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IMPLICATIONS OF ANTHROPOGENIC INDUCED PERTURBATIONS ON NIGERIAN NATIONAL PARK RANGELANDS

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ABSTRACT

This paper reviews the implications of anthropogenic induced perturbations on national Park rangelands. It aimed at investigating the degradation, effects and sustainability of national park rangelands in Nigeria. The proximate causes of rangeland degradation include overgrazing, logging, hunting, unsustainable fuelwood use, mining, and plowing of rangelands with subsequent loss of soil productivity while ultimate causes are typically associated with policies, socio-economic changes or interactions of socio economic and governance factors with climatic stressors such as drought, desertification, erosion and flood. The loss of biodiversity is the end product of a wide range of factors causing rangeland degradation. Social and economic systems provide the context and rationale for rangeland management in national parks. Sustaining rangeland ecosystems requires attention to the social, economic and ecological conditions. National parks play a pivotal role in biodiversity conservation efforts since they are the means of protecting species that cannot sustain in anthropogenic interference ecological settings. It is also the place of natural evolution and forthcoming ecological restoration. Hence, conservation of rangelands in national parks is a vital issue that needs to be addressed for sustainable development.

Keywords: Rangeland, Biodiversity, Perturbation, Conservation, National park, Nigeria.

INTRODUCTION

Anthropogenic Induced perturbations have continuously inhabited the national park rangelands resulting to serious biodiversity decline due to loss of species, habitat and ecosystems in recent time. National parks across the world are most threatened by unsustainable resource use, these threats are most prevalent in developing countries where local communities in and around national parks depend on forest resource collection for their livelihoods (Center for International Forestry Research (CIFOR), 2018). This has been a result of increasing human populations, economic and social changes, climate change, demand from urban centers and improved access to once remote areas (Carter *et al*., 2014; CIFOR, 2018). The increasing levels of rangeland degradation are now common features in Nigeria National parks and the loss of these lands and their associated biodiversity is becoming a cause of great concern because of the numerous consequences.

Nigeria is blessed with rich and unique array of ecosystems which have evolved a diversity of fauna and flora (Meduna *et al*., 2009). This ranks Nigeria as one of the richest countries of Africa in terms of biodiversity (Meduna *et al*., 2009). However, biodiversity conservation in protected areas including the country's national parks' rangelands is facing serious anthropogenic induced perturbations. Several authors (Meduna *et al*., 2009; Nchor and Ogogo, 2012; Oladeji *et al*., 2012; Abdulkadir, 2015; Malik *et al*., 2016; Shettima *et al*., 2017; Adetola and Ofuya, 2021) have identified some of the anthropogenic induced factors affecting rangeland conservation in Nigeria Nnational parks to include land clearing for agriculture, enclave communities, uncontrolled logging, mining, firewood collection, overgrazing, uncontrolled bush burning and poaching.

Sustainable management of rangeland ecosystems has direct implications for conservation of biological diversity and for the livelihoods of local communities (Bhattarai, and Upadhyay, 2013). The high rate of rangeland degradation in Nigeria national parks calls for an urgent need for the development and implementation of systematic approaches to local ecosystem management actions. These approaches may relieve the level of resources degradation by minimizing the degree of local communities' dependence on these resources (Anemut, 2006; Secretariat of the Convention on Biological Diversity SCBD, 2008). To overcome this strong dependence, a deeper understanding on the implications of anthropogenic induced perturbations on national park rangelands is of paramount importance thereby, calling for developmental strategies to control human induced threats for sustainability.

The Conceptual Framework of Anthropogenic Induced Perturbations
Perturbation refers to an alteration of the function of a biological system, induced by external or internal mechanisms (Wang, 2013). When the concentration of a biological species is perturbed, the perturbation can spread along physical interactions and reactions, reaching other parts of the ecosystems (Santolini and Barabási, 2018). Anthropogenic implication on the environment includes changes to biophysical environments (Wuebbles *et al*., 2017) and ecosystems, biodiversity and natural resources (Hawksworth and Bull, 2008; Sahney *et al*., 2010). Anthropogenic Induced land changes as manifested in many national parks in Nigeria, drive changes in biogeochemical processes, with altered ecosystems often leading to global warming (Cook, 2016; Wuebbles *et al*., 2017), which in turn cause climate change (in form of drought, flood and favourable environment for pathogen and invasive species manifestation) and environmental degradation such as ocean acidification, mass extinction and biodiversity loss, ecological crisis and collapse (Wuebbles *et al*., 2017).

Rangeland Degradation
The term land degradation describes a process, when land is destroyed. It is a human induced or natural process which negatively affects the land to function effectively within an ecosystem, by accepting storing and recycling water, energy and nutrients (World Summit on Sustainable Development WSSD, 2005). Land degradation is the temporary or permanent lowering of the productive capacity of land. It thus covers the various forms of soil degradation, adverse human impacts on water resources, deforestation, and lowering the productive capacity of rangelands (Ladan, 2004). Rangeland degradation is therefore, defined as the reduction or temporary loss of the biological and economic productivity of land (World Meteorological Organization WMO, 2005). Currently, rangeland degradation has been identified as one of the most serious global environmental issues (Wessels *et al*., 2007).

Rangeland degradation is of concern for a vast area of the world's rangelands and their value for ecosystem services including food, water, and livelihoods for many of the poor forest inhabitants (Asner *et al*., 2004). Reynolds *et al*. (2003) also stressed that no general concept of land degradation exists that is uniformly applicable to all situations because it is necessary to define the factor being degraded. However, in general, degraded rangelands are characterized by sustainedreduced biological and economic productivity associated with improper or

unsustainable human land uses and the impact of this unsustainable use on hydrology, soil processes, and vegetation composition (Bedunah *et al*., 2012) is becoming a source of concern.

Causes of Rangeland Degradation

Historically, anthropogenic activities have been in existence in forests and dates back to early human occupation of forest regions (Neelo *et al*., 2015). Loss of biodiversity and rangeland result from many proximate and ultimate causes, some of which are natural but aggravated by anthropogenic activities. The proximate causes of rangeland degradation include overgrazing, unsustainable fuelwood (including shrubs) use, mining, and plowing of rangelands with subsequent loss of soil productivity (Bedunah *et al*., 2012). Nwonkonwo (2003), Ladan (2004), Akosim (2012) and WWF (2015) identified land use and land cover change, poverty, excavation and construction activities, urbanization, bush burning, expansion of invasive species, habitat modification, population growth, the severe impact of fertilizers on the environment, land pollution, climate change and over exploitation of natural resources as the proximate and primary causes of rangeland degradation.

The ultimate drivers, however, are typically associated with policies, socio-economic changes, or interactions of socio-economic and governance factors with climatic stressors such as drought (Bedunah *et al*., 2012). Also, geomorphic processes, such as gully formation, may have significant effects on vegetation productivity and creating rangeland degradation (Hobbs *et al*., 2008; Stavi *et al*., 2010). One of the approaches in conservation plans of natural environment is the separation of local people from the area that is under conservation, but this measure is a potential degrading factor (Homewood, 2004; Goldman, 2003).

Another rangeland degradation factor cited is the role of policies and regulations i.e., land management or land tenure and the hypothesis that environmental sustainability is inversely related to the levels of hierarchy and dissociation present in the governing body (Hill, 2006). Similarly, rangeland degradation can also occur by rangeland fragmentation, there are three general categories of processes causing fragmentation of rangelands worldwide: dissection, decoupling, and compression (Hobbs *et al.*, 2008). Management methods also plays an important role in the sustainable use of rangelands and different studies have been conducted for surveying efficacy of different rangeland management methods (Verdoodt *et al*., 2009; Batabyal, 2004).
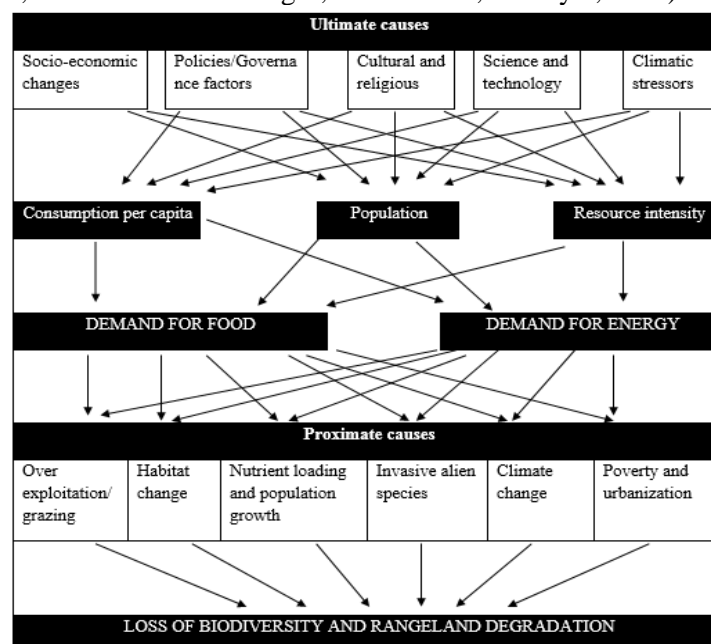

Figure 1: Causes of biodiversity loss and rangeland degradation
Source: Akosim (2012)

Anthropogenic Induced Threats in Nigeria National Parks

Anthropogenic induced threat is defined as activities of human origin that cause significant damage to protected areas or in serious conflict with the objectives of the protected areas administration and management (Tranquilli *et al.*, 2014). National parks were established mainly to maintain biological diversity and natural formations including rangelands (Nigeria National Park Service NNPS, 2021). Many of these national parks are experiencing degradation (Nchor and Ogogo, 2012; Abdulkadir, 2015; Adetola and Ofuya, 2021). Nchor and Ogogo (2012) in their survey identified the most pervasive anthropogenic induced threats to rangeland management across the seven (7) national parks in Nigeria to include logging, enclave communities, grazing, illegal farming,

mining, trans-border and wildfires. They also pointed out that the average degree of each anthropogenic induced threat in the rangelands of the seven Nigeria national parks ranged from 2.7 to 19.6 with hunting (19.6) being the highest across the Parks followed by grazing (18.1), enclave communities (14.7) and logging (13.7). Fishing (12.3) was also high while illegal farming, mining, and trans-border were moderate. NTFP and illegal fires were mild (Table 1). This implies that the top four anthropogenic induced threats that occurred across the seven Nigeria national park rangelands include hunting, logging, encroachment/enclave communities and grazing. Generally, anthropogenic induced threats were highest in KLNP (153) followed by CRNP (123) and CBNP (104). GGNP (96), KNP (91) and OONP (81) had moderate anthropogenic induced threats while ONP (38) suffered from mild anthropogenic induced threats (Nchor and Ogogo 2012).

Table 1: Overall Threats in all the Nigeria Parks

Anthropogenic Threat	CRNP	GGNP	CBNP	OONP	ONP	KLNP	KNP	Total	Average Score
Hunting	27	8	10	18	12	18	27	137	19.6
Logging	36	12	0	0	18	18	12	96	13.7
NTFP's	8	1	2	2	2	2	2	19	2.7
Illegal Farming	2	8	4	2	2	8	2	28	4.0
Enclave communities	27	18	0	0	4	36	0	103	14.7
Mining	0	0	6	27	0	4	0	31	4.4
Fishing	8	27	12	12	0	27	0	86	12.3
Trans border	12	12	12	0	0	2	0	38	5.4
Grazing	2	8	27	18	0	36	36	127	18.1
Fires	1	2	2	2	0	2	12	21	3.0
Total	**123**	**96**	**104**	**81**	**38**	**153**	**91**	**686**	**98.0**

Key: CRNP = Cross River National Park, GGNP = Gashaka Gumti National Park, CBNP = Chad Basin National Park, OONP = Old Oyo National Park, ONP = Okomu National Park, KLNP = Kainji Lake National Park, KNP = Kamuku National Park, NTFP's = Non-Timber Forest Products.
Source: Nchor and Ogogo (2012)

Abdulkadir (2015) and Malik *et al*. (2016) in their study, reported high destruction of biodiversity and its rangeland in Gashaka Gumti and Kamuku national parks due to illegal livestock grazing, crop farming on the parkland and fuelwood collection. Overgrazing and deforestation over time have reduced the abundance and diversity of natural flora and fauna in Kainji Lake, Old Oyo and Gashaka Gumti national parks (Meduna *et al*., (2009; Oladeji *et al*., 2012; Malik *et al*., 2016). Shettima *et al*. (2017) report on assessment of human activities in Chingurmi Duguma Sector of Chad Basin National Park highlighted the most

common threats as cultivation, grazing, collection of gum, poaching and deforestation. The major threat indicators in Cross River national park were found to be human encroachment and logging (Adetola and Ofuya, 2021).

Researchers have a tendency to categorize the communities located within or around the protected areas as marginalized communities with little political influence, remote from established markets and employment opportunities and lacking critical services and

infrastructure (Asebe, 2012). Although there is some truth in this perception, it is important to note that there are differences within these communities in terms of social and political systems, economic activities, history and most importantly the linkages of these parks to national, regional and international economics and networks (Simmon, 2018).

Implications of Anthropogenic Threats on National Parks

Research shows that, humans are responsible for the extinction of species 100 - 1,000 times than the natural rate of extinction and it is estimated that up to 25 % of the world's fauna and flora could extinct by the middle of the next century (WWF, 2018). Research further states that, human interference on the natural ecosystems is creating a significant obliteration by posing a threat on the sustenance of natural habitats (FAO, 2011; Stolton *et al*., 2013). Deforestation is one of the anthropogenic activities that do occurred either by farming activities through shifting cultivation practice, extractions of fire wood through trees felling practice, poaching, hunting and gathering through bush burning, etc, which lead to serious dessert encroachment (Shettima *et al*., 2017) and environmental problems. The rate at which the dessert encroachment is taken place now is more than 1.5 kilometres per year, and this may be due to human activities. These negative activities have some negatives implications on fauna, flora species (Shettima *et al*., 2017) and ecological systems.There are various ways through which human activities present risks to biodiversity and ecosystem services. Such ways include direct ingestion, absorption by plants, food chains, consumption of contaminated water and alteration of soil pH, porosity, colour and its natural chemistry which in turn implicate the soil quality (Meer *et al*., 2018) thereby causing rangeland degradation in national parks.Ecological diversity offers a natural capital of plant and animal species. Biodiversity constitutes the genetic diversity, the species diversity and the ecosystems diversity (Dudley, 2008). In line with this, national parks play a pivotal role in global biodiversity conservation efforts since they are the means of protecting species that cannot sustain in human interference ecological settings.

Constraints to Rangeland Management in Nigeria National Parks

Rangelands are characterized by conflicts related to land uses (Selemani, 2014). Human population saturation in high fertile lands (buffer zones) and reliable rainfall areas has motivated in-migration to rangelands where people can access land for cultivation (Kideghesho *et al*., 2013). According to Nchor and Ogogo (2012), the major constraints of rangeland management in Nigeria national parks were in the area of inadequate boundary demarcation, unsettled disputes regarding land tenure or used rights between local communities and park authorities, inadequate staff and financial resources to conduct critical law enforcement activities. The major staffing weakness across the seven national parks in Nigeria was number of staffs. Lack of funding was the indirect cause of this shortfall (Nchor and Ogogo, 2012). Nchor and Ogogo (2012) also established that, the negative implications of low staff levels across the Nigeria national parks particularly in the area of protection were widespread, ranging from poor to ineffective law enforcement; poor threat detection, litigation, monitoring or prevention; high workloads and staff morale.

The consequences of inadequate trained staff include inadequate communication with local communities. A range of simple but critical skills such as community relations and conflict resolutions were identified as areas that require improvement.Malik *et al*. (2016) pointed out that arrest is a major tool of law enforcement in Nigerian protected areas but has not been a deterrent or reduced illegal activities in the protected areas particularly National Parks due to frequent release of offenders by courts and mild penalties imposed by current conservation laws. Nchor and Ogogo (2012) echoed that, the protection and development of Nigeria national parks continues being a challenge due inadequate funding which has led directly to a raft of other management problems, including inadequate field equipment, transportation, and facilities.

Strategy Development for Addressing Anthropogenic Induced Threats in National Parks

Based on the local context, management objectives of the national parks, status of the natural capital, etc, different strategies can be deployed in addressing the implications of anthropogenic induced perturbations on the natural resources. Devising appropriate strategies which could help to alleviate the interrelated challenges of forest degradation is an essential element for effective management of national parks. Conservation education with rural communities should be emphasized. Conservation education may help re-align the people's minds toward protection of biodiversity and thus conservation would trickle down from people's own initiatives. Transforming communities into conservators requires clear understanding of the value that nature and the consequences of having non-functional ecosystems (Jafari *et al*., 2013). Those who destroy biodiversity in order to survive should be provided with adequate alternative livelihood strategies. The conservation policies should take the issue of population growth as a challenge that calls for pragmatic approaches for its solution (Jafari *et al*., 2013).

In responding to the anthropogenic induced threats which rangelands in protected areas are facing, Pressey *et al*. (2015) designed the logic model in developing the strategic interventions (figure 2). This model begins with targets/goals/objectives - action - inputs - outputs and finally outcomes. Pressey *et al*. (2015) described the targets, goals and objectives as the measures to be formulated and deployed in the performance management of a given strategic action designed to show the chain of influence. Inputs are financial or material investments in enhancing the management of national parks (Stem *et al*., 2005).Outputs are the concrete, tangible and countable direct results that emanate from the implementation of conservation activities (Pressey *et al*., 2015).Outcomes are the expected short-term and long-term impacts of different intervention outputs (CTOC, 2018) which will help to enhance the conservation and rehabilitation of Rangelands in national parks by ensuring sustainable development and utilization of the ecosystem services that in turn contribute in meeting the national targets of ecotourism development; the policy and strategy of parks and the regulations associated with National Parks development and protection.

According to Shakman and Rodriguez (2015), the Logic Model also "provides a kind of map for a program or initiative, helping clarify a program or policy's destination, the pathways toward the destination, and markers along the way. It also shows the linkages among the required inputs, activities and the ultimate desired outcomes of an initiative. The logic model is also regarded as it is not a strategic or fully developed plan for designing or managing a program or policy" since "additional work is necessary to create both programmatic and evaluation plans" (Shakman and Rodriguez, 2015). Hence, this approach helps to describe the process of the desired change in the park by making explicit ways of thinking about the current human induced problems, its underlying causes, the long-term change sought, and what needs to be in place for the realization of the change to come about. This process also calls for the prior and proper analysis of the identified threats on the natural capitals of the park since without a well evidenced supportive procedure and a proper situational analysis, the crafting and exploring of alternative strategies may prove to be misleading in achieving the intended outcome of conserving the biodiversity potential of rangelands in National Parks.
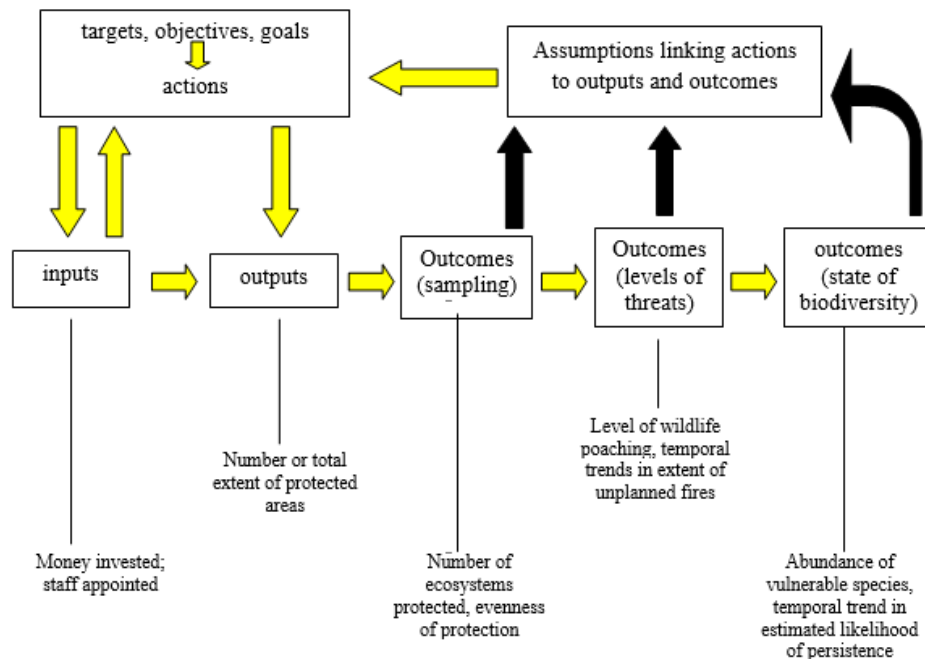
Figure 2: Logic model for achieving biodiversity conservation in rangelands
Source: Pressey (2015)

CONCLUSION AND RECOMMENDATIONS

To maintain and improve ecosystem services from rangelands, we must understand the direct and indirect causes of rangeland degradation in national parks, the interest indicated by diverse groups in society to improve rangeland conditions, what role range scientists play in these issues, and why rangeland science has apparently been unsuccessful in ''heading off'' the problem in Nigeria. Rangelands can be used sustainably if their ecosystems are maintained intact and they are most productive with increasing diversity.

Human encroachment, expansion of invasive species, adjacent land development, poaching, expansion of agricultural activities, increased livestock pressure and cutting of trees for meeting household energy demands are among the rampant threats that affect the biodiversity potential of Nigeria national parks, thus affecting the productive potentials of the rangelands. The indicative strategic approaches which will help to counteract these challenges could include, securing the park boundaries by regulations; establishment of buffer zones which would benefit the local and indigenous communities by designing management plans; and enhancing law enforcement. The best strategic approaches in addressing rangelands degradation and reduced human induced impact on national parks is through the adoption of logic model and promotion of public awareness and education. The lack of environmental education is the main factor undermining economic development and intensifies degradation of biodiversity and ecosystems in national parks. Here efforts could be made to design education and public awareness programmes to communicate crucial environmental messages to the communities by utilizing numerous mediums and strategies including social media, popular theatre, traditional media such as radio and television.

REFERENCES

Abdulkadir, I.W. (2015). Community participation in the management of Kamuku national park, Birnin Gwari, Kaduna State, Nigeria. A thesis submitted to the department of Geography, Ahmadu Bello University, Zaria, Nigeria: 1-54.

Adetola, B.O. and Ofuya, E.E. (2021). Evaluating the mitigation measures to biodiversity threats in Cross River national park, Nigeria. International Journal of Conservation Science. 12(1): 237-246.

Akosim, C. (2012). The tragedy of the commons: Biodiversity perspective in the north east region of Nigeria. 15th inaugural lecture presented to Modibbo Adama University of Technology Yola, Adamawa State. Nigeria on 7th November, 2012: 12-22.

Anemut, B. (2006). Determinants of Farmers' Willingness to Pay for the Conservation of National Parks: The Case of Simen Mountains National Park, Haromaya University, Ethiopia.

Asebe, R. (2012). Contesting Views on a Protected Area Conservation and Development in Ethiopia. *Journal of the Social Sciences*. 1-14.

Asner, G.P., Elmore, A.J., Olander, L.P., Martin, R.E. and Harris, A.T. (2004). Grazing systems, ecosystem responses and global change. Annual Review Environmental Resources 29:261–299.

Batabyal, A.A. (2004). A note on first step analysis and rangeland management under uncertainty. *J. Arid Environ*. 59(1):159-166.

Bedunah, D.J., Jay P. and Angerer, J.P. (2012). Rangeland degradation, poverty, and conflict: How can rangeland scientists contribute to effective responses and solutions?*Rangeland Ecol. Manage.* 65:606–612.

Bhattarai, K.R. and Upadhyay, T.P. (2013). Rangeland Management in Sagarmatha (Mount Everest) National Park and Buffer Zone, Nepal: An Ecological Perspective," *Mountain Research and Development*. 33(1): 19-28.

Carter, R.W., Walsh, S.J., Jacobson, C. and Miller, M.L. (2014). Global Change and Human Impact Challenges in Managing Iconic National Parks. *George Wright Forum*. 31(3): 245–255.

Center for International Forestry Research (CIFOR), 2018). Protected areas threatened by overexploitation and human activity, study finds. https://www.cifor.org. Accessed on June 23, 2021.

Center for Theory of Change (CTOC), (2018). Theory of Change. The Center for Theory of Change, Inc. http://www.theoryofchange.org/what-is the theory-of-change/how-does-theory-of-change-work/when-to-use/. Accessed on June 12, 2021.

Cook, J. (2016). Consensus on consensus: a synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*. 11 (4): 048002.

Dudley, N. (2008). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN: 1-86.

Food and Agricultural Organization (FAO), (2011). The State of the World's Land and Water Resources for Food and Agriculture, Managing systems at risk. Earthscan 711, Third Avenue, New York, NY 10017.

Goldman, M. (2003). Partitioned nature, privileged knowledge: Community-based conservation In Tanzania. *Development and Change*. 34(5): 833–862.

Hawksworth, D.L. and Bull, A.T. (2008). Biodiversity and Conservation in Europe. *Springer*. p. 3390.

Hill, J.B. (2006). Human ecology in the Wadi Al-Hasa: Land use and abandonment through the Holocene. The University of Arizona, Press, Tucson.

Hobbs, N.T., Galvin, K.A. Stokes, C.J., Lackett, J.M., Ash, A.J. and Boone, R.B. (2008). Fragmentation of rangelands: implications for humans, animals and landscapes. *Global Enivron. Change.* 18: 776–785.

Homewood, K.M. (2004). Policy, environment and development in African rangelands. *Environmental Science and Policy*. 7: 125–143.

Jafari, K., Alfan, R., Kuruthumu, M. and Ismail, S.S. (2013). Emerging issues and challenges in conservation of biodiversity in the rangelands of Tanzania. *Nature Conservation*. 6:1-29.

Kideghesho, J., Nyahongo, J., Hassan, S., Tarimo, T. and Mbije, N. (2006). Factors and Ecological Impacts of Wildlife Habitat Destruction in the Serengeti Ecosystem in Northern Tanzania. *Ajeam-ragee*. 11: 917-932.

Ladan, S.I. (2004). The phenomenon of land degradation in Nigeria: A review of effects and current solutions. *Journal of Applied Science and Technology*. 6(1): 390-399.

Malik, R., Yager, G.O. and Ojo, V.A. (2016). Assessment of illegal activities carried out by rural dwellers in selected support zone communities of Gashaka-Gumti national park in Taraba State, Nigeria. *Nigerian Journal of Agriculture, Food and Environment*. 12(1):52-55.

Meduna, A.J., Ogunjinmi, A.A. and Onadeko, S.A. (2009). Biodiversity conservation problems and their Implications on ecotourism In Kainji Lake National Park, Nigeria. *Journal of Sustainable Development in Africa*. 10(4): 59-73.

Meer, B.B., Dishan, E.E., Ikima, D. and Ateh, G.O. (2020). Ecological Implication of Environmental Contaminants on Biodiversity and Ecosystem Services: The Nigerian Experience. *Research Journal of Soil and Environmental Science*. 2(1): 1-9.

Nchor, A.A. and Ogogo, A.U.(2012). Rapid assessment of protected area pressures and threats in Nigeria national parks. *Global Journal of Agricultural Sciences*. 11(2): 63-72.

Neelo, J.,Teketay, D., Kashe, K. and Masamba, W. (2015). Stand Structure, Diversity and Regeneration Status of Woody plant species in Open and Exclosed Dry Woodland Sites around Molapo Farming Areas of the Okavango Delta, Northeastern Botswana. Open Journal of Forestry, 5, 313-328.

Nigeria National Park Service (NNPS), (2021). Cross River National Park. Available: https://www.nigeriaparkservice.org/?p=140. Accessed on July 12, 2021.

Nwonkonkwo, C.W. (2003). Rural Women and Environmental Degradation in Nigeria. Paper Presented at the 2nd National Conference Organized by School of Arts and Social Sciences, Federal College of Education, Katsina.

Oladeji, S.O., Agbelusi, E.A. and Trevelyan, R. (2012). Anthropogenic activities threatening the management of ecotourism resources in Old Oyo national park, Nigeria. *Ethiopian Journal of Environmental Studies and Management*. 5(1): 100-110.

Pressey, R.L., Visconti, P. and Ferraro, P.J. (2015). Making Parks make a Difference: poor alignment of policy, planning and management with protected-area impact, and ways forward. *Phil. Trans. R. Soc.* B 370: 20140280.

Reynolds, J.F., Smith, D.M.S. and Lambin, E. (2003). Do humans cause deserts? An old problem through the lens of a new framework: the Dahlem desertification paradigm. In: Allsopp, N., Palmer, A.R., Milton, S.J., Kirkman, K.P., Kerley, G.I.H., Hurt, C.R. and Brown, C.J. [Eds.]. Proceedings of the 7th International Rangelands Congress; 26th July–1st August 2003; Durban, South Africa. Hilton, South Africa: Grassland Society of Southern Africa: 107.

Sahney, S., Benton, M.J. and Ferry, P.A. (2010). Links between global taxonomic diversity, ecological diversity and the expansion of vertebrates on land. *Biology Letters*. 6 (4): 544–547.

Santolini, M. and Barabási, A.L. (2018). Predicting perturbation patterns from the topology of biological networks. Proceedings of the National Academy of Sciences. Jul 2018, 115 (27): E6375-E6383.

Secretariat of the Convention on Biological Diversity (SCBD), (2008). Protected Areas in Today's World: Their Values and Benefits for the Welfare of the Planet. Montreal, Technical Series no. 36: 1-96.

Selemani, I.S. (2014). Communal rangelands management and challenges underpinning pastoral mobility in Tanzania: a review. Livestock. *Research for Rural Development*. 26(78): 1-10.

Shakman, K. and Rodriguez, S.M. (2015). Logic Models for Program Design,

Implementation, and Evaluation: Workshop toolkit (REL 2015–057). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Northeast and Islands. http://ies.ed.gov/ncee/edlabs.Accessed on August 10, 2021.

Shettima, M.L., Mohammed, A.G., Waziri, M., Na'isa, M.A.K., Aliyu, A., Badawi, H.L., Edet, B.E. and Musa, A.M. (2017). Survey and Assessment of the human activities in Chingurmi Duguma Sector of Chad Basin National Park, North–Eastern Nigeria. *International Journal of Environmental Protection and Policy*. 5(6-1): 50-70.

Simmon, S. (2018). Responses of Vegetation, Small Mammals and Large Herbivores to Human Induced Pressures in the Savannah Plains of Nech Sar National Park, South Ethiopia Rift Valley. University of ANTWERP, Belgium Faculty of Science Department of Biology, PhD dissertation.

Stavi, I., Perevolotsky, A. and Avni, Y. (2010). Effects of gully formation and head cut retreat on primary production in an arid rangeland: Natural desertification in action. *J. Arid Environ*. 74(2): 221-228.

Stem, C., Margoluis, R., Salafsky, N. and Brown, M. (2005). Monitoring and Evaluation in Conservation: a review of trends and approaches. *Conserv. Biol*. 19, 295–309.

Stolton, S., Shadie, P. and Dudley, N. (2013). IUCN WCPA Best Practice Guidance on Recognising Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area Guidelines Series No. 21, Gland, Switzerland: IUCN. xxpp.

Tranquilli, S., Abedi-Lartey, M., Abernethy, K., Amsini, F., Asamoah A, Balangataa C, Bouanga E, Breuer, T., Brncic, M.T, Campbell, G, Chancellor, R, Chapman, C.A., Davenport, T.R.B., Dunn, A., Dupain, J., Ekobo, A., Eno-Nko, M.,

Furuichi, T., Gatti, S., Ghiurghi, A. Hashimoto, C., Hart, J.A., Head, J., Hega, M., *et al*., (2014). Protected Areas in Tropical Africa: Assessing Threats and Conservation Activities. *PLoS ONE*. 9(12):114-154.

Verdoodt, A., Mureithi, S.M., Ye, L. and Van-Ranst, E. (2009). Chrono-sequence analysis of two enclosure management strategies in degraded rangeland of semi-arid Kenya, *Agriculture, Ecosystems and Environment.* 129 (1): 332-339.

Wang, R.S. (2013). Perturbation. In: Dubitzky, W., Wolkenhauer, O., Cho, K. H. and Yokota, H. (eds) Encyclopedia of Systems Biology. Springer, New York, NY. Available: https://doi.org/10.1007/978-1-4419-9863-7_385. Accessed on August 12, 2021.

Wessels, K.J., Prince, S., Malherbe, J., Small, J., Frost, P. and Van-Zyl, D. (2007). Can human induced land degradation be distinguished from the effect s of rainfall variability? A case study in South Africa. *J. Arid Environ*. 68 (2): 271–297.

World Meteorological Organization (WMO), (2005). Climate and land degradation. WMO-No989: 1-35.

World Summit on Sustainable Development (WSSD), (2005). WSSD 2002 Teachers Guide – Land Degradation. Available: http://www.birdlife.org.za/resoruces/wssd. Accessed on July 16, 2021.

World Wide Fund for Nature (WWF), (2018). Living Planet Report - 2018: Aiming Higher. Grooten, M. and Almond, R.E.A. (Eds). WWF, Gland, Switzerland.

Wuebbles, D.J., Fahey, D.W., Hibbard, K.A., DeAngelo, B., Doherty, S., Hayhoe, K., Horton, R., Kossin, J.P., Taylor, P.C., Waple, A.M. and Weaver, C.P. (2017). Executive summary. In: Climate Science Special Report: Fourth National Climate Assessment. Volume I [Wuebbles, D.J., Fahey, D.W., Hibbard, K.A., Dokken, D.J., Stewart, B.C. and Maycock, T.K. (eds.)]. U.S. Global Change Research Program, Washington, DC, USA: 12-34.