WEST AFRICAN WETLANDS CONFERENCE

1-2 December 2021

Centre for African Wetlands, University of Ghana

Local Organizing Team

Jones K. Quartey, Kofi Amponsah-Mensah, Emmanuel Taye, Dickson Agyemang and Yaw Agyeman Boafo

Abstract Reviewers

Prof. Yaa Ntiamoa-Baidu, Prof. Chris Gordon and Prof. Alfred Oteng-Yeboah, Prof Daniel Bruce Sarpong

Time	**Activity**	**Chairperson/** Presenter
Wednesday 1st December 2021		
8:00 GMT	Registration	
9:00 – 9:30 GMT	Opening and Welcome Address	Prof. Erasmus H. Owusu, (Director, C3SS, UG)
9:30 – 11:00 GMT	**Session 1 – Status of West African Wetland Ecosystems**	**Prof. Yaa Ntiamoa-Baidu** (Centre for African Wetlands)
9:30 - 9:45GMT	Status of Ghana's coastal Ramsar sites - three decades after designation	Yaa Ntiamoa-Baidu & Jones K. Quartey
9:45 - 10:00 GMT	Mangrove Degradation and Management Practices in Coastal Communities of Ghana	Andrew Agyekumhene
10:00 - 10:15 GMT	Landscape-based analysis of wetlands patterns in the Ogou River basin in Togo	Abalo Mabafei
10:15 - 10:30 GM	Improving waterbird monitoring in African Wetlands	Khady Gueye
10:30 - 10:45 GMT	Patterns of bivalve collection in the Bijagos, across islands with varying protection levels	Catarina Santos Ramos
10:45 – 11:15 GMT	*Group Photo, Coffee Break/Poster Session*	
11:15 – 12:25 GMT	**Session 2 – Wetland Biodiversity in a changing world (I)**	**Mr. Dickson Agyemang** (Wildlife Division, Ghana)
11:15 - 11:40 GMT	Trends in populations of waders using the Ghana coast	Yaa Ntiamoa-Baidu, Jones K. Quartey, E. Taye & A. Nuoh
11:40 - 11:55GMT	Senegal's Atlantic coastal areas play a key role for Eurasian Spoonbill (*Platalea leucorodia leucorodia*)	Aissatou Yvette Diallo
11:55 - 12:10 GMT	Status and Threats to Waterbirds in Ojo Coastal Communities, Lagos State, Nigeria	Emmanuel O. Osagiede
12:10 - 12:25 GMT	Conserving Wetland Biodiversity for Sustainable Development in Coastal West Africa	Santos Iderlindo
12:30 – 13:30 GMT	*Lunch/ Poster Session*	
13:30 – 15:00 GMT	**Session 3 – Wetlands and Food Security**	**Prof. Daniel B. Sarpong** (Dean, School of Agric. UG)
13:30 - 13:55 GMT	Determinants of the Adoption of Wetland Wise-use Strategies in Rural Communities in Northern Ghana	Daniel B. Sarpong & Selorm Ayeduvor
13:55 - 14:10 GMT	Optimal farm plan in wetlands agriculture for household food security	Gabriel Umoh
14:10 - 14:25 GMT	Mangroves and people's livelihoods	Yakhya Gueye
14:25 - 14:40 GMT	Coastal wetlands and community resilience to climate-induced diseases	Joseph Ayitiah
14:40 - 15:00 GMT	*Comfort break*	

PROGRAMME

Time	**Activity**	**Chairperson/** Presenter
15:00 - 16:30 GMT	**Poster session**	All Poster Presenters
Thursday 2nd December 2021		
8:00-8:30 GMT	Registration	
9:00 – 10:30 GMT	**Session 4 – Wetlands and Water/ Energy**	**Prof. Chris Gordon** (IESS, UG)
9:00 - 9:25GMT	Overview of issues	Prof. Chris Gordon
9:25 - 9:40 GMT	Water Quality, Use and Management of Wetlands in Semi-Arid Northern Ghana	Enock Dankyi
9:40 - 9:55 GMT	Extremal Analysis of Monthly Rainfall Using Bayesian Estimation	Kingsley Kwakye
9:55 - 10:10 GM	Human pressure on Waders at lhéu dos Passaros Integral Reserve (Angola)	Miguel Xavier
10:10 - 10:25 GMT	An assessment of impacts of fuelwood extraction on the mangroves of Cameroon	David Chik Forkam
10:25 – 11:00 GMT	*Coffee Break and Poster Session*	
11:00 – 12:30 GMT	**Session 5 – Wetland Biodiversity in a Changing World (II)**	**Prof. Alfred Oteng-Yeboah** (University of Ghana)
11:00 - 11:15 GMT	Ecophysiological response of *Avicennia germinans* (L.) L. and *Rhizophora racemosa* (G. Mey.) to the variation in groundwater salinity in Ouidah, Benín.	David Akodekou
11:15 - 11:30 GMT	Local uses of mangroves and perceived impacts of their degradation in Grand-Popo Municipality, a hotspot of mangrove in Benin, West-Africa	Constant Gnansounou
11:30 - 11:45GMT	Response of riparian tree species to climate warming in the semi-arid savannas of Ghana	Emmanuel Amoah Boakye
11:45 - 12:00 GMT	Salinity and human population density correlate with fine scale geographical distribution of mangroves and composite plant species in Benin, West Africa	Corine Sinsin
12:00 - 12:15 GMT	Mapping spatio-temporal changes in mangroves cover and prediction of their future dynamics in Benin	Mahoutin G. S. Zanvo
12:30 – 14:00 GMT	Action for West African Wetlands: Setting priorities and defining strategies	Gabin AGBLONON/ Yakhya Gueye (WI- Afrique) Louisa Sawyerr (Centre for African Wetlands)
14:00 GMT	*Lunch and Departure*	

ABSTRACTS OF ORAL PRESENTATIONS

Status of Ghana's Coastal Ramsar sites three decades after designation

Yaa Ntiamoa-Baidu[1] and Jones K. Quartey[1,2]

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Abstract

Ghana's coastline is dotted with over 50 lagoons and wetland formations ranging from very small lagoons to the large expanse of open lagoons and marshlands associated with the Volta River. These wetlands play significant roles in the socio-cultural systems and livelihoods of coastal communities and are important for biodiversity and maintenance of the coastal ecosystem. Ghana designated five coastal sites, Muni-Pomadze, Densu Delta, Sakumo, Songor and Keta lagoons in 1992 as Internationally Important Wetlands (Ramsar sites) on the basis of their importance for waterbirds. We review the status of these sites, thirty years after their designation, using four criteria: i) species diversity and relative abundance of waterbirds, ii) species composition and productivity of fisheries, iii) habitat quality, and iv) extent of coverage. At the time of designation, the Ghana coast supported internationally important numbers of nine species of shorebirds, Spotted redshank, Greenshank, Ringed plover, Curlew sandpiper, Sanderling, Little stint, Black-tailed godwit, Avocet and Black-winged stilt. There have been significant declines in the international importance of the sites for waterbirds, with species occurring in internationally important numbers dropping from 6 to 1 at Sakumo and by 1 or 2 species at the other four sites. Species such as Black-tailed Godwit and Avocet which were abundant at several sites have virtually disappeared. There has been changes in the relative abundance of fish species occurring in the lagoons with significant decrease in size of tilapia species such as *S. melanotheron*. All five sites have suffered habitat degradation from urbanisation and associated housing and industrial developments, pollution from domestic, industrial and agricultural waste. There have been also significant losses in the extent of coverage of the wetland sites originally designated. We use the case of Ghana's coastal wetlands to discuss the threats facing West African wetlands in general, and question the effectiveness of the Ramsar "wise-use" concept in securing the survival of wetlands in the sub-region.

Key words – waterbirds, coastal wetlands, fisheries, and habitat quality

Mangrove Degradation and Management Practices in Coastal Communities of Ghana

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Abstract

Mangroves are increasingly becoming degraded around the globe especially in West Africa. This study explored the local utilization, threats and existing conservations practices towards mangroves in the whole of Ghana through field visits, interviews and laboratory analyses. The study encountered three species of mangroves along Ghana's coastline, namely: white (*Avicennia germinans*), red (*Rhizophora racemosa*), *and* black (*Laguncularia racemosa*) mangroves. White mangroves are the most dominant, with black mangroves being the least dominant. The current mangrove cover of Ghana is 72.4 km^2 with over 18 million trees, consisting of both naturally occurring and planted mangroves. The Volta Region of Ghana has the largest strand of mangrove while the Central region has the least abundance of mangroves. Notable flora associated with the mangrove forests in Ghana included *Acrostichum aureum*, *Sesuvium portulacastrum, Paspalum vaginatum, Sporobolus maritime* and *Cornarcarpus erectus*. Mangroves in Ghana provide suitable habitats for several species of wildlife including birds, mollusc, fishes, reptiles and mammals. Ghana's mangrove forest is declining at a rate of 8.1 km^2 per annum due to overcutting, land conversion, wildfires, pollution, overgrazing (by goats and sheep) and natural death from disease. Overcutting of mangrove for fish smoking and housing construction were the major threats to mangrove forest in all the four regions. Continuous education, law enforcement and local controls mechanisms are effective in protecting mangroves and should be sought.

Landscape-based analysis of wetlands patterns in the Ogou River basin in Togo (West Africa)

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Abstract

Climate change and anthropogenic pressures are increasingly affecting land resources, especially wetlands. This work is a contribution to the sustainable management of wetlands in Togo, particularly in the Ogou basin, which are have not been the focus of previous scientific investigations. The objectives of this study were to (i) map the diversity of wetlands in the Ogou River basin, and (ii) analyze wetlands habitat fragmentation at the landscape level. First, three images from Landsat 8 of 2017 and 2018 were used for wetland mapping in ENVI 4.7 software. The unsupervised classification ISODATA were used after neochannels color composition (Brighness, Greeness of the Tasseled Cap and the Modified Water Detection Index (MNDWI)). Next, the Normalized Difference Vegetation Index (NDVI) was used to map land cover for wetland categorization. Field surveys and very high-resolution Google Earth images were used to evaluate the land use and wetland mapping, using Pontius matrix which showed total discrepancies of 20% and 21% for land use and wetlands, respectively. Finally, the "LECOS" extension of the QGIS software was used to calculate landscape metrics. Two wetland types were identified according to Ramsar categorization. The "inland wetlands" (90.66%) consists of forested peatlands (33%), tree-dominated freshwater wetlands (26.68%), bush-dominated wetlands (22.14%), and non-forested peatlands (8.84%). The "artificial wetlands" (09.34%) consists of seasonally flooded agricultural land (09.32%) and water storage areas (0.03%). These wetlands make up 34.98% of the land use in the study area and are differently affected by the fragmentation process. Thus, at the global scale inland wetlands are less fragmented than artificial wetlands. However, at a more detailed scale of categorization, bush-dominated wetlands are the most fragmented. These results are important for monitoring wetlands dynamics and can assist in efforts towards the biological conservation and ecological restoration planning in the study area.

Keywords: Wetlands, Landscape analysis, Fragmentation, Ogou River basin, Togo

Improving waterbird monitoring in African wetlands

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Abstract

Every year, millions of migratory waterbirds move from breeding sites in Europe to wintering sites in Africa to complete their life cycle. They use the East Atlantic flyway from the Arctic to South Africa. Many of these birds depend on a network of wetlands along the flyway that play crucial roles as breeding grounds, stopover sites and wintering areas, and are also important for people's livelihoods and culture. Some key sites in West Africa (PNBA, PNOD, Bijagós, Saloum...) along the flyway are threatened by human activities such as land reclamation, fisheries, industrial pollution and climate change. To address the threats to migratory birds, Wetlands International Africa West Coast and Gulf of Guinea (WIACO) through its MAVA funded project for Building capacity for the conservation and monitoring of coastal wetland birds in West Africa, has strengthened the NGO-government partnership for the conservation of migratory birds along the West African coast. Networks have been improved through conservation monitoring and conservation action. Bird monitoring in the region, especially in Senegal, Mauritania and Guinea-Bissau has been improved, with more people trained, engaged and better coordinated. Local communities have been involved in capacity building sessions for bird monitoring and conservation action at grass root level.

Key words: Waterbirds; East-Atlantic Flyway; monitoring

Patterns of bivalve collection in the Bijagós, across islands with varying protection levels.

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Abstract

The Bijagós archipelago is one of the most important sites in west Africa for migratory waders after Banc d'Arguin in, many of which are currently declining. The exploitation of shellfish consumed both humans and waders (and fish), which is heavily tied to the cultural practices in the Bijagós, may vary across the archipelago according to island specific protection level of natural resources and the strength of local rules based on cultural and societal organization. Some of these resources like the bivalve *Tagelus adansoni* are essential to the realization of certain ceremonies, limiting the progression of young Bijagós throughout the social structure when stocks are low. Other species such as the bivalve *Senilia senilis* are important protein sources for the local populations. In this study, we selected four islands varying in the protection status of their benthic resources: a National Park, a Marine Community Protected Area, an unprotected area with strong traditional believes and an unprotected with eroding traditional rules to assess variation on factors associated with bivalve collection by local populations. We interviewed 182 women (who are in charge of bivalve collection in the Bijagó society) across 4 islands and 20 villages. The results showed that *S. senilis*'s collection was driven by own consumption and economic profit (for sale), whilst *T. adansoni* is mostly collected for own consumption and cultural practices. As expected, study areas with formal protection supported a larger amount of *S. senilis* collection than unprotected areas, which likely reflects protection status and area management. Conversely, *T. adansoni* had higher collection levels in unprotected areas. And while *S senilis*'s populations were perceived to be decreasing *T. adansoni*'s has been increasing following a temporary extinction.

Trends in populations of waders using the Ghana coast

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Abstract

Biomonitoring is one of the simplest and rapid tools in assessing the ecological health of ecosystems. Monitoring populations of shorebirds in time and space has often been used to assess the ecological integrity of wetlands on the global scale. Generally, shorebird populations are declining globally. Anthropogenic activities and in more recent times climate change have been implicated in these declines. In Ghana, shorebird monitoring started in the late 1980s using a well-structured and consistent protocol. The regular monitoring has led to the establishment of an enviable database that spans four decades. This paper presents trends in the population of shorebirds occurring on the Ghana coast between the periods 2005 and 2020. Teams of at least two persons carried out monthly counts of waterbirds using established transects. Shorebird count data were analysed and trends estimated with the TRends and Indices for Monitoring data (TRIM) model. The results show a general stability in species composition across the entire Ghana coast with annual species counts ranging from 49 to 67. However, there has been a decline in shorebirds populations occurring along the coast, with peak numbers recorded at any one time in any year varying from 53,610 to 257,421. The Ghana coast has been shown to be important for nine wader species; Spotted redshank, Greenshank, Ringed plover, Curlew sandpiper, Sanderling, Little stint, Black-tailed godwit, Avocet and Black-winged stilt. Trend analysis of counts of these nine species showed a general strong population decrease along the entire Ghana coast. However, the population trends of these species were species- and site- specific, varying from moderate increase to strong decrease. These findings support the global decline in shorebird numbers, raising concerns for the protection of shorebirds and questions our current management practices in protecting waterbirds and wetlands.

Keywords: Population trend, shorebird, wader, monitoring

Senegal's Atlantic coastal areas play a key role for Eurasian Spoonbill (*Platalea leucorodia leucorodia*)

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Abstract

Senegal is located at the southern end of the flyway of the East Atlantic population of the Eurasian Spoonbill (*Platalea leucorodia).* Senegal hosts hundreds of Eurasian Spoonbills every year. Among the key sites for this species in Senegal are the Djoudj National Park and the Palmarin Reserve. The lack of in-depth scientific studies on the Eurasian Spoonbill in Senegal motivated the choice of this species for our research work, which aimed to compare the behaviour and dynamics of this species in these two sites. Thus, we carried out regular monthly counts in 2017 and 2018 and observed behaviour of the birds. In terms of population size, Djoudj and Palmarin are priority sites for the Eurasian Spoonbill, and both regularly hold more than 1% of the East Atlantic population, especially Djoudj, which can hold as much as one third of the population. The Technopôle wetland at Dakar is a secondary stopover site during migration. The highest numbers are recorded at Palmarin during October and at Djoudj in April. The most common activities observed for the birds are feeding and resting. Whilst all sites have variable measures of protection in place, a proliferation of invasive plants at Djoudj reduces the habitat available for feeding shorebirds, whilst at Palmarin and the Technopôle, human activities (tourism, agriculture, fishing, construction) can cause significant disturbance if not well managed. There is an urgent need to remedy the problem of invasive plants at Djoudj to minimize the impacts on Eurasian Spoonbills, as Djoudj is their most important wintering site in Senegal and perhaps of the entire flyway.

Keywords: Behaviour, Djoudj, Eurasian Spoonbill, Migration, Palmarin, Technopôle.

Status and Threats to Waterbirds in Ojo Coastal Communities, Lagos State, Nigeria

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Abstract

Ojo is one of the largest commercial towns in Lagos State. The entire mangrove in the communities found in Ojo are close to the coastline with several islands, creeks and lakes all of which support diverse waterbirds. A survey on the status and threats to waterbirds was conducted in five coastal communities in Ojo; Ojo Jetty, Ibeshe, Olomo meta, Idoluwo and Ishagira along a 2km transect on a boat. All waterbirds sighted and heard were identified and recorded. The threats to waterbirds were identified through direct observation, interview with key informants and secondary sources. A total of 620 individual waterbirds of 21 species, belonging to 8 families were recorded. 20 waterbird species are categorised as Least Concern and one species, Eurasian Curlew (*Numenius arquata*) is categorised as Near Threatened in the IUCN Redlist. Of the 21 waterbird species, 6 are migrants while 15 are resident birds. Bird diversity, species richness and abundance significantly differ across the five sites. Ojo Jetty which has the largest mudflat had the highest diversity, species richness and abundance while Olomo meta had the lowest diversity and species richness with no mudflats. Waterbird abundance was lowest at Ishagira. The identified threats include dredging, fishing, farming, human disturbance, water pollution and land reclamation. These threats have the potential of driving population declines in the waterbird species recorded in this study. Conservation education among coastal communities is crucial for ensuring that the remaining coastal wetlands continue to support a wide range of waterbirds.

Conserving Wetland Biodiversity for Sustainable Development in Coastal West Africa

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Abstract

Wetland biodiversity is under multiple threats, of both natural and anthropogenic origins. Coastal wetlands are of particular interest due to the synergistic impacts of climate change and uncontrolled human activities. Numerous reports highlight severe ecosystems change in the wetlands of the West Coast and Gulf of Guinea, including hyper-salinity and pollution; two key factors that are a direct result of adaptation capacity and uncontrolled rise in infrastructural development. In consequence, sensitive coastal ecosystems such as mangroves, seagrass beds and turtle nursery grounds have seen a steady decline in species diversity, as well as dwindling ecosystem services as environmental quality continues to deteriorate. Thus, calling for a concerted multi-sectoral approach to ensure sustainable development and to conserve our precious wetland biodiversity. To that effect, Wetlands International Africa (WIACO) is currently running projects to protect the aforementioned sensitive coastal ecosystems through the provision of scientific baselines to inform policies, building capacity of actors to implement sustainable management measures and empower civil society to promote ownership and conscientious utilisation of the ecosystems in question. Key among these projects include (but not limited to) the MAVA-funded projects, PRISE and ResilienSEA. These projects are aimed at reducing the impacts of infrastructure on coastal ecosystems and conserving seagrass beds in West Africa over a span of 5 years (2018 – 2022). The target countries for both of these projects include Senegal, Mauritania, Guinea, Guinea Bissau and Cape Verde, and in addition, Sierra Leone and The Gambia, for the ResilienSEA project. In these countries, the project works with government institutions, academia, civil society, media, etc., to make sure that appropriate management tools are available, sustainable infrastructure is featured in university curricula and that civil society is actively involved in the conservation of sensitive coastal ecosystems in West Africa. All these will be backed by the national, sub-regional and international partnerships set up to usher in and implement a third phase of the project upon the departure of the MAVA Foundation for Nature in 2022.

Keywords: Infrastructure, sensitive coastal ecosystems, wetlands, policies, West Africa

Determinants of the Adoption of Wetland Wise-use Strategies in Rural Communities in Northern Ghana

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Abstract

Many rural communities in northern Ghana depends on wetland resources as sources of food, income and livelihoods. However, the extent to which these households integrate wise-use of wetland resource into their livelihood strategies varies significantly due to socio-economic differences. Understanding how such differences influence the confidence to invest in wetland resource use is important when considering possible interventions for supporting rural livelihoods and promoting the sustainable wise-use of wetlands in Ghana. This paper examines the determinants of the adoption of household wetland wise-use strategies in Northern Ghana, with a focus on communities confidence in investing in wetland resource use. Data was collected from 305 randomly sampled households in Northern, Upper East and Upper West Regions under CAW-OSIWA project of enhancing rural livelihoods and food security through wise use of wetlands in northern Ghana in May 2019. Using probit regression model, the results of the study showed that improved household educational level enhances confidence in investing in wetland resource use. We also find that confidence to invest in wetland resources is positively influence by land tenure (family, purchase or lease), access to credit and farmer-based organizations. Additionally, farmer training in wetland resource wise-use, size of wetland and farmer location enhances the confidence to invest in wise-use and management of wetland resources. The study recommend that government policies meant to increase sustainable wise-use of wetland resources must consider land ownership, access to credit, membership of farmer groups and farmer location as key factors that increase farmer intention to invest in wise-use and management of wetland resources. Also, farmer training and sensitization on wetland wise use strategies are recommended policy options to increase farmer investment in wise-use wetland resources. Lastly, policies aimed at promoting sustainable wise-use of wetland resources must encourage investments in education and skills development of rural communities to enhance management of wetland resources.

Key words: Wetlands, Adoption, Wise use, Northern Ghana

Optimal farm plan in wetlands agriculture for household food security

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Abstract

Crop cultivation is an age long practice in wetlands/coastal communities of Akwa Ibom State located in the Niger Delta region of Nigeria. However, in spite of the wetlands farming making substantial contributions to household food needs and national food demand, the choice of crops cultivated and farm size are largely dictated by the soil and environmental conditions, food culture of the people; all these are learned by farmers through trial and error with no formal efforts to plan and have documented guide. In this study, the target-MOTAD variant of Linear Programming model was used to determine the optimal crop combinations that would ensure household food security given the risks associated with wetlands farming in the study area. The results provide a range of crop enterprise combinations which farmers can choose depending on their attitude towards risks. However, crop combinations comprising tubers, grains and vegetables (cassava, cocoyam, maize and fluted pumpkin) appears to be the best option for achieving household food security from wetlands farm in the study area. It is therefore, recommended that farm planning should be inculcated in farmers so that farming on the wetlands would be systematic and capable of contributing bridging the gaps in global food deficit on a sustainable basis.

Mangroves and people livelihood

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Abstract

Wetlands are important features in the landscape that provide numerous beneficial services for people. Wetlands provide a number of important functions and products to the communities, making important contributions to the food security of local communities through the ecological functions and the products which they provide. Wetlands International through various projects safeguards wetlands for the benefits of nature and people especially mangrove forest in regards to the services they provide not only to the nature but also to the communities. Mangroves confer tangible provisioning ecosystem services to local coastal populations such as: honey, oysters, fish and selfish for food need of the population. This study highlight how local communities benefited from the sustainable Mangrove use for food security.

Keywords: Food security, Mangroves, Sustainable use, coastal communities.

Coastal wetlands and community resilience to climate-induced diseases

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Abstract

Wetlands provide resources for people both directly and indirectly. The "problem" for human health is that wetlands are seen to be the causes of diseases. In an era where predicted climate change is expected to perpetuate flooding as a result of extreme weather events, wetlands are linked to the spread of water related and vector-borne diseases. This study aimed at exploring the knowledge, beliefs and actions of community and institutional stakeholders on the role that functioning wetland ecosystems play general wellbeing and in building community resilience to diseases including diarrhoea, cholera, typhoid among others. The study was undertaken in the Anyako and Atiteti communities in the Keta Municipality and Anloga District Assembly in the Volta region and Opetekwei in the Accra Metropolitan Area. Using on a qualitative method, data were collected using key informant interviews, participant observations, focus group discussion and in-depth interviews with a semi-structured interview guide. Results showed an extremely high level of households' dependence on the local wetlands for well-being. Poor hygiene and sanitation, especially waste disposal and open defecation in the wetlands is a common practice. Health offices admit they do not have proper diarrhoea data to track trends, however, acknowledge cases increase during the rainy season. The study recommends more education and awareness creation activities to change the attitudes and behaviours of the community folks.

Keywords: Lagoons, Keta, Wetlands, Erosion, Flooding

Water Quality, Use and Management of Wetlands in Semi-Arid Northern Ghana

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Abstract

Wetlands play a crucial role in the economic development of communities in Northern Ghana through crop production, fishing, animal rearing, biodiversity conservation, and water supply. Despite their essential benefits, however, wetlands in northern Ghana are threatened by multiple anthropogenic pressures, with the potential impact on the quality and sustainability of these water resources. In this study, we present a comprehensive assessment of water quality on four major wetlands located in the Northern regions of Ghana. The wetlands were located in the Binaba, Janga, Sankana and Barzuah communities and comprised two river wetlands (at Janga and Barzuah) and two reservoirs (at Sankana and Binaba) created from artificial dams. Sampling was performed during both the rainfall and dry seasons to reflect the changes in the volume of water and related properties. The samples were analysed for several water quality parameters including pH, turbidity, TSS, TDS, nutrients, and major ions. For most parameters, seasonal variations were found to be significant, and largely influenced by dilution and water volume. Water samples from reservoirs appeared to be generally of higher water quality but were more susceptible to point pollution due to their closed nature. While water from the wetlands was generally of good quality, the importance of maintaining and improving the water quality of these water bodies is critical considering their impacts on livelihoods in Northern Ghana and on the quality of water resources in southern Ghana.

Extremal analysis of monthly rainfall using Bayesian Estimation

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Abstract

Producers of greenhouse gases do not produce them for fun but as Dolan and Goodman (1995) clearly stated "the problem of global warming illustrates the principle that every economic activity involves opportunity cost". Meanwhile, the budgetary impact of extreme weather events is more pronounced in developing countries than in advanced economies (Lis et al, 2009). In Ghana, about 76% of all disaster events are hydrological, meteorological in nature and account for 45% of the deaths and 79% of the economic losses (NADMO, JULY 2010). Meanwhile, the unavoidable extreme weather events and their associated hazards can be forewarned through detailed statistical weather analysis. Considering the uncertainties about the level of rainfall that causes disaster and also when to expect disasters, the study has analysed the high extreme rainfall data in Ghana using the Generalized Pareto Distribution (GPD) with Bayesian estimation. The increasing number of Bayesians and the success stories in estimation and prediction in recent times lie in the appropriateness of their prior information before data sampling. Due to absence of expert knowledge on the shape and scale parameters in our case, two truly non informative priors: Jeffreys and Maximal Data Information (MDI) priors were considered for the study. In all the rainfall stations the MDI prior performed better than the Jeffreys prior except for Sefwi – Bekwai where both priors performed equally with P_a = 0.49. We state conclusively from our POT extremal analysis that, for each synoptic station in Ghana, it is possible to observe monthly rainfalls above the observed maximum monthly rainfall as provided by the data in the study. We therefore recommend that economic activities that require the construction of reservoirs such as hydroelectric electric power generation and farming activities should make provision for possible higher amounts of rainfall to ensure all-year production.

Keywords: Extremal Analysis, Bayesian estimation, Extremal Type Theorem (ETT), Generalised Pareto Distribution,

Human pressure on Waders at lhéu dos Passaros Integral Reserve (Angola)

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Abstract

The Integral Nature Reserve of Ilhéu dos Pássaros, 1.7 km ², is the smallest conservation area in the Protected Areas System of Angola. The Reserve is considered to be one of the most important protected areas in Angola, for being an important area for waterbirds and as mangrove system. The nature of the Reserve's lagoon system provides an ideal habitat for several groups of waterbirds, especially waders. Surveys carried out over the last four years point to the existence of an important population of waders (*Numenius phaeopus; Calidris alba; Limosa lapponica; Numenius arquata; Tringa nebularia; Numenius phaeopus; Tringa stagnatilis; Arenaria interpres; Calidris ferruginea; Calidris minuta; Calidris alba; Tinga glareola; Tringa stagnatilis and Actitis hypoleucos)* who frequent the Reserve. In comparison with the other groups of waterbirds that reside or frequent the Reserve, waders represent one of the most important populations, with a proportion above 70%. However, the Reserve is located in the Bay of Mussulo, with great anthropogenic pressures from the resident communities, from the urban waste of Luanda, but also the impact of tourists who frequent the Bay of Mussulo. The work carried out in the last four years is essentially focused on mitigating human pressures on the Ilhéu dos Pássaros Reserve and surrounding habitats. In order to achieve these efforts were focused in two main areas. the monitoring of the waders in the Reserve and throughout the Mussulo Bay, as well as the environmental awareness and awareness of the resident communities and tourists who frequent this environment. The results obtained are relatively satisfactory. However, efforts must be maintained to ensure the conservation of this important site for waders and other waterbirds.

An Assessment of Impacts of Fuelwood Extraction on the Mangroves of Cameroon

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Abstract

The supply of mangrove fuelwood to supplement energy for various forms of consumption through he intermediary of actors in rural, peri-urban and urban communities across the entire coast of Cameron has witnessed an increase. This study sought to contribute towards the elaboration of a framework of mangrove fuelwood value chain actors' in order to promote effective sustainable utilization and governance of mangrove across the Cameroon coast. Data were collected through a survey of 3063 fuelwood actors and analysis was done using inferential and descriptive statistics. From findings, the two types of stakeholders involved in the mangrove fuelwood value chain at the Cameroon coast were direct (harvesters, transporters, wholesalers, retailers and consumers) and indirect (government and traditional authorities) stakeholders. Chi-square (X^2) test statistic showed that different socio-economic variables influenced mangrove fuelwood trade along the coast of Cameroon. Of the two sources of energy used along the Cameroon coast, wood energy was highly solicited (approximately 80% aggregately) for all wood sources. There was a significant difference ($p<0.01$) in the use of both wood and non-wood energy sources. The mean flux of mangrove fuelwood for all the mangrove blocks was 18.46 m3, showing a significant variation (CV > 50%) among the direct actors across the different blocks. The main consumers of mangrove fuelwood were households, fish smokers, restaurants, soya roasters and bakeries. The annual volume of mangrove fuelwood consumed and carbon dioxide emissions across the Cameroon coast showed high variation ($p<0.05$). *Rhizophora* and *Avicennia* were the dominant mangrove species exploited across the coast of Cameroon. The Cameroon estuary was the major hotspot of mangrove fuelwood exploitation and carbon dioxide emission. There was significant variation in perceptions and attitude of mangrove fuelwood consumers as well as significant variations in their Readiness-to-Pay (RTP). While taxation imposed by all indirect actors on direct actors were consistent for fuelwood collectors, fuelwood boat owners, Pickups, and motorcycle ($p>0.05$). Recommendations regarding the putting in place of better systems of mangrove governance for greater involvement of fuelwood stakeholders are further made.

Key words: Mangroves, Fuel wood exploitation, Value chain, supply chain, Readiness to pay, Cameroon Coast

Ecophysiological response of *Avicennia germinans* (L.) L. and *Rhizophora racemosa* (G. Mey.) to the variation in groundwater salinity in Ouidah, Benín.

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Abstract

Mangrove ecosystems, as a result of their fragile nature, show high vulnerability to long-term shift in precipitation and salinity. This study evaluated the ecophysiological responses of *Avicennia germinans* and *Rhizophora racemosa* to the variations in precipitation and salinity during two years (2018 and 2019) within the mangroves of Djègbadji located at Ouidah municipality, southern Benin. More specifically, we (1) assessed the seasonal and annual variation in precipitation and salinity in Ouidah; (2) investigated the structural patterns of *A. germinans* and *R. racemosa* within the mangroves of the locality and (3) evaluated the mangrove litter fall productivity of the study area. Four underground water tubes were installed *in situ* to measure groundwater salinity and nutrients. Two plots (7.5m×10m) and ten litter fall traps were also installed to assess the structural patterns and the litter fall productivity of the study species. Furthermore, rainfall data were monthly retrieved from the meteorological station of Ouidah and analyzed for the period 2001-2019. A cluster analysis was used to classify the seasons into three groups, rainy, dry and nortes. A three-way ANOVA test was applied to assess the spatial and temporal variation of salinity and nutrients. Outcomes of the study indicated a heterogeneous distribution and seasonal variation of the rainfall in the study area over the last nineteen years ($F= 91.26$; $p<0.001$) based on the standardized precipitation index (SPI). There is also a temporal variation of the salinity and nutrients ($p < 0001$) which switched from freshwater conditions to mesohaline conditions. The structural patterns showed a monospecific fringe and monospecific riparian type for *A. germinans* and for *R. racemose* respectively. The litter fall productivity differs according to site ($F = 4.66$, $p<0.05$), season ($F=16.91$, p 0.0001) and year ($F = 8.06$, $p<0.05$) as well as their interactions ($p < 0.05$).

Keywords: Litter fall; drought; mangrove; salinity; nutrients; standardized precipitation index

Local uses of mangroves and perceived impacts of their degradation in Grand-Popo Municipality, a hotspot of mangrove in Benin, West-Africa

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Abstract

Detailed understanding of the interactions between human beings and their surrounding ecosystems is essential for designing sustainable use and management of these ecosystems. Mangroves are one of the most productive ecosystems worldwide, yet among the most threatened. This study (1) explored main activities of local communities in relationship to mangroves and variation across geographical locations, gender, and age category, (2) investigated plants and animals used and collected from mangroves and adjacent areas, and (3) assessed local perception on the impacts of their activities on the degradation of mangroves and potential effects of this degradation on their life attributes (security, income, health and culture). The study was conducted in Grand-Popo Municipality, a hotspot of mangroves and the only one coastal Municipality embedded in the Mono Transboundary Biosphere Reserve in Benin. Data were collected through individual interviews (n = 360) in nine villages of the municipality. Results showed that local communities of Grand-Popo implement nine income generating activities within mangroves of which fishing (31.65%), wood collection (22.73%), *Cyperus articulatus* collection (21.67%), medicinal plant collection (8.98%), and salt production (5.56%) were frequent. There were important differences across geographical locations, gender, and age categories with regard to mangrove resources and socio-economic activities. Respondents reported twenty-tree fish species, two shrimp species, two crab species and one oyster species as fishery resources commonly collected from mangroves. Most informants (58.33%) believed that their activities do not negatively impact mangroves despite their large acknowledgment of mangrove coverage depletion (75% of respondents). Our findings provide important information on resources collected and used in mangrove ecosystems and highlight strong geographical locations, gender, and age categories variation which have implications for sustainable participative management of mangroves.

Keywords: Mangroves, *R. racemosa*, *A. germinans*, Grand-Popo, Mono Transboundary Biosphere reserve, Benin

Response of riparian tree species to climate warming in the semi-arid savannas of Ghana

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Abstract

Riparian forest ecosystems in savannas play significant roles in biodiversity conservation and hydrogeochemical cycle. This ecosystem is vulnerable to warming induced increases of water deficit. Yet, little is known about the impact of the warming temperatures on the growth of the trees. Here, we assessed species-specific temporal variability in above-ground biomass stem growth of riparian trees in the savannas of Ghana from the ~1900s to the present. We used 31 basal area increment chronologies of deciduous *Anogeissus leiocarpus* and evergreen *Afzelia africana* trees after correcting for the effect of age and size. We found no strong overall trend in trees growth in the riparian forests despite the strong species-specific growth fluctuations during the course of century. Quantifications of tree growth variability as a function of seasonal climatic factors revealed strong influence of dry and rainy season temperature and precipitation variables, emphasizing growth sensitivity to climatic forcing. Our results show that climate warming has not induced tree growth declines in this study area; thus suggesting that water supply in the riparian forest is still sufficient to compensate for adverse effects of warming-induced increase in evapotranspiration.

Salinity and human population density correlate with fine scale geographical distribution of mangroves and composite plant species in Benin, West Africa

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Abstract

Mangroves are one of the most productive, socio-economic and ecologically important coastal ecosystems. An accurate information on their geographical distribution and composite plant species and how both are related to environmental factors are necessary for planning their management. This study assessed the geographical distribution of mangroves and their composite plant species in relationship to salinity and human population density in Benin. Field data - *Occurrence*, *density*, and *salinity* - together with secondary data –*Human population density* and *historical physico-chemical constants*- were collected. Occurrence data and shapefiles of Benin contours (districts and water bodies) were uploaded in ArcGis 10.3.1 to map current distribution of composite species and its concentration. Results showed that in Benin, mangroves are composed of five typical species (*Rhizophora racemosa* G. Mey, *Avicennia germinans* (L.) L, *Acrosticum aureum* L., *Conocarpus erectus* (L.), and *Laguncularia racemosa (*L.) C. F. Gaertn) confined to lakes and lagoons of the paralic meridional zone. From the border with Nigeria to the border with Togo, it showed uneven concentration and disproportionate species representation; which are correlated to salinity ($r = -0.17$, $p = 1.97e-05$) and human population density ($r = -0.40$, $p < 2.2e-16$). The hypothesised scenario which could explain the observed concentration of mangroves is that salinity at first sight defines concentration of mangroves; the latter attracts human settlement which then exerts pressure through excessive resources extraction, resulting in their shrinkage. Our findings provide information on areas with low mangrove concentrations (due to human-induced degradation) and highlighted *C. erectus* and *L. racemosa* as less represented species (only 01 and 40 occurrences, respectively) which should be considered in upcoming restoration.

Keywords: mangroves, Benin, sustainable management, lakes, lagoons, threats.

Mapping spatio-temporal changes in mangroves cover and prediction of their future dynamics in Benin

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Abstract

Mangroves are precious ecosystems that provide vital socio-economic, environmental and cultural benefits to humanity. However, they are declining alarmingly due to human activities and natural hazards. Assessment of their spatio-temporal dynamics is essential for their monitoring and guide their sustainable management. We assessed the spatio-temporal dynamics of mangroves and predicted their future trends using remote sensing techniques and Markovian chain analysis. Landsat images TM/ETM+ (for 1988, 2001, and 2019) were obtained, processed, classified, and analyzed using remote sensing techniques and GIS. The changes observed during these periods (1988–2001, 2001-2019 and 1988–2019) were used to predict the future trends at horizon 2050 using Markovian chain analysis. Results showed that mangroves, which occupied 5205.24 ha in 1988 in the study area, experienced a 62.07% decline between 1988 and 2001 but 18.84% increase between 2001 and 2019. The latter is attributed to increased efforts of mangrove restoration. Mangroves were mainly converted into meadow (52.35% in 1988-2001 and 7.31% in 2001-2019) and other vegetation types (17.57% in 1988-2001 and 27.05% in 2001-2019). Municipalities of Abomey-Calavi and Ouidah were places where mangrove decline was highest, and therefore require greater conservation efforts. Future projection based on Markovian chain analysis suggests that mangroves will continue to decline but slowly. This study provides essential information to guide future conservation actions of mangroves in the study area.

Key words: Coastal ecosystems, dynamics, remote sensing, Markov chain, Benin.

ABSTRACTS FOR POSTER PRESENTATIONS

Spatial distribution and nesting behavior of the Black-winged Stilt (*Himantopus himantopus*, Linnaeus 1758) in the peri-urban wetland of Dakar Technopôle (Senegal, West Africa)

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Abstract

This study focused on the spatial distribution and nesting of the Black-winged Stilt (*Himantopus himantopus*) at the Dakar Technopôle in 2017 and 2018. The Technopôle constitutes a particular wetland ecosystem, playing a determining role in the reproduction and survival of many bird species, and it is part of the Niayes Important Bird & Biodiversity Area (IBA). The maximum numbers of Black-winged Stilt counted during breeding periods are 766 individuals in 2017 and 1506 individuals in 2018. However, numbers decrease on arrival of the rains. Data on reproduction (79 nests in 2017 and 71 nests in 2018) show that this peri- urban wetland is a favoured environment for Black-winged Stilt nesting. This is the first time that such a large number of Black-winged Stilt nests have been reported in Senegal. In spite of disturbances linked to anthropogenic factors, the reproductive success of Black-winged Stilt reached more than 85% during the two years of monitoring. The Technopôle requires protection measures for better preservation of biodiversity, particularly for birds, especially noting the site's recent status as a nature reserve (Réserve naturelle urbaine de la grande

Niaye de Pikine) and the growing popularity of the site for birdwatching and ecotourism.

Keywords: Black-winged Stilt, Niayes of Dakar, Nesting, Technopôle, Urban wetland.

Managing Wetland Ecosystem Services in Lagos, Nigeria: Using an Integrated Planning Approach

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Abstract

Different wetland stakeholders have varying levels of trade-off to make with respect to use wetland and contribution to their well-being. The goal of a well-managed wetland ecosystem can be achieved using the Integrated Planning Approach (IPA)- a decision-making framework with cross-cutting strategies and cross-scale approaches to managing ecosystem services trade-offs. This is a placed based approach which is participatory in nature. For an effective management of wetlands ecosystem service trade-offs, we identified the following four major elements in the IPA process: 1) Situation Analysis, 2) Strategy formulation, 3) Strategy implementation, and 4) Strategy evaluation. The study was carried out on the Lagos Wetland ecosystem. Here stakeholders were able to identify over-exploitation of wetland resources, high dependence of locals on wetlands for livelihood, prevalence of poverty, lack of awareness, limited resources and land reclamation as key issues impacting the wetlands. Various strategies proposed include awareness program, setting-up monitoring system for early response, continuous species inventory, alternative livelihood options, as well as implementation comprehensive management plan incorporating climate change adaptation strategies. These will eventually feed into policy formulation and appropriate policy realignment and evaluation process. Although, the IPA concept is not new in management decision making but we propose its use through integration of existing and emerging frameworks and the use of some strategic analytical tools in classical and contemporary natural resource management. Under this model, IPA becomes a participatory process in which all actors consider all actions and help to achieve a neutral or balanced operational ground. Ecosystems are rapidly changing due to environmental uncertainties, so long-term forecasts cannot be relied upon with a high level of confidence. The study support recommendation of the MA in recommending the importance of integrating ecosystem management goals in all relevant policymaking.

Waterbird trends along the East-Atlantic Flyway

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Abstract

The East Atlantic Flyway is used by many resident and migratory waterbirds along the West African coast. Simultaneous counts of these populations provide the opportunity to estimate the size and trends of the total population. This information is very informative for site managers as they can compare their local populations and trends with the Flyway data, and thus see how important their sites are and also whether trends at their sites are affected locally or by factors elsewhere. The results of simultaneous counts in 2018, 2019, 2020 performed in collaboration with the partners will be presented and the resulting distribution and trends of waterbirds population will be described. The simultaneous count in the region is in the framework of the cooperation between Wetlands International Africa - Western Coast and Gulf of Guinea, Wadden Sea Flyway Initiative and BirdLife International to improve the monitoring and management of waterbirds along the Flyway.

Key words: waterbirds; East-Atlantic Flyway

Mangroves of the Western Coast of Ghana, West Africa

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Abstract

Stretching from New Town to the Ankrobra estuary on the western coast of Ghana, is an area with extensive mangrove stands, a number of estuaries, and sandy beaches which serve as important habitats for coastal organisms. The Ankobra and Amanzule estuaries serve as feeding and roosting habitats for important migratory birds such as sanderlings, and also as spawning and nursery grounds for fishes such as Chrysichthys nigrodigitatus, Elops senegalensis, and Mugil bananensis. In addition, the sandy beaches support the breeding of three turtle species, Leatherback (Dermochelys coriacea), Green (Chelonia mydas), and Olive Ridley (Lepidochelys olivecea) which utilise the coastal areas for foraging and nesting. Due to the importance of that stretch of the Ghanaian coast, which serves as habitats for various species of flora and fauna, designating the area as an Ecologically or Biologically Significant Marine Area (EBSA) would complement actions being taken to protect and sustainably manage the biodiversity in Ghana.

Developing new urban tourism destinations in Benin: an integrative approach with citizens around the swampy green lung of Fifadji in Cotonou

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Abstract

Urban swamps in West African coastal areas are heritage ecosystems with high diversity of aquatic flora and fauna species. They have a great ecotourism potential to develop cities in a sustainable way while maintaining large food chains. However, the inevitable urban population growth, which accelerates a form of anarchic urbanization, continues to expose swamps to insalubrity, backfill and disappearance. Moreover, landscaping projects are few aware of the ecological role of Wetland in city. This is the case of Fifadji swamp's which extends over 71 hectares of non-building areas in Cotonou, the largest metropolis of Benin. The project aims to assess the remaining biodiversity of Fifadji swamp to contribute to its preservation and urban ecotourism enhancement engaging citizens. The preliminary investigation shows that Fifadji swamp plays a central role against the risks of flooding by evacuating rainwater. We recorded 29 plant species ranked in 20 families mostly threatened by the construction of water collectors. Pantropical species are the most dominant (28%) followed by 21% of Guineo-Congolean endemism species. Hemicryptophytes composed of Poaceae and Cyperaceae (28%) co-dominate with microphanerophytes or Trees (28%). Geophytes (14%), Hydrophytes and Chamaephytes (10% each) include some species which play the role of water purification, banks and watercourses stabilization while providing natural habitat for fauna. This floristic cortege is associated with an attractive and native fauna including permanent (waterhen, lesser gallinule) and other migratory birds, crocodiles, monitor lizards, freshwater turtles, amphibians, crustaceans, fishes. In Cotonou heartland, Fifadji swamp's appears to be a last refuge for biodiversity. Citizens were engaged for its preservation as the first aesthetic "Green Lung" to optimize tourism contribution to the economic development, and community well-being in a city where popular greenspaces are still lacked. The green lung will integrate native species restoration to make Fifadji as a reference pole for eco-citizenship and green employment.

Keywords: Benin, Eco-citizenship, Ecotourism, Green lung, Urban, Wetland Biodiversity, West Africa

Assessing institutional stakeholders' perceptions of Keta Lagoon Complex as nature-based solution for reducing climate change-induced risks and vulnerabilities

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Abstract

According to the Intergovernmental Panel for Climate Change (IPCC), high confidence and diverse scientific knowledge exist in confirming the impacts and pressures of climate change on natural ecosystems as well as human systems and their adaptive capacity. Wetlands provide multiple ecosystem service benefits including Climate regulation which is considered one of the most important ecosystem services that support climate adaptation and resilience. Most wetland ecologies worldwide including coastal wetlands are disturbed and deteriorating at an alarming rate due to several non-climatic and natural factors. The Keta Municipal district which falls within the top 25 coastal erosion hotspots along the eastern coastline of Ghana is considered to be the worst affected area with an erosion rate of about 8 m/yr. About 30% of its total land area of 1,086km^2 is interspersed with lagoons, creeks, and mangrove forests, offering great potential for tourism development, livelihood support and, biodiversity conservation. The Keta Lagoon Complex which happens to be the largest in Ghana is also a designated Ramsar site. However, the Keta municipality is vulnerable to a range of climate-induced hazards; flood, erosion, storm surges among others. Several years of grey infrastructure measures by the State, including the famous sea defense walls and dikes have resulted in negative impacts in adjoining coasts and ecosystems. This study explores relevant institutional stakeholders' knowledge and planning actions on nature-based solutions as instruments for reducing climate change-induced risks and vulnerabilities in the Keta municipality. Data collection and analysis for this study will focus on institutional stakeholders of the Keta municipality. The study will conduct in-depth interviews with key informants and, focus group discussion. Results from this study will determine stakeholders' level of understanding and appreciation of coastal wetlands as an adaptation tool to reducing coastal vulnerabilities.

Keywords: Ecosystem services, Erosion, Flood, Keta, Wetlands

Biodiversity of aquatic plants and microflora in Tagwai dam, Niger state, Nigeria

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Abstract

Aquatic micro and macro-flora constitute the variety of life within the ecosystems that make up the wetlands of the world. Tagwai dam located in Chanchaga local government area of Niger State, Nigeria, located between longitude 6^{o}39 to 6^{o}44 East and latitude 34^{o} to 9^{o}37 North to South-west of Minna, Niger State, Nigeria, was the site for transect sampling collection of aquatic flora. Phytosociological method was adopted by using planktonic net, sterilized polythene bags and plastic bottles from five sampling stations. Isolation and identification of microflora was conducted using serial dilution for bacterial species and biochemical tests for the identification. Agar pour plate method for the isolation and morphological characteristics for the identification of fungal species. The dominant aquatic macro flora families identified included *Araceae, Nympheaeceae, Alismataceae, Marsileaceae* and *Ceratophyllumaceae.* The identified bacterial species were *Salmonella* sp., *Proteus* sp., *Psuedomonas* sp., *Enterobacter* sp., while, the fungal species identified were those of *Aspergillus sp., Mucor pusillus, Penicillum notatum* and *Candida albicans* were also the most dominant microflora. The presence and abundance of these aquatic plants and microflora revealed their importance as source of food and energy to the wetland ecosystem with the micro flora being the primary source of energy and the first organisms in the food chain of a wetland community.

Keywords: aquatic plants, biodiversity, microflora, transect sampling, tagwai dam

Wetlands conservation in Ghana; are we winning the war?

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Abstract

Wetlands are dynamic and distinct aquatic ecosystems. They play several significant functions, including habitat for diverse wildlife (both plant and animals), water purification, water storage, flood control, processing of carbon and other nutrients, stabilization of shorelines, culture sustainability, ecotourism, and support for research. In spite of its life-sustaining benefits, Ghana's wetlands continue to face habitat destruction, pollution, indiscriminate cutting of live trees, wildfire, inappropriate farming practices, illegal fishing methods, sand and gravel mining, and illegal hunting/killing of wildlife. With increasing population and its associated demand for settlement and food (agriculture), encroachment has been the greatest threat to wetlands in Ghana leading to loss of greater portions of these important ecosystems. Though the management of wetland is under the mandate of Ghana Wildlife Division, other institutions, especially Non-governmental Organisation have also supported the fight against wetland degradation. This work explored the many strategies available for addressing these challenges through interviews using semi-structured questionnaires. Area coverage of wetlands should be clearly defined and physically demarcated. Local support for wetlands conservation is important to sustain conservation actions. There is the need also for the recognition that local controls and enforcement mechanism have the potential to achieve more success in wetland resource management. Government support by way of effective laws and their enforcement are needed. Developing wetland resources to attract tourism can help to promote their protection.

The Role of the "Kenya Lake System" in the conservation of the Great White Pelican (*Peleacanus onocrotalus*)

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Abstract

The Kenya Lake System was inscribed as a World Heritage Site by UNESCO in June 2011. The three lakes consist of Lake Bogoria, Lake Nakuru and Lake Elmenteita that are located within the East African Rift System along with Lake Naivasha. The lakes are recognized as Wetlands of International Importance as well as Important Bird Areas (IBA) by the Ramsar Convention and Birdlife International, respectively. These lakes are known for their high numbers of migratory and residential birds that are listed as vulnerable, endangered and species of least concern by the IUCN. These lakes, together with their riparian land, support over 500 million birds and over 70 species of mammals. The Great White Pelican (GWP) is known to feed in large numbers in Lake Nakuru and Lake Naivasha but breed at Lake Elmenteita the only known breeding site in East Africa Rift Valley. The three lakes hold over ten thousand individuals annually on average. In 2009, over seventy thousand individuals were recorded in Lake Nakuru while Lake Naivasha had over 3,000 individuals in the same year (National Museums of Kenya). The population of these globally threatened birds fluctuates depending on food availability and water levels. Over eight thousand breeding pairs of Great White Pelican have been observed in Lake Elmenteita. Satellite tracking has shown over-wintering of the GWP from the European region into the East African Lakes. Despite their capacity to support a huge diversity of flora, fauna and avian life, these lakes face a number of challenges. No comprehensive strategy for conservation of the Great White Pelican has been developed as few studies have been conducted on this species. Siltation, pollution and uncontrolled developments at the sites have contributed to the destruction of the natural habitat. The high water levels experienced in 2013 submerged the breeding islands and changed the lakes' ecology. New research is required in order to develop clear management strategies for conserving the species and enhancing the long-term management of these sites.

Conserving seagrass beds in West Africa, ResilienSEA

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Abstract

Information on seagrasses of West Africa is highly deficient, and as a result, conservation measures for protecting these important ecosystems are largely inadequate. This lack of information has also led to the limited number of experts actively involved in seagrass conservation, as well as integration of their conservation measures in coastal zone management plans. This by extension is also causative of the fact that they are not well featured in national and sub-regional policies. The ResilienSEA project, funded by the MAVA Foundation for Nature, aims to improve knowledge on seagrasses of West Africa, and to fill the aforementioned information gaps for their conservation. To do this, the project focuses on the following strategies: conducting scientific research, building capacities of stakeholders, setting up the required partnerships for long-term protection, as well as communication at national, regional and international levels. With the aforementioned strategies, the ResilienSEA project equips West African conservationists with the necessary tools and expertise to better conserve the pilot seagrass sites in the coastal areas of the seven target countries (Mauritania, Senegal, The Gambia, Guinea Bissau, Guinea, Cape Verde and Sierra Leone). In these countries, the project works with government institutions, academia, civil society, media, etc., to make sure that by 2022, seagrass beds in West Africa are protected using the appropriate plans and policies based on verified scientific information. From the year 2018 till present, the project has successfully mapped all pilot sites in the seven countries, launched an MSc scholarship programme and provided technical training (regional and national), as well as offer policy support for seagrass inclusion in the additional protocols of the Abidjan Convention. The project will continue to strengthen the partnerships and prepare for a successful launch of a phase 3 after the departure of the main donor (MAVA Foundation for Nature) in 2022.

Keywords: Seagrass, Research, capacities, partnerships, policies

Case study on Mangroves and Oysters

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Abstract

Mangroves are very important to the estuarine ecosystems because they provide a vast number of goods and services providing refuge for juvenile fish and other animals including oysters. Red mangroves, because of their unique root structure, facilitate oysters' growth by providing protection from sedimentation and offering a stable refuge during storms. The mangrove Oyster (*Crassostrea tulipa*) is an important source of proteins and income to the coastal communities in West Africa especially in Senegal contributing to food security and to the welfare of the community. The mangrove oyster is usually harvested by women by cutting the roots of the mangrove trees on which matured oysters are found. Though the Oysters are very important to the communities, their traditional harvest has put enormous pressure to mangrove conservation and subsequently, threatening the stock of Oysters in the future. Wetlands International developed a new sustainable way of growing Oysters, increasing their production hence allowing women to increase income and sustain food security for their families. This shows different steps of a more sustainable way of Oysters production and the increasing benefits of women who depend on mangrove products.

Keywords: Mangroves, Oysters, food security.

Wetlands-wise use impacts on Livelihoods and Food Security in Northern Ghana

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Abstract

Climate change have adverse effects on food security and livelihoods of rural communities in developing countries. Empirical evidence shows that sustainable wise-use of wetland resources for farming can enhance livelihoods and reduce the effects on rural household's food insecurity. However, there is a dearth in knowledge as to how current food policies in Ghana are informed by farmer wise-use of wetland resources and its impact on livelihoods and food security. This study examines the link between wetland wise-use and livelihoods and food security in Northern Ghana. We analyze data obtained from a multi-stage sampling procedure where 305 households were randomly selected in Northern, Upper East and Upper West Regions under CAW-OSIWA project of enhancing rural livelihoods and food security through wise use of wetlands in northern Ghana in May 2019. We find that adoption of wetland wise-use strategies provides a viable option for livelihood of rural households. Also, the results revealed that adoption of wise-strategies improves farmers' productivity and household food security. The study recommends promotion of sustainable wetland wise-use strategies (crop and livestock farming) that allow the rural communities to use wetlands to enhance their livelihood with minimum degradation. Secondly, wise-use strategies should be integrated within the broader agricultural development policies that aimed at reducing poverty and increasing farm income in order to provide the necessary incentives for the rural communities to adopt wise-use wetland management options.

Key words: Wetlands, Adoption, Wise use, Livelihoods, Food Security, Northern Ghana

Linking research and conservation needs of mangrove wetlands in West - Central Africa: current status, challenges and prospects

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Abstract

Western Africa wetlands classified as marine/coastal, inland and man-made wetlands cover more than 15% surface area with mangroves in 19 countries (Mauritania to Angola coast in the Gulf of Guinea). Playing significant ecological, economical and socio-cultural roles in the lives of coastal communities. Mangroves are in moderate decline, with average estimates reducing a quarter between 1980 and 2006 driven by population growth, economic and political trends, climate change and changes in upstream habitat. Well known threats not properly quantified and documented for management applications. Few ongoing efforts including conservation (20% in protected areas), restoration programmes, isolated and uncoordinated governmental and NGOs projects with little private sector participation. Few isolated research initiatives hardly integrated into projects; mangrove issues largely descriptive with little quantitative data or information on stocks, regeneration dynamics and flows of ecosystem services and threats to guide any sustainable mangrove management and livelihood support actions. Fewer projects have monitoring components not capitalized for research endeavors supporting decision making processes. Future challenges and perspectives further examined include amongst others: mainstreaming mangrove and wetlands research activities into regional forestry projects as a core component, capacity building with private sector involvement.

Keywords: mangroves, wetlands, research, conservation, West-Central Africa

Anthropogenic and eco-climatic factors as drivers of wetland conversion: Observations from Ondo State's wetland areas, Southwest Nigeria

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Abstract

Diverse wetland habitats respond to climate change with other environmental stressors in different ways. Human disturbances and climate change have affected wetlands worldwide over a long period. By altering wetlands pattern and extent, these eco-climatic factors have changed the viable wetland ecosystems and resulted in the shrinkage of its spatial extent. As more wetlands have been disappearing over the years, there is currently limited information on how eco-climatic factors drive wetland conversion within a short period on a local scale. In this study, cloud-based (Google Earth Engine) and machine learning techniques used to determine the extent and drivers of wetland conversion within five years period (2015 and 2020) in Ondo State (Nigeria). Fifty-eight eco-climatic factors were employed to determine the drivers of wetland conversion. The wetlands in Ondo State covered a landmass of 89.46km^2 (0.58%) in 2014 and increased to 316.13 km^2 (2.04%) in 2020. They are widely distributed close to the Atlantic Ocean at the southern edge of the State. However, the wetlands changed to degraded vegetation/agricultural lands (6.10km^2; 0.04%), open secondary forests/plantations (1.24km^2; 0.01%) and built-up areas/bare grounds/rock outcrops (1.95km^2; 0.01%) within the period. Burn severity, solar radiation, anthropogenic activities, urbanization, water availability, precipitation, soil quality, topography, atmospheric temperature, and wind speed influenced wetland conversion based on the machine learning iterations. The findings in this paper provide additional information and theoretical guidance for wetland monitoring and management. Also, it would help achieve ecological protection and well-coordinated wetland resource development with utilization in the wetland areas of Ondo State, Nigeria.

Keywords: wetland conversion; burn severity; machine learning; climate change; Nigeria

Ecological risk of metal contamination in Densu Delta Wetlands.

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Abstract

Metal contaminations in aquatic environment originate from human activities such as mining and effluents. Wetlands are important coastal system but most vulnerable to chemical contamination. To evaluate ecological risk of metal pollution in Densu Delta Wetlands, surface sediments were collected (n = 10) in ten stations with an Eckman grab. The concentration of metals (zinc, lead, copper, mercury, iron, and manganese) in sediment was analyzed using standard methods. The ranges of metal concentrations (mg/kg) are Fe, 201.10 to 720.90; Mn, 40.10 to 152.70; Zn, 7.3 to 158.3; Pb, 1.9 to 84.7; Cu 3.4 to 23.0; and Hg, 0.01 to 0.05. The mean concentration of metals in the sediment were Fe > Mn > Pb > Zn > Cu > Hg. The highest mean concentration of Fe reflects redox conditions. There is a low contamination factor (CF) for five metals (Zn, Hg, Fe, Cu, and Mn) (CF < 1) to high contamination of Pb (3 < CF ≤ 6). The most toxic metals were Pb and Hg. The decreasing order of Potential Ecological Risk (PER) of metals was Pb (PER = 44.75) > Hg (PER = 28.78) > Cu (PER = 7.29) > Zn (PER =2.62). The risk assessment showed that Pb had the highest ecological risk, followed by Hg while Zn had the lowest risk. The study contributes to understanding metal contamination in tropical estuarine wetland environment. The findings provide evidence to support effective legislation to control chemical contamination in coastal ecosystems.

Waterbird population estimates in Hadejia-Nguru wetlands: analysis of a five-year monitoring program

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Abstracts

This paper reports the population of waterbird species estimated within a five-year survey; 2015, 2016, and 2018 to 2020. Overall, results reveal 1,139,666 individual birds of 93 species from 19 families. The average waterbird population was 40330 individuals in 2015 (species richness, S, 64), 33281 in 2016 (S=61), 49950 in 2018 (S=64), 40773 in 2019 (S=72), and 63598 in 2020 (S=70). There was no significant difference in bird population and richness across the years ($p \geq 0.05$). The bird families with the highest bird species were Accipitridae (11 species), followed by Ardeidae (11 species), and Anatidae and Scolopacidae (10 species each). The three waterbird species with the most population were White-faced Whistling Duck (443652), Garganey (234074 individuals) and Ruff (168142). Generally, the waterbird population in the Hadejia-Nguru wetlands did not show declines over the survey period even though there has been evidence of fluctuation. Four species of conservation concern were recorded; Beaudouin's Snake Eagle (Vulnerable), Hooded Vulture (Critically Endangered), Martial Eagle (Vulnerable) and Pallid Harrier (Near Threatened). There is more need for monitoring and census of waterbirds at a different season of the year and increase awareness of conservation in the wetland would ensure the long-term management of waterbirds and their habitat.

Developing guidelines for managing habitat for waterbirds along the East Atlantic Flyway in Africa - a case study of coastal birds in Lagos, Nigeria

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Abstract

Coastal wetlands are important habitats for many migratory and resident bird species, and provide important food resources for shorebirds. However, wetlands around the world are being lost and degraded, not least of all, in Lagos, Nigeria, where wetlands are continually being reclaimed for development. On February 2021, five coastal wetland locations in the Lagos Metropolis were surveyed for water birds, ongoing human activities, threats and management status. This survey turned up twenty-eight (29) bird species that are known to use coastal habitats, some classified as shorebirds. Of these, 6 species have populations that migrate within Africa, 7 species are Palearctic migrants, and the others are resident species. Many activities that are likely to threaten the survival of these birds were also observed including: artisanal fishing, commercial boating, sand dredging, indiscriminate waste disposal, land development, aquaculture and logging. These activities pose threats directly and indirectly to the survival of the birds which depend on these habitats. Indirect threats include the modification, deterioration, and eventual loss of habitat, and direct threat is through fisheries by catch. Furthermore, these coastal bird habitats were mostly overseen by traditional leaders but mostly unmanaged with regard to conservation and sustainable use. This study reveals, even more urgently, the need for more research and long-term monitoring programs for shorebirds. Although there are widespread threats to coastal birds and their wetland habitat, we do not yet know the degree to which they may threaten the survival of shorebirds in Lagos in the long-term. Data gotten through research will speed up, and fast-track conservation efforts.

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