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The Mangrove Forests of the Cameroon Coast and its Socio-Economic Significance

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Abstract. The study analyses anthropogenic influence on the mangrove forests of the Cameroon coast and focuses on the development and improvement of the constructive-geographical foundations of rational nature management for the conservation and possible renewal of its natural resources base. The exploitation of mangrove forest landscapes

has yielded significant benefits to the local population living within the mangrove forest limits, but the beneficiaries have not made commensurate investments in their sustainability and rational use. Therefore, this habitat must be carefully conserved or protected from wanton anthropogenic activities for the development purpose. The study made use primary and secondary data in establishing the facts analysed in this work. The secondary data comprised of materials of prominent authors who have contributed much to the findings related to coastal mangroves. Primary data collection was field visits carried out by the author in 2016. Questionnaires and semi-structural questions were used to collect information from mangrove exploiters. The findings confirm that the coastal mangrove forests in Cameroon have multiple functions beneficial to the communities adjacent to the coast, but, unfortunately, the beneficiaries have not made commensurate efforts to their sustainability and rationale. The Mangrove forests covered a surface area of 200 000 km², but Cameroon lost 30 % of its mangrove forest cover in 1980–2006. If projected under *ceteris paribus*, Cameroon lost approximately 45 % of its mangrove forest cover in1980–2020. Haven understood that man has raped huge surfaces of mangrove forest for his selfish economic gains, the study proposed an urgent need for environmentally sustainable adaptive strategies like those earmarked in the Ramsay agreement and the ICZM (Integrated Coastal Zone Management) for the rational management of coastal mangroves in Cameroon.

Ключові слова: Mangrove forest, Cameroon Coast, socio-economic, rational management

Мангрові ліси на узбережжі Камеруну та їх соціально-економічне значення

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Анотація. Дослідження присвячене аналізу проблеми антропогенного впливу на мангрові ліси узбережжя Камеруну, а також розробці та вдосконаленню конструктивно-географічних основ раціонального природокористування для збереження та можливого відновлення його природно-ресурсної бази. Надмірна експлуатація цих мангрових лісових ландшафтів принесла більші переваги місцевому населенню, яке мешкає в межах мангрових лісів, але бенефіціари не зробили відповідних інвестицій з точки зору їх стійкості та раціонального використання. Отже, це середовище існування повинно бути ретельно збережене або захищене від безглуздої антропогенної діяльності в ім'я розвитку. Під час дослідження було використано первинні та вторинні матеріали для встановлення фактів проаналізованих в даній роботі. Вторинні дані представлені у вигляді праць відомих дослідників, які внесли значний вклад у вивчення прибережних мангрових заростей. Проведені автором в 2016 році польові дослідження стали основою для написання статті. Для збору інформації було проведено опитування та анкетування експлуататорів мангрових заростей. Дослідження показали, що прибережні мангрові ліси Камеруну виконують безліч функцій, які приносять користь громадам, прилеглим до узбережжя, проте від людей не спостерігається пропорційних зусиль для забезпечення стійкості та раціонального їх використання. Раніше мангрові ліси займали площу 200000 км², але з 1980-2006 рр. Камерун втратив майже 30 % від загальної площі. Згідно спостережень з 1980–2020 рр. Камерун втратив приблизно 45 % мангрового лісового покриву. У дослідженні Хейвена (основу якого покладено в дану статтю) йдеться про те, що людство знищило величезні площі мангрових лісів заради своєї егоїстичної економічної вигоди; в дослідженні пропонується терміново розробити екологічно стійкі адаптивні стратегії, подібні до тих, які передбачені в Рамсейській згоді та КУПЗ (Комплексне управління прибережною зоною) для раціонального управління прибережними мангровими заростями в Камеруні.

Ключові слова: мангрові ліси, узбережжя Камеруну, соціально-економічне значення, раціональне природокористування.

Introduction.

Cameroon is one of the Central African countries located at the heart of the Gulf of Guinea, within the

Bay of Biafra, covering a surface area of 475, 412km² (*Sayer et al, 1992*) with a population of approximately 25 million inhabitants. This coastal zone is characterized

by the equatorial climate and consists of a vast coastal environment which is an extension of the Atlantic Ocean with a coastline of about 402km. This coastline extends from 2° 20' N at the Equatorial Guinea borders to 4° 40' N at the Nigeria borders and between 8°151E and 9° 30E (Fig. 1). With a continental shelf of about 10.600km² (Jean Folacky, 2004) and an Exclusive Economic zone (EEZ) of about 15,400km (Jean Folacky, 2004) it forms a convivial environment that harbors a wide range of aquatic ecosystems which are typical for the coastal plain of the Atlantic. This includes ocean, coastal forests, deltas, sand dunes, mangroves, coastal rivers, estuaries, lagoons, bays, lakes, rocky and sandy beaches, mudflats. It is drained by major rivers (Ndian, Meme, Mungo, Wouri, Dibamba, Sanaga, Nyong and Ntem), with a total drainage river basin of about 2.7 x 105 km² with the Sanaga contributing the highest sediment load (2.8 x 102 km^3 / year).

Cameroon is richly endowed with mangrove forests which covers a surface area of about 200000 ha extending from the Rio Del Rey Estuary to the Ntem Estuary Mangroves. These mangrove forests have a huge value for the coastal adjacent communities that derive their livelihoods from them. However, today, the rate at which this unique forest ecosystem is degraded leaves much to be desired.

These mangroves can be grouped into three distinctive fragments, Fig. 1. We have the Rel Dey Rey estuary mangroves which occupies the largest area (54%). It is situated mainly in the south west region of Cameroon, precisely from Bakassi to Limbe. We equally have the Cameroon estuary mangroves which cover (45% of the coastline. It is situated in part of the south west region (Mount Cameroon, Tiko) and the entire Littoral region, through the Wouri estuary to the Sanaga estuary.

Finally, we have the Ntem estuary mangroves which occupy (1%). This extends through the south region to the borders with Equatorial Guinea. The mangrove forest ecosystem provides important ecosystem goods and services to the mangrove forest adjacent communities.

These communities have hugely benefited from these ecosystem goods and services, but have made little or no efforts towards their sustainability. Cameroon is witnessing a very high rate of anthropogenic pressure on the mangrove forest ecosystem. This pressure has resulted in the de functioning of this unique ecosystem.

Despite the laudable efforts both nationally and internationally through a variety of projects and programmes initiated in Cameroon through organisations, such as FAO, WWF, EU, the Guinea Current Large Marine Ecosystem (GCLME) project and the United Nations Environmental Programme (UNEP) for the conservation and preservation of mangroves, it remains very glaring that the mangrove forest ecosystem has still not received the adequate attention it deserves from policy makers.

The mangrove forests disappear drastically because of over-exploitation of their resources, fuel wood, conversion of mangrove surroundings for other land uses, such as agriculture, coastal landfill, pond aquaculture and urbanization with its concomitant effects of population growth and pollution.



Fig. 1. Map of Coastal Mangrove in Cameroon

Over the past decades, much concern on the degrading nature of the mangrove ecosystem has been highlighted. This action has drawn the attention of policy makers all over the world to give a special attention on this peculiar ecosystem which is at the verge of extinction.

Review of previous researches.

Some of the works have been reviewed in this study. In Africa, the Cameroon mangrove forest is the 6th largest and first in Central Africa in terms of surface occupation (Ajonina, 2008). Therefore, Cameroon is ranked as one of the most giant mangroves in the World (Ajonina, 2008) Fig. 2. According to (Ellison and Zouh, 2012), the continuing degradation and depletion of this unique ecosystem has the possibility of reducing not only the terrestrial, aquatic production and wildlife habitats, but more importantly, the environmental stability of mangrove coastal forests that acts as a buffer zone to the inland agricultural crops and villages will become severely impaired. In their study related to the shrinking of Africa's mangroves, (Ajonina, 2008) underscored that these mangroves have been increasingly affected by deforestation. In the West Africa, mangrove areas have diminished from 20,500 km² in 1980 to 15800 km² in 2006. In Central Africa they have reduced from 6,500 in 1980 to 4300 km² in 2010. While it is estimated that Eastern Africa's mangroves have decreased from 2555 km² in 1980 to 7211 km² in 2010, (The Encyclopedia of Earth, 2007). Conclusively, according to (FAO, 2007), Africa has lost up to 500 000 hectares of mangroves over the past 25 years. Other related findings on mangrove forest include the works of (FAO, 2007, Feka, Manzano and F. Dahdouh-Guebas, 2011, Simon and Rafaelli, 2012 and The Encyclopedia of Earth, 2007). Mangrove forests cover about 152361 000 ha of the tropical and sub-tropical coastlines of the world. Their degradation and possible reduction can be quantified to the loss of numerical functions like ecological, conservation, and the sustenance of the mangrove forest adjacent communities who solely depend on them for their livelihood (The Encyclopedia of Earth, 2007). Nonetheless, the wanton exploitation of this unique ecosystem in the West African coast has favoured a decline of about 25 % of mangrove forests over the past 25 years (Din and Baltzer, 2008, FAO, 2007). According to (Ajonina and Usongo, 2001), Cameroon has equally lost about 53.216 ha of mangrove forests over the last 13 years (Ngo-Massou et al., 2016). This situation is very unhealthy, as their sustainability

is a stake. Due to the lack of political regulation in the management of coastal ecosystems, anthropogenic activities play a major role in the reduction of mangrove biodiversity and the provision of ecosystem services (Ndema-Nsombo et al., 2015, UNEP, 2007).

Results and their analysis.

The coastal mangrove forest of Cameroon provides a rich biodiversity and peculiar ecological niche for the service of the forest-adjacent communities. The communities exploit the forest for food, household fuel wood, and medical plants. The forests are vulnerable to degradation and deforestation activities, such as logging and slash-and-burn agriculture. The location of mangroves at the heart of the economic capital, which is the industrial hub of the country, is another cause for concern. Heavy industries which require more water for heating and cooling of their machines are all situated along the mangrove coast. The discharge of their waste products cannot be underestimated, as these wastes are not treated and no less toxic for the survival of aquatic life, including mangroves. Fig. 3 is a summary of the industries located along the Cameroon coastal mangrove area.

This section examines and analyses the main causes of mangrove decrease, their dynamics, and mutations over time. The final part will be the results of this mutation if they have helped in improving the sustainability of mangroves or they are considered a threat to the mangrove forests. Some adaptive environmentally sustainable measures will be recommended for the preservation and conservation of this unique ecosystem witnessing the ultra-fast rates of degradation.

The evidence from the Fig. 2 buttresses the truth that the mangrove forests of the Cameroon coast are situated in the heart of the economic capital of Cameroon. Hence, industrial pollution is eminent as shown in the Table 1. The evidence from the Fig. 2 buttresses the truth that the mangrove forests of the Cameroon coast are situated in the heart of the economic capital of Cameroon. Hence, industrial pollution is eminent as shown in the Table 1.

Company	Product	Contaminant	
CIAC and PLASTICAM	Producers of plastic buckets, paints and tyres	Hydrocarbons, Tubes	
SAPCAM	Paint production	Combustible fuel oils	
CONFITEX	Textiles	Acid waste oils	
TOTAL FINAELF	Crude oil exploitation and marketing oil products	Hydrocarbons and lead (pb)	
SCDP	Oil products storage and distribution	Oil dumps (contains lead, Arsenic copper etc.)	
SHELL TEXAACO	Aviation, petrol, diesel fuel and wax	Hydrocarbons, lead, cadmium, copper, zinc and other trace metals	
CEP/CHEMICALS	Paints, detergents, vanish	Acid mercury, copper, lead, phosphates, trace metals etc.	

Table 1. Producers of petroleum effluents in Douala-Cameroon



Fig. 2. Major Economic Activities along the Cameroonian Coast

Added to the above, the main Agro-industrial establishments, which have equally contributed to the bastardization of this zone, include HEVECAM. SPFS. SOCAPALM. SAFACAM. CDC and PAMOL. The CDC alone employs over 15 000 persons for a cultivated area of more than 90.000 ha, making it the second largest employer after the state. It is recommended that a detail analysis of the impact of the drivers to mangrove existence be carried out with field measurements and the use of satellite images.

The dynamics of Cameroon coastal mangroves: Indeed, Cameroon since its independence has made conservation a major priority which is recognized as a step towards the aspiration of the sustainable management of the forest and its resources. Cameroon has revised the forest policy in order to meet this aspiration. A framework Law No 96/12 dated 05/08/96 had Article 94 put in place to preserve and conserve its ecosystems. Although, despite these laudable efforts, it is obvious that policy makers have not given the mangrove forests of the Cameroon coast the adequate attention they deserve. This unique ecosystem has been the most disturbed in modern times and in a continuous decline within the last decades, Table 2. These forests are located at the land-sea interface; thus, they constitute a highly productive ecosystem with rates of primary production equal to those of the tropical humid evergreen forests (Alonji, 2002). They accumulate carbon in tree biomass and most of this carbon is lost by decomposition and export to the adjacent ecosystem (Alonji, 2002).

The main economic activity in this zone is traditional fishing. This activity equally has a negative impact on the mangrove ecosystem. The increasing demand of smoked and roasted fish has a direct impact to the supply of fuel wood. Mangrove wood is preferable to any other wood because it burns very slowly and its charcoal is considered the best for this purpose.

Year	1980	1990	1997	2000	2005	2006
Area km ²	2720	2563	2494	2515	2500	1957

Table 2. Available data of Cameroon Mangrove Estimates (FAO, 2007)



Fig. 3. Wood Exploitation in the Tiko Mangrove Forest

An urgent need to detect, preserve and restore the degraded mangrove forest at the Cameroon coast will be a welcome initiative in order to preserve the natural resources for posterity. The «matanda warriors» go deep into the creeks along the Tiko shores with the use of canoes, cut the trees and haul them to the beaches for splitting into firewood for sale. Red mangrove (*Rhizophora sp.*) is by far the most solicited species used for fuel wood, fish smoking and roasting, and timber.

Other factors that impact the rate and quality of a mangrove's self-restoration include large portions of land that consist of industrial estates of oil palm, rubber, tea and bananas. With the population increasing large acres of arable land are put under cultivation to feed the growing population.

Another issue of concern in this maritime zone is the progressive degradation of the marine and coastal ecosystems caused by the over-exploitation of its fishery resources, coastal erosion and industrial pollution. This zone like any other coastal environment has witnessed rapid urbanization, uncontrolled industrialization, port and maritime activities. The exploitation of petrol and unlawful discharge of toxic wastes have exposed this zone to land, air and water pollution. A glaring example is the Rey Del Rey and Ntem estuaries which are highly abused and threatened by oil and gas exploration. Over 5 million inhabitants living adjacent to the coast is evidence that livelihood is solely dependent on the natural resources within their disposal. This population has altered the landscape through unsustainable and uncontrolled implantation of agro-industrial plantations and a handful of infrastructural development facilities.

Measures to protect the mangrove ecosystem in Cameroon: Despite the legal provisions binding the exploitation of coastal mangroves in Cameroon, much is still expected if Cameroon wants to protect, conserve and rationally manage its mangroves resources. Coastal mangroves in the country are legally protected since 1996 (Frame law No 96/012 relative to the management of environment in Cameroon), but the peri-urban environs of the Douala mangroves alone have experienced a loss of 53.16 % in the last 3 decades and the degradation continuous progressively. Wildlife habitats have been affected to the extent that even their rehabilitation cannot provide a reasonable shelter that can be used to combat climate change.

Since the coastal communities depend primarily on the exploitation of these resources for their livelihood it is only through a participatory management that the sustainability of this zone can be achieved. The communities should have a say in the management of the resources they depend on.

The implementation of an International protocol for the protection of nature should be applied in this zone. This includes agreements, like the Integrated Coastal Zone Management (ICZM) which stands for the sustainable development in coastal areas. The Ramsar Convention on wetlands of international importance, of which Cameroon is a signatory, remains an important instrument for the management of this unique ecosystem. This convention has put in place a mechanism that works for the conservation and wise use of all wetlands through local, national and international assistance.

Taking into cognisance the importance of coastal zones, the government has to facilitate the training of young scientists on the management of coastal and marine zones. More skilful professionals with excellent knowledge of suitable programmes for nature management are required. Modern technology (GIS) and related software, like Mapinfo and suffer 9 can be used to analyse and monitor changes occurring in the mangrove zone.

Conclusion.

A combination of physical and human activities is responsible for the intensive degradation of the mangrove's ecosystem. But the anthropogenic factor is at the forefront. An urgent need to detect, protects, and restore degraded mangrove forests is a major step towards an environmentally sustainable management of natural resources. These zones are experiencing an increasing magnitude of global environmental change processes exhibited by catastrophic events, such as tropical cyclones, tsunami and tidal bores, flooding, saline water incursion, deepening shoreline erosion, wetland loss and the threat of sea level rise.

The fact that this zone is overcrowded with diverse social and economic activities is evidence that the carrying capacity of the coastal environment is undergoing an accelerated decline in receding shorelines, loss of biodiversity and increasing human pollution. Policy makers must, therefore, pay more attention and implement adaptive environmental strategies to enhance their sustainability.

To safeguard aquatic resources from water pollution, industrial wastes should be treated before disposal.

Cameroon has lost 45 % of its mangrove forest. If the rate of deforestation and degradation continues unabated, mangrove forest at the Cameroon coast will be history in the next 60–70 years. It is, therefore, time for the government to create protected areas and monitoring groups to give routine reports. The amelioration of swampy flood plains and the harmonious management of the relationship between nature and the society are of immense importance to the protection of this fragile ecosystem. A constructive geographical direction that manages natural resources not only enables resource

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availability today, but it also ensures sustainability for future generations.

A program to monitor, control and sustain fishing activities in the mangrove areas of Cameroon was developed in 2009, along with a program to monitor socio-economic aspects to ensure the sustainable management of these areas. However, there is still a lot to be done, because policies can be good on paper but poor in execution. Government enforcement of this policy remains vital in order to conserve and rationally manage mangroves in the coast of mangrove.

Rational use of natural resources in the coastal zone, with emphasis on the mangrove forest must comprehensively take into consideration the physical-geographical and socio-economic processes, as well as the national and international laws binding their exploitation. They must equally execute developments that determine the current state and dynamics of changes in natural systems during their operation. The activities of integrated managements of coastal mangroves in different countries of the world were analyzed basing on a detailed and well-structured study of domestic and foreign publications related to this topic. Some environmentally sustainable adaptive strategies that can be the scientific basis for the relevant legislative frameworks for the optimization of nature management and spatial planning of coastal zones have been proposed with the aim to safeguard the mangrove ecosystem from extinction within Cameroon.

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