

The analysis of variance (ANOVA) used followed the order of one-way analysis of variance of the model:

$$y_{ij} = \mu + \alpha_i + e_{ij}$$

Where

y_{ij} = Response of the j^{th} individual unit belonging to i^{th} category

μ = Overall population mean

α_i = Effect of i^{th} category

e_{ij} = Random error

Similarly, the model is valid when

$$y_{ij} = \mu + e_{ij}$$

Where $\mu_i = \mu + \alpha_i$

Results and discussion

Statistical trend and distribution

Statistical distribution of the mangrove species in the region using area coverage estimates from 1980 to 2006 IS shown in Table 2. The table indicates a moderate decline of mangrove cover in most of the region with time. The mangrove area coverage of few countries increased over the period of the assessment; two had a slight decline; nine countries had moderate decline three countries (Congo, Democratic Republic of the Congo and Cote d'Ivoire) show a severe decline in the mangrove forest distribution in relation to their habitat (Table 3).

Thus, countries such as Mauritania, Togo and Benin with small mangrove areas appear to recover from decline to increased area while countries with large mangrove areas tended to continue to decline. These trends indicate the mangrove conservation and management consciousness in those countries. Hitherto, West African mangroves had been regarded as the least human-disturbed ecosystem. Results of this study confirm that the West African mangroves are not only seriously but are threatened.

Similarly, five countries showed significant trend of mangrove coverage in the region. The five major countries include Nigeria, Guinea Bissau, Guinea, Cameroon and Gabon with Nigeria having the highest total mangrove coverage of 7386km² and Gabon with lowest estimates of 1606km² (Figure 2)

Quantitative estimates of mangrove coverage.

The estimates of mangrove area coverage in Nigeria was significantly different from all other countries; estimates from Cameroon, Guinea Bissau and Guinea were not significantly different from one another at $P < 0.05$. Similarly, Sierra Leone, Senegal and Gabon's estimates were not significantly different at $P < 0.05$; while Cote d'Ivoire, Liberia, Equatorial Guinea, DR Congo, Angola and Gambia were not significantly different from one another at the same level of significant, but significantly different from

estimates from Ghana, Congo, Benin, Togo, Mauritania and Sao Tome Principe at $P < 0.05$ (Table 4).

These statistical observations agreed with Macintosh and Ashton (2003) that observed that the mangrove forests of Nigeria are the largest in Africa and the third largest in the world after India and Indonesia; and that the declining rates across the countries assessed was to large extent started with the oil boom of the early 1970s in many parts of West Africa. In Nigeria petroleum industry activities have been however fragmented and isolated the mangrove ecosystem. In some areas of heavy petroleum activities the natural surface drainage is perpetually disturbed and diverted while dredge spoil dome remain indefinitely bare (Ekeke, et.al 2008). These activities account for decline in the mangrove area of Nigeria. Decline in other West African countries are also related to human activities.

Conclusion

The study has statistically examined the mangrove forest coverage estimates along the West African coastlines in nineteen different countries from Mauritania to Angola. The results showed significant differences in the mangrove estimates among countries of assessment with Nigeria having the highest estimates and Sao Tome Principe with the least at $P < 0.05$ level of significance. Mangrove ecosystem decline in West African countries are related to indiscriminate human activities particularly petroleum industry activities. There is however need for ground survey of the mangrove ecosystem of West Africa for accurate information on the ecosystem status.

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Table 1: Common West African mangroves species

Scientific Name	Common Name
<i>Rhizophora racemosa</i>	Red Mangrove
<i>Rhizophora harrisonii</i>	Red Mangrove
<i>Rhizophora mangle</i>	Red Mangrove
<i>Avicennia africana</i>	Black Mangrove
<i>Acrostichum aureum</i>	Golden Leather fern
<i>Conocarpus erectus</i>	Bulfanoon Mangrove
<i>Laguncularia racemosa</i>	White Mangrove
<i>Nypa fruticans</i>	Nypa Palm

Source: UNEP, 2007

Table 2: Mangrove distribution, total mangrove area coverage and percentage estimates of the nation’s coverage

Country	Number of mangrove species	Total mangrove area (Km2)	Coastline distance (km)	Percentage estimates
Mauritania	3	2.09	1268.4	0.01
Senegal	7	1287	1327.2	6.39
Gambia	7	581	502.7	2.88
Guinea Bissau	6	2999	3176	14.89
Guinea	7	2039	1614.5	10.12
Sierra Leone	6	1052	1677.1	5.22
Liberia	6	110	842	0.55
Cote d'Ivoire	5	99	797.3	0.49
Ghana	6	139	757.8	0.69
Togo	3	11	52.7	0.05
Benin	6	66	152.7	0.33
Nigeria	8	7386	3121.9	36.67
Cameroon	6	1957	1798.7	9.71
Equatorial Guinea	2	258	602.6	1.28
Sao Tome Principe	4	1.40	269	0.007
Gabon	7	1606	2019.1	7.97
Congo	6	17	205.1	0.08
Congo DR	6	201	176.8	0.99
Angola	3	333	2251.8	1.65
Total	104	20144.49	22613.4	100

Source: UNEP, 2007



Figure 1: Mangrove forests distribution in Nineteen West African countries

Source: UNEP, 2007

Table 3: Table of mangrove area estimates in six different years

Country	Forest area estimates (km ²)						Estimate change	
	Year	1980	1990	1997	2000	2005		2006
Mauritania		1.5	1.1	1.0	1	1	2.09	Increase
Senegal		1690	1450	1830	1270	1150	1289	Moderate decline
Gambia		704	612	747	581	580	581	Slight decline
Guinea Bissau		2760	2480	3649	2210	2210	2999	Increase
Guinea		2992	2792	3083	2762	2760	2039	Moderate decline
Sierra Leone		1677	1454	1695	1053	1000	1052	Moderate decline
Liberia		193	143	427	92.5	67.55	110	Moderate decline
Cote d'Ivoire		302	201	644	99.4	99	99	Severe decline
Ghana		181	168	214	138	124	137	Moderate decline
Togo		10	10	-	10	10	11	Increase
Benin		21	16.5	17	13.5	11.5	66	Increase
Nigeria		9990	9980	1113	9970	9970	7386	Moderate decline
Cameroon		2720	2563	4	2515	2500	1957	Moderate decline
Equatorial		267	260	2494	253	250	258	No change
Guinea		-	-	277	-	-	1.4	No data
Sao Tome		2185	1858	-	1529.	1500	1606	Moderate decline
Principe		200	120	1759	4	80	17	Severe decline
Gabon		606	353	188	83.5	220	201	Severe decline
Congo		530	433	374	220	330	333	Moderate decline
Congo DR				607	336			
Angola								

Source: UNEP, 2007

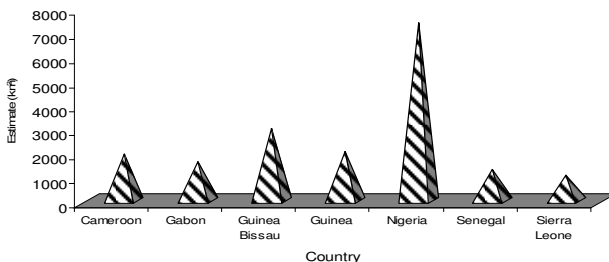


Figure 2: Estimates of mangrove forest coverage in some West Africa Countries

Table 4: Descriptive statistics of the estimate of Mangrove coverage across countries of study

Countries	Mean \pm S.E	Number
Mauritania	1.29 \pm 0.18 ^a	6
Senegal	1446.5 \pm 108.05 ^c	6
Gambia	634.17 \pm 29.83 ^b	6
Guinea Bissau	2699.67 \pm 233.96 ^d	6
Guinea	2738.00 \pm 150.12 ^d	6
Sierra Leone	1321.83 \pm 133.11 ^c	6
Liberia	172.17 \pm 53.97 ^{ab}	6
Cote d'Ivoire	240.73 \pm 87.19 ^{ab}	6
Ghana	160.33 \pm 13.82 ^a	6
Togo	8.5 \pm 1.71 ^a	6
Benin	24.25 \pm 8.45 ^a	6
Nigeria	9738.33 \pm 506.97 ^c	6
Cameroon	2458.17 \pm 105.98 ^d	6
Equatorial Guinea	260.83 \pm 4.03 ^{ab}	6
Sao Tome Príncipe	0.23 \pm 0.57 ^a	6
Gabón	1739.56 \pm 105.23 ^c	6
Congo	114.75 \pm 28.51 ^a	6
Congo DR	329 \pm 63.11 ^{ab}	6
Angola	428.17 \pm 48.15 ^{ab}	6

Means with the same superscripts are not significantly different from one another (among countries) at $P < 0.05$