Wetland Vegetation Resources and Livelihood Outcomes of Yala Swamp Residents

Anntonina Ngina Muendoh, Prof. Maurice Sakwa

Department of Development Studies, Jomo Kenyatta University of Agriculture and Technology

DOI: https://dx.doi.org/10.47772/IJRISS.2024.804079

Received: 24 March 2024; Revised: 03 April 2024; Accepted: 06 April 2024; Published: 07 May 2024

ABSTRACT

Wetlands are highly productive ecosystems, providing several goods and services that are of value to people. Never the less, there is limited evidence to attest to this value especially in wetland areas of Kenya. The study was conducted to assess the effects of wetland vegetation use on community member's livelihoods. The research design of the project was a descriptive survey with a sample of 200 participants drawn from households in Yala swamp area. Data was collected from a sample of 146 households using a structured questionnaire. This represented a 73.2% response rate, which was considered sufficient for analysis and inference. The study showed that the wetland vegetation use has a positive influence on both improved healthcare and nutrition of the Yala swamp community members. The study concluded that wetland vegetation resources played an important role in ensuring the community members' livelihood outcomes through improved incomes, healthcare, and better nutrition. The study recommends that wetland resources should be protected otherwise, their key functions could be impaired when wetlands are lost or degraded.

Key terms: Wetland resources, vegetation, livelihood outcomes, Yala Swamp.

BACKGROUND OF THE STUDY

An ecosystem is a dynamic complex comprised of communities of microbes, plants, and animals, which interact as a functional unit with the living environment Convention on Wetlands (2021). It is common knowledge that wetlands provide numerous ecosystem services that are advantageous to human health. The Convention on Wetlands (2021) identifies several primary ecological services provided by wetlands, including but not limited to recreation, fiber production, water supply, water purification, climate regulation, flood control, and coastal protection. Particularly significant is the contribution of wetlands to the subsistence of the impoverished in developing nations. For example, C.M. and McInnes, R.J. (2019) states that wetland activities contribute to 50% of the monthly income of the dependent population.

Numerous wetlands are inhabited by unique plant species that have adapted to the damp and dry cycles of the environment. Additionally, unique grasses such as water couch and common papyrus reed, sedges, spike-rushes, aquatic macrophytes (e.g., ribbon weed and Ruppia), herbs and forbs (e.g., nardoo), algae, and mosses can be found in wetlands. Saltmarshes are home to vegetation that has adapted to saltier conditions IPCC (2018). On the basis of the predominance of their vegetation and the frequency of inundation, inland wetlands fall into three distinct categories Angelsen et al., (2011). Permanent wetlands, characterized by continuous or near-constant flooding, are predominantly inhabited by aquatic vegetation, Sedges, rushes, spike-rushes, water couch, common reed, and herbs and forbs, primroseand Ranunculus species are characteristic of semi-permanent wetlands, which are typically flooded annually. Ephemeral wetlands, characterized by sporadic inundation and extended periods of drought, support various dryland species such

as lignum, river red gum, black box, and coolabah Diwa, J.B. (2021). They also provide habitat for an assortment of animals this is according to Cuni-Sanchez, A., Omeny, P., Pfeifer, M., Olaka, L., Mamo, M.B., Marchant, R. and Burgess, N.D. (2019). Certain areas, such as the Yala wetland, contain a unique variety of clay that is found only in specific locations and contains minerals that are vital for animal life and cattle use this clay as a salt lick Abirdew, S. (2021).

Habitants residing in wetland regions frequently fashion baskets, mats, and seats from the plants that are readily accessible. Cut papyrus fronds are utilized in the production of a variety of items for sale or personal use. In addition to housing linens and drying surfaces, mats also exhibit promise as materials for roofs and ceilings. Variously sized mats are crafted from papyrus and are commercially traded for monetary compensation. Wetlands also provide access to construction materials, with vegetation and papyrus being utilized as roofing materials. Papyrus is packaged in bundles, of which thirty can be used to construct a dwelling of average size Githumbi E, Courtney Mustaphi C, Marchant R. (2021). It would be expensive to construct a comparable dwelling using iron sheeting for the roofing material. Thus, the replacement value of papyrus as a construction material is as follows. In addition to clay and trees, the wetland accommodates construction materials. Traditional dwellings in the wetland region are constructed from materials such as clay, sand, wood, and papyrus; for these materials, the majority of the population depends on the wetland. Twelve percent of the population near Lake Kanyaboli derives direct income from the sale of construction materials Eneji, C. et al., (2021). Additionally, wetlands supply the wood and stucco used to construct and adorn the walls of dwellings. In the absence of these wetland products, masonry would have to be utilized as an alternative, which would incur additional expenses. Bricks are produced by employing earth furnaces to bake a unique clay sourced from wetlands. Plants residing in wetland habitats serve as a source of fuel, comparable to charcoal or firewood; inhabitants of the vicinity rely on fuel wood for both commercial and non-commercial needs.

Kenya possesses remarkable wetland ecosystems, including river floodplains, lake systems, and deltaic mangrove formations that encompass an estimated 10% of the country's land area IPCC, (2022). Wetlands have the capacity to serve as agriculturally viable areas due to their ample water supply and high soil fertility. Consequently, wetlands can be considered as valuable assets in the fight against poverty Chepkoech, W.et al., (2018). According to reports, wetland vegetation significantly contributes to food security and direct financial income, both of which are vital to livelihoods. Numerous households employ wetlands as a buffering mechanism when food becomes scarce Bett, H.K. et al., (2018). Prior research on the utilization of wetlands in Kenya has predominantly concentrated on prominent wetland areas that are predominantly linked to economically significant activities, including transportation, transportation, and fishing. Therefore, the economic value of wetland vegetation in Siaya County's Yala marshland, a satellite of Lake Victoria, was investigated in this study. The main objective of the study was to identify the effects of ecosystem assets use on the community members' livelihoods in Yala swamp with special attention given to the effects of use of wetland vegetation resources on the community members' livelihoods. This study is meant to add to the existing body of knowledge in the areas of community development and management of wetland ecosystems as well as enhancing efforts towards overall sustainable development which would go a long way in ensuring that people living in wetland areas have continued access to provisioning, cultural, regulating and supporting benefits that wetland ecosystems offer while addressing.

METHODOLOGY

The study was conducted around Yala wetland located in Siaya County in Kenya, from January to March 2023. It applied the survey design to investigate the effect on wetland resources on livelihoods of the residents of Yala swamp which has an estimated population of 1,866 (KNBS, 2009). The study area has four conservation groups whose members were targeted: Hawinga with 532 members, Nyadorera (458 members), Kadimu (407 members) and Muweri with 469 members. A sample size of 200 was obtained

using Yamane (1967):

$$n = \frac{N}{1 + \mathrm{N(e)}^2}$$

n = sample size

N = total population

e = is the level of precision

the confidence level is 95% which yields a margin of error of ± 5%. Utilizing the formula where our population is 1866:

$n = \frac{1236}{1+1236(0.05)^2}$ = 200

The study adopted stratified sampling using conservation groups are strata. This ensured equal chances of participation by members and proportional allocation of the sample to the groups. The four strata had sampling allocation as follows: Hawinga (57), Muweri (50), Nyadorera (49) and Kadimu (44). A total of 200 structured questionnaires were administered by the researchers to the participants from which 73.2% response rate was achieved. Data was analyzed using descriptive statistics in which mean scores were used to further explain the Likert scale tables which were interpreted as (minor 1.0 – 1.6, neither minor nor major 1.7 -2.3 and major 2.4 – 3.0), Chi-Square and Regression tests, where Ordinary Least Square (OLS) regression on the effect of wetland vegetation resources and livelihood outcomes in Yala swamp community (see Table 9) was carried out. In addition, to simplify the number of factors on which the variables under investigation had more loading a rotated component matrix was used.

FINDINGS

Background Characteristics

The study considered various demographic characteristics which gender, age, household head, level of education, number of dependents, occupation, and distance from home to the wetlands. Findings in Table 1shows that more female than male respondents participated more in this study. These results can be attributed to the fact that women, and not men spend most of the time in homes and that is why the researcher could find them in homes.

The age of the most sampled respondents fell within 30-35(30.1%) and 40- 45 years at (28.8%) each, followed by those within 25-30 (21.2%) age bracket and lastly by those within 18-25 (12.3 %) and 35-40 years at (7.5%). This imply that the study collected data from both the young and the elderly. In addition, data was collected from people of maturity age.

The study findings revealed that 94(64.4%) of the households in Yala swamp are headed by men while 52(35.6%) by the females. As seen in many cultures, men play the role of household heads. On education, the study has shown that the majority of the residents 66(45.2%) have secondary school as their highest formal education attained, followed by 51(34.9%), primary education then college with 22(15.1%). The minority 4(2.7%) had a university degree and 3 (2.1 %) never attended any formal education training. Education facilitates the acquisition of knowledge, values, and habits in one's occupation which influences how one accurately utilizes available resources. Concerning occupation, findings show that respondents' composition constituted different professions, with the majority 55(37.7%) being business people, 41(28.1%) farmers, 30(20.5%) are fishermen and lastly 20(13.7%) are teachers.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

Table 1: Demographic characteristics of study participants

Variable	Frequency	Percent
Gender		
Female	83	56.8
Male	63	43.2
Total	146	100.0
Age (years)		
18-25	18	12.3
25-30	31	21.2
30 – 35	44	30.1
35 – 40	11	7.5
40 – 45	42	28.8
Total	146	100.0
Gender of household head		
Male	94	64.4
Female	52	35.6
Total	146	100.0
Education level	53	14.7
Primary	51	34.9
Secondary	66	45.2
College	22	15.1
University	4	2.7
Never attended	3	2.1
Total	146	100.0
Occupation		
Fishing	30	20.5
Farming	41	28.1
Teaching	20	13.7
Business	55	37.7
Total	146	100.0

Effects of wetland vegetation resources use on community member's livelihoods.

The livelihood outcomes of the community members of Yala Swamp examined in the study included how the community used the income earned from ecosystem assets to improve their nutrition and health. Firstly, the participants were asked to indicate how they used wetland resources to improve their income. Table2 presents summary statistics. The mean score indicates varied reactions regarding wetland resource use and livelihoods of the residents of Yala swamp. The respondents generated income through growing crops in the wetland and selling them. This was their major source of income. Income was also generated by selling handicrafts made from wetland vegetation, selling of event decorations and medicinal herbs. The data was in agreement with Ramsar (2005) that people residing near wetlands derive economic benefits from wetland vegetation resources.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

Table 2: Use of wetland resources to improve income.

Item	Frequency	Mean	Standard Deviation
Making and selling event decorations	23 (21.3%)	2.2	0.833
Selling crops grown from the wetland	56(38.4%)	2.9	1.930
Selling medicinal herbs from the wetland	14(9.5%)	2.4	0.8206
From harvesting wetland vegetation and selling them to crafters and event decorators	15(10.3%)	2.4	0.8265
Through selling handicrafts made with wetland vegetation	30 (20.5%)	2.7	1.903

Secondly, the respondents were required to indicate how they used wetland resources to better their health. Findings are presented in Table3.

Table 3: Use of wetland resources in improving health

Item	Frequency total	Mean	Standard deviation
Get food from the wetland	54 (36.9%)	2.9	1.79372
Income from wetland carters for hospital checks	49 (33.6%)	2.6	0.8886
Used herbs available in the wetland to cure diseases	43 (29.5%)	2.0	0.82603

According to the means, respondents used the wetland vegetation for food and also proceeds from wetland as the major sources to improve their health. The herbs played neither a major nor a minor role in the respondent's health. This can be attributed to most people moving from using traditional methods to cure their illnesses to conventional medicine. the results also suggest that community members around the wetland have used the wetland resources (vegetation and aquatic) to improve their diet which has had a positive impact on their overall health. This can also be seen in Chettri, S. et al. (2011) study that communities surrounding wetlands can utilize resources for a specific purpose or combine different uses to maximize gains or benefits. The wetland also provides medicinal benefits to residents from

local shrubs and trees whose fruits, flowers, leaves, roots and barks are used to treat a wide range of ailments. These results agree with those of Sarmah et al. (2013), Panda and Misra (2011), Marti (2011) and Salem and Mercer (2012).

Thirdly, the study inquired from the participants how they used wetland resources to improve their nutrition. The results are summarized in Table 4.

Table 4: Use of wetland resources to improve nutrition

Item	Frequency	Mean	Standard deviation
By consuming the aquatic resources wetland	41 (28.1%)	2.8	0.871
Eating wild vegetables from the wetland	45 (30.8%)	2.9	0.946
Used herbs available in the wetland	40 (27.4%)	2.6	0.8640
Extra income from wetland resources also carters for nutritional needs	20 (13.7%)	1.7	0.7571

Given the statistics, the study observes that the major contributors to nutrition vegetables and aquatic resources i.e., fish from the wetland and the use of wild herbs as medicine and also as food. With extra income from the wetland resources being used to carter for other nutrition needs such as purchase for fruits,

cereals, and other items to further the respondent's wellbeing. In addition, earnings from sales of wetland resources i.e., vegetation, aquatic and water being used indirectly to boost nutrition. These findings are in agreement with those of Agatha (2014) on Yala swamp where the residents derived nutritional benefits through fish, crops, and traditional vegetables among others. The results corroborate with those of Terer (2004) also cited by Momanyi (2015).

Factor analysis was conducted to bring out the key aspects of community members livelihood outcomes in Yala. The Varimax rotated matrix on the principal component factor loading was used to identify these aspects (See Table 5).

Table 5: Rotated Component Matrix on Livelihood Outcomes

Participants arguments	Components		
	Improved healthcare	Improved nutrition	increased income
Income from wetland vegetation resources contributes to healthcare	**.805**	-.064	-.012
Wetland vegetation's income enhances health of my household's	**.687**	.355	.155
Ecosystems assets have a major contribution to livelihood outcomes	**.744**	-.179	-.279
Wetland contribution to health	.295	**.595**	.112
Wetland resources contribution to nutrition of the families	.015	**.865**	.165
Important contribution	.085	**.795**	.125
Incomefrom wetland resources improves nutrition of the people	.023	.397	**.797**
Wetland resources improves income of the household in the community	.102	.247	**.547**
Mean of components	**2.50**	**2.1**	**2.13**
Alpha Cronbach	**0.712**	**0.81**	**0.71**

The variables of livelihood outcomes were substantially loaded on three components. The first component comprises of statements which are associated with improved healthcare, the second is compost of statements related to improved nutrition and the third component is associated with increased income. The study established a mean response of the first component of 2.50 which indicates that the respondents used wetland vegetation resources majorly to improve their healthcare. Concerning the second and the third components, the means of 2.1 and 2.13 shows that wetland resources had neither minor nor major influence on improvement of the participants nutrition and income respectively. This imply that the participants were indifferent on this issue. The alpha Cronbach coefficients for the components met the reliability test threshold.

Concerning use of wetland vegetation, the researcher enquired from the respondents to indicate what type of wetland vegetation they exploited. Table 6 presents summary statistics.

Table 6: Vegetation Resources Exploited

Item	**Frequency total**	**Mean**	**Standard deviation**
Vegetation type			
Papyrus	41 (28.1%)	3.0	0.986

Reeds	28 (19.2%)	2.5	0.8451
Grass	20 (13.7%)	2.3	0.876
Wild vegetables	16 (10.9%)	2.1	0.803
Herbs	14 (9.6%)	2.0	0.818
Ferns	27 (18.5%)	2.4	0.853

From the table, the significant vegetation resources were papyrus which was used to a great extent followed by reeds and ferns. This can be attributed to the fact that they are the dominant species of vegetation on the wetland and, they have a wide range of uses. Grass was somewhat used by the community members mostly for foliage and construction. Wild vegetables and herbs were also somewhat used by the respondents mostly for food and medicine. These observations were in agreement with the Omeny, P., Pfeifer, M., Olaka, L. (2019) findings that around swamps a large number of the inhabitants earn direct income from a combination of materials such as papyrus, reeds and grasses.

The respondents were also asked to indicate what they do with the wetland vegetations. Table 7 summarizes the results.

Table 7: Use of Wetland Vegetation

Item	**Frequency**	**Mean**	**Standard deviation**
Vegetation for making handicrafts	53 (36.3%)	2.7	0.8937
Vegetation for event decorations	33 (22.6%)	2.3	0.8260
Vegetation for animal fodder	32 (21.9%)	2.2	0.8867
Vegetation for building construction i.e., roofing	15 (10.3%)	1.8	0.7878
Vegetation for medicinal purposes	13 (8.9%)	1.6	0.6446
	146 (100%)		

The results show that most of the respondents (36.3%) agreed that the major use for the wetland vegetation was handcrafts making where reeds, papyrus and ferns were majorly used. Event decorators used vegetation in a neither major nor minor way. Other uses of vegetation that were neither minor nor major were for animal fodder and for construction as the community members had moved from thatching their houses with grasses and other vegetation to using iron sheets to a great extent. Vegetation used for medicine was a minor use which makes sense as most respondents could access modern health care from clinics and hospitals thus minimizing use of herbs as medicine.

The study conducted factor analysis on the use of wetland vegetation for economic purposes to generate variables for regression estimation. Table 8 presents Varimax rotated matrix on the principal component factor loading was used to identify these variables.

Table 8: Rotated Component Matrix on the use of wetland vegetation

Participants arguments	Component
	Use of wetland vegetation
Vegetation for making handicrafts	**.515**
Vegetation for event decorations	**.601**

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VIII Issue IV April 2024

Vegetation for animal fodder	**.748**
Vegetation for building construction i.e., roofing	**.695**
Vegetation for medicinal purposes	.805
Mean of components	**2.60**
Alpha Cronbach	**0.812**

The variables of wetland vegetation were adequately loaded on one component now called, use of wetland vegetation resources. This component has a mean value of 2.6 which means that the respondents used wetland vegetation resources majorly. The alpha Cronbach coefficient of 0.812 met the reliability test threshold

Table 9: Regression Confession

Variables	Model 1				Model 2				Model 3			
	B	**Std. Error**	**T**	**Sig.**	**B**	**Std. Error**	**T**	**Sig.**	**B**	**Std. Error**	**T**	**Sig.**
Constant	1.025	.093	.272	.002	.326	.089	3.66	.001	1.005	.093	10.81	0.000
Wetland vegetation	.119	.090	1.019	.001	.382	.091	4.216	.000	.322	0.80	3.33	.001
Dependent	Improved health				Improved nutrition				Increased income			
R – squared	0.230				0.381				0.45			
Adj. R squared	0.209				0.130				0.165			
Std. Error	0.633				0.935				0.194			
F ratio (2, 115)	4.215				9.497				1.267			
Prob. > F	0.030				0.000				0.000			

The F-statistics findings indicate that the regressed models are statistically significant given the p-values of less than 0.05. The R-square statistics shows that wetland vegetation resources have a 23% influence on improved healthcare of the study participants and 38.1% influence on improved nutrition. Concerning the coefficient of regression, the results show that use of wetland vegetation resources has a positive and statistically significant influence on both improved healthcare and nutrition of the Yala Swamp residents. Specifically, the study reports that a unit change in the use of wetland vegetation resources leads to 11.9% improvement in the health and 38.2% improvement in the nutrition of the community. This imply that use of wetland vegetation resources for economic purposes has a greater impact on the Yala residents' nutrition.

Furthermore, findings indicate that use of wetland vegetation resources increases the income of community members. This is demonstrated by positive and statistically significant coefficient between increased income and wetland vegetation resource use. These results are consistent with various other studies. For example, Martini, Buffa & Parisi (2008) established a statistically significant positive relationship between use of wetland vegetation resources and increase in the income of the households. In addition, Baral, S., Basnyat B., Khanal, R., and Gauli, K. (2016) argues that wetland vegetation in Kenya is used for income generation and as thus, improving the livelihood outcomes of the people. Kakuru et al. (2013)) established similar findings where they noted that permanent wetlands, which are always or nearly always flooded, are dominated by aquatic plants such as ribbon weed (*Vallisneria* species) and wavy marshwort good for economic value of the residents. Wetland vegetation is almost a basic need essential for the households adjacent to the wetland. Those living close to the wetland for example use the vegetation for livestock feed, as food, medicine, for construction, for events such funerals and weddings, for furniture making all activities which bring income to the household. Romulus (2014) reported similar findings from Yala swamp where vegetation extracted from the wetland was used mainly for domestic purposes while Oduor et al. (2015)

reported the vegetation harvested was used for commercial purposes by local people in Yala wetland.

CONCLUSION

The purpose of the study was to investigate the effect of wetland vegetation resource on the community member's livelihoods. Descriptive statistics shows that the study participants generated income through growing crops in the wetland and selling them thus agriculture in the wetland was the major source of income for respondents followed by sale of handcrafts. Most used vegetation resources are papyrus which are the dominant type of vegetation with wide range of uses. Grass is commonly used to make foliage and for construction as well as wild vegetation and herbs are also used by the community for food and medicine. Vegetation resources were mainly used for making handcrafts, fodder for animals, house construction, and decorating events. Nevertheless, the use of wetland vegetation as medicine was minor. Regarding regression analysis, the R-square statistics shows that wetland vegetation resources have a 23% influence on improved healthcare of the study participants, 38.1% influence on improved nutrition and 35% increase in income. The study has established that use of wetland dvegetation resources has a positive and statistically significant influence on both improved healthcare, nutrition, and income of the Yala Swamp residents. The study concludes that earnings from sales of wetland vegetation have a positive impact on livelihood outcomes of the residents of Yala swamp. Thus, this study recommends protecting or conservation of these resources otherwise their key functions are impaired when wetland vegetation is lost or degraded. In addition, communities within and around wetlands should be sensitized on the value of the resources within these lands. This can help to reduce the levels of unemployment and poverty in those areas.

REFERENCES

1. Githumbi E, Courtney Mustaphi C, Marchant R. (2021). Late Pleistocene and Holocene Afromontane vegetation variability at a headwater wetland within the Eastern Mau Forest, Kenya. Journal Quaternary Science.
2. Ahidur, R. (2016). Impact of Human Activities on wetland: a case study from Bongaigaon District,
3. Assam, India. International Journal of Current Microbiology and Applied Sciences. ISSN: 2319-7706 Volume 5 number 3(2016)
4. Githumbi E, Kariuki R, Shoemaker A, Courtney Mustaphi C, Chuhila M, Richer S, Lane P, Marchant R. (2018). Pollen, people and place: paleoenvironmental, archaeological, and ecological perspectives on vegetation change in the Amboseli landscape, Kenya. Frontiers in Earth Science
5. Baral, S., Basnyat B., Khanal, R., and Gauli, K. (2016). A total economic valuation of wetland ecosystem services: An evidence from Jagadishpur Ramsar site, Nepal. The Scientific World Journal
6. Abila, R. Marta Barluenga, Johannes Engelken, Axel Meyer and Walter Salzburger (2004): population – structure and genetic diversity in a haplochromine cichlid of a satellite lake of Lake Victoria. In: Molecular Ecology Angelsen, A., Larsen, H.O., Lund, J.F., Smith-Hall, C. and Wunder, S. Eds. (2011). Measuring Approaches. Nairobi: Acts Press.
7. Boyard-Micheau, J., Camberlin, P., Philippon, N. and Moron, V. (2013), "Regional-scale rainy season onset detection: a new approach based on multivariate analysis", Journal of Climate, Vol. 26 No. 22
8. Byg, A. and Salick, J. (2009), "Local perspectives on a global phenomenon – climate change in Eastern Tibetan villages", Global Environmental Change, Vol. 19 No. 2
9. Chaudhary, P. and Bawa, K.S. (2011), "Local perceptions of climate change validated by scientific evidence in the Himalayas", Biology Letters, Vol. 7 No. 5
10. Chaudhary, P., Rai, S., Wangdi, S., Mao, A., Rehman, N. and Chettri, S. (2011), "Consistency of local perceptions of climate change in the Kangchenjunga Himalaya landscape", Current Science, Vol. 101 No. 4
11. Chepkoech, W., Mungai, N.W., Stöber, S., Bett, H.K. and Lotze-Campen, H. (2018), "Farmers' perspectives: impact of climate change on African indigenous vegetable production in Kenya",

International Journal of Climate Change Strategies and Management, Vol. 10 No. 4
12. Crona, B., Vetenskapsakademien, K., Wutich, A., Brewis, A. and Gartin, M. (2013), "Perceptions of climate change: Linking local and global perceptions through a cultural knowledge approach", July.
13. Convention on Wetlands (2021), "Global wetland outlook: special edition 2021", Secretariat of the Convention on Wetlands, Gland, Switzerland, available at: www.global-wetland-outlook.ramsar.org/
14. Cuni-Sanchez, A., Omeny, P., Pfeifer, M., Olaka, L., Mamo, M.B., Marchant, R. and Burgess, N.D. (2019), "Climate change and pastoralists: perceptions and adaptation in montane Kenya", Climate and Development, Vol. 11 No. 6
15. Davidson, N.C., van Dam, A.A., Finlayson, C.M. and McInnes, R.J. (2019), "Worth of wetlands: revised global monetary values of coastal and inland wetland ecosystem services", Marine and Freshwater Research, Vol. 70
16. Dinku, T. (2019), "Challenges with availability and quality of climate data in Africa", in Melesse, A.M., Abtew,W. and Senay, G. (Eds), Extreme Hydrology and Climate Variability: Monitoring, Modelling, Adaptation and Mitigation, Elsevier, New York, NY
17. Dinsa, T.T. and Gemeda, D.O. (2019), "The role of wetlands for climate change mitigation and biodiversity conservation", Journal of Applied Sciences and Environmental Management, Vol. 23 No. 7
18. Eneji, C.-V.O., Onnoghen, N.U., Acha, J.O. and Diwa, J.B. (2021), "Climate change awareness, environmental education and gender role burdens among rural farmers of Northern Cross River state, Nigeria", International Journal of Climate Change Strategies and Management, Vol. 13
19. De Groot, C. (2002). Social Capital: The Missing Link. In Uslaner, E.M. (Ed.), Social Capital and Participation in Everyday Life, London: Routledge.
20. Kamanga, P., Vedeld, P., Sjaasatd, E. (2009). Forest incomes and rural livelihoods in Chiradzulu District, Malawi. Ecological Economics,
21. Faniriantsoa, R. (2023), Enacts Datasets Documentation, Earth Institute, Columbia, SC.
22. IPCC (2018), "Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change"
23. IPCC (2022), "Climate change 2022: impacts, adaptation, and vulnerability. Contribution of working group II to the sixth assessment report of the intergovernmental panel on climate change, in Pörtner, H.O., Roberts, D.C., Tignor, M., Poloczanska, E.S., Mintenbeck, K., Alegría, A., Craig, M., Langsdorf, S., Löschke, S., Möller, V., Okem, A. and Rama, B. (Eds), Cambridge University Press, Cambridge, UK and New York, NY
24. Wood, AP, Dixon, AB & McCartney, M. (2013). Wetland Management and Sustainable Livelihoods in Africa. Earthscan, London.
25. Yamane, Taro. 1967. Statistics, An Introductory Analysis, 2nd Ed., New York: Harper and Row.
26. Addis, Y. and Abirdew, S. (2021), "Smallholder farmers' perception of climate change and adaptation strategy choices in Central Ethiopia", International Journal of Climate Change Strategies and Management