# Sustainable Forestry and Fisheries Resources Management in the Context of Coronavirus Pandemic in Africa

**[1]Ismail Olabisi AZEEZ* & [2]Siyanbola Adewumi OMITOYIN**

[1]Department of Social and Environmental Forestry
[2]Department of Aquaculture and Fisheries Management,
Faculty of Renewable Natural Resources, University of Ibadan, Nigeria
*Email: azeezismail2000@yahoo.com

**Abstract**

Apart from serving as veritable sources of livelihood, forest and fisheries resources are central to the provision of nutritious food and raw materials, most especially in Africa. However, the global impact of Coronavirus (COVID-19) has negative implication for sustainable exploitation and use of these resources in sub-Saharan Africa. Sustainable natural resources management had been submitted as key to overcoming covid-19 pandemic effect without suffering any loss in Africa. This chapter therefore reviewed the extant economic and social hardships, which the pandemic is provoking in the aquaculture, fisheries and forestry sectors with the view to formulating and maintaining sustainable natural resources and ecosystems protection agenda within the whims of Africa countries. The paper reported forest and fisheries resources as safety nets for meeting food shortages, essential health products, clean water and other natural products, most especially in rural Africa. It identified the nature nurturing services and utilities derived from forest products as under threat from Covid-19 induced pressure from urban residents' reliance on forests as food safety nets. impacts of the pandemic on Africa's fisheries and aquaculture sector were also reported to include reduction in the demand for her products from the hospitality, restaurant and catering (HORECA) sector; stagnant activity in the fish export market, price hike in the local fish markets and contamination of marine resources through human infection.

The paper therefore recommends the application of sustainable aquaculture, fisheries and forest resources management tools for resilience and recovery from the Covid-19 pandemic in Africa. Such tools, it emphasized must tap from policy recommendations based on in-depth understanding of the multi-stakeholder nature of the sector and make use of available financial and human resources efficiently.

**Keywords**: COVID-19 impact, forest resources, fisheries and aquaculture, Africa development, nature's safety nets.

## Introduction

Forests and forest resources make essential services and products available to support livelihood and health in normal times and during the time of crisis. Forests provide income, fuel wood and food security for households. Thus, increasing human wellbeing and reducing forest communities' vulnerability to shocks and adversities (Fisher and Shively, 2005). FAO (2018a) also submitted products from forests as providing food, income, and diverse nutrients for the vulnerable, globally. According to the World Bank (2021a) around 350 million people globally are estimated to be almost wholly dependent on forests. Forests also remove one third of global greenhouse gas emission annually, thus mitigating climate change (IPCC, 2013). Apart from harboring natural fisheries resources, mangrove forests also contribute to mitigation of climate change, protects the coast from tidal waves and are the richest in carbon of all tropical forests (Comforth *et al.,* 2013). Humans have also utilised renewable aquatic resources for food, clothes and other necessities since the creation of earth. Fisheries resources and aquaculture provide nutritious food and raw materials for hundreds of millions of people around the world and support over 10% of livelihoods (FAO, 2020b). Bondad-Reantaso *et al*. (2020) reposed fish and fish products as key components of a healthy diet that are safe to eat. Bernacsek (1987) posited fisheries as an important component of African economic sector, which employed between 5 and 10% of her agricultural labour force and contributed 7% to her agricultural exports. Essential services and products required for public health are also produced by the forestry sector globally. However, human footprint was estimated by FAO (2015) to have affected 83% of the global terrestrial land surface and has degraded about 60% of the ecosystems services in the past 50 years alone.

Covid-19, categorized as a pandemic originated from a market specialized in live animal and seafood in Wuhan, China (Jiang *et al.*, 2020) but has negative implication for sustainable exploitation and use of forests and aquatic resources globally. It is the current topical human footprint iterated by FAO (2020a) as having grave implications for: social protection, including health and safety; forest dependent livelihoods; international trade and supply (natural resources inclusive) chains; environmental stability; the vulnerable communities, including women; as well as good governance and progress towards achieving global development targets, most especially in the developing countries. Long-term impacts was predicted on the demand and prices of seafood unless timely, sound and decisive measures are taken to safeguard global food supply chains apart from protecting the poor and vulnerable (especially fishing) communities (World Fish, 2020). As aptly put by WWF (2020), the pandemic imposed debt burdens and poverty levels on African states and her citizens, which is among the highest in the world. It also has more negative impact on GDP levels across the African continent and its nature dependent economies (WWF, 2020). All sectors of the economy are disrupted by the pandemic, resulting in loss of income and jobs as well as aiding of urban-rural migration (UN/DESA, 2020a). Urban-rural migration has also increased the risk of degradation and wanton exploitation of natural resources with negative effects on the society and producers. Natural resources based sectors and practices may therefore have a critical role to play in the search for resilience to and hence recovery from the effect of the Covid-19 pandemic.

Sustainable natural resources management had been submitted as the key option available to Africa for overcoming covid-19 pandemic effect without suffering any loss. This is because despite the challenges, Africa has been submitted to possess a comparative advantage (over other continents) at resilience and recovery if sustainable harnessing and use of her renewable natural resources could be prioritize (WWF, 2020). It is thus imperative to look into and provide solutions to the immediate economic and social hardships, which the pandemic is provoking in the aquaculture, fisheries and forestry sectors with the view to formulating and also maintaining long-term natural resources and ecosystems protection agenda (EC, 2021). This chapter reviews the roles of forests and fisheries resources in the society, the impact of the pandemic on the sectors and explores the options for neutralizing the impact of the pandemic on Africans within available means.

**Roles of forest and fisheries resources in Africa development**

Apart from being the home to different tree species, forests host several non-timber forest products and wildlife including shedding the aquatic resources habitat. Forests alleviate poverty among rural communities; they are critically strategic to public health, disaster risk recovery and employment, yet they are continually under threat in Africa from wildfires, illegal logging, pollution and impacts of climate change. Thus, the forest ecosystem (made up of several micro-biomes) play different roles in the survival of different biological actors within, around and even far from the forest. Although, the resources therein are competition to other equally important human needs for food, shelter and infrastructure, forests supporting rather than dependence nature for human existence cannot be overstressed. Human's greatest challenge is thus balancing their existential support benefits from forests with other equally germane uses to which the land on which they are, can be put. Some identified human support benefits of forests are:

***Provision of safety nets***

Currently, most African nations are net food importers despite having more than 50%of the uncultivated, available arable land in the world (Deininger, 2011). FAOSTAT (2021) puts agricultural land use in Africa at 22.8% of those available for use between 1961 and 2018. This has grave implication for food security in the continent even before the advent of Covid-19 pandemic. Measures put in place by government to curb the spread of covid-19 pandemic, most especially limiting human movement or total lock down in some cases further compounded the problem as they take their tolls on global trading with attendant increase in food prices. Apart from the impact of global trading on food prices, farmers and labourers movement restrictions will also have negative implications for agricultural productivity. OECD (2020) observed that more than 50million African residents' could be pushed into a food situation by movement restriction.

The fall back in situations like this for most rural dwellers and even some urban poor is usually the aquatic and forest resources. Literature is replete with evidence of forests serving as safety nets to most residents in forest enclaves and environments (Zulu and Richardson, 2013; Kumar *et al.,* 2015; Kehlenbeck *et al.*, 2015). Fishing was reported as an important subsistence and safety-net activity for many of the world's poorest communities by

Holmes *et al.* (2014) while Paul (2020) submitted forest as playing key role in supporting global nutrition and food security. Though Wunder *et al*. (2014) reported a reduction in the reliance of the rural communities on forests due to economic growth at the beginning of the 21st century, these communities were observed to have earlier enjoyed forest provisions. As observed by FAO (2018a), 40% of the rural poor live in the savannah or forest areas and forests provide food, nutritional diversity and income for the vulnerable (estimated at 20% of the world population) globally. For example, fisheries provides about three billion of the global population with at least 20% of their total animal protein (FAO, 2014a).

Also, one of three people in the world still use wood fuel to meet their need for energy to heat their homes and cook (Zulu and Richardson, 2013; Kandel *et al.*, 2016; Démurger and Fournier, 2011) with reliance highest in Africa (Gond *et al.*, 2016; Eba'aAtyi *et al.*, 2016; FAO, 2014, 2017). FAO (2018a) also submitted charcoal and wood fuel as the most accessible and affordable sources of energy for people affected by humanitarian crises and natural disasters. Apart from the rural people, the forest also provides cardboard and paper based packaging for the delivery of food and household products in urban cities (APB, 2012; Mordor Intelligence, 2021). Thus a sustainably managed forest ecosystem is a useful safety net to the immediate and remote communities directly or indirectly.

***Provision of essential health products***

Apart from the medicinal uses to which forest fauna and flora can be put, the aesthetic, scenic and serenity of the forest biome is psychologically soothing to human mental health (FAO/UNEP, 2020). Land conservation, reduction of forest loss and fragmentation, creation of buffer zones through forest restoration have also been documented to possibly reduce human-wild animal interactions and by extension the risk of future disease outbreaks (Bloomfield *et al.*, 2020). This is because all existing infectious diseases in humans and 75% of emerging ones were transferred from animals to humans (UNEP, 2016). The clearing of forests for agriculture and other uses is therefore likely to predispose humans to infectious diseases from displaced wildlife. Even Bloomfield *et al.* (2020) linked increasing occurrence of diseases like COVID-19 to the absence of forests. Also worthy of note is that forest clearance affect wildlife biomes. This was why Holmes *et al.* (2014) hinges the continuous production of wild fish partly on the viability of the marine ecosystems (which is shed by forests) in which they

exist. Invariably forestry activities affect human health and the latter also affects the former (Colfer *et al.,* 2017).

In the same vein, 70 - 80 % of Africans consult traditional medical practitioners who often rely on medicinal plants. The United Republic of Tanzania, for instance, was reported to have 30,000 to 40,000 traditional practitioners compared with only 600 western doctors (Cunningham, 1993) while natural origin pharmaceuticals worth US$75 billion was reported sold yearly by Kate and Laird (1999). The prediction of the market value of Herbal Medicine to Surpass USD 129 Billion Revenue Mark by 2023 at 5.88% CAGR, by MRF (2021) also underscores the import of forest to the pharmaceutical industry. In addition, cleanliness is imperative in public health. African public health systems in urban cities and rural areas rely on forest products for sanitary and hygiene supplies like paper towels, toilet paper, tissues, ethanol used for sanitizers as well as soluble cellulose fibre and wood pulp for personal protective equipment like protective clothing and masks.

***Access to clean water***

Forests form an integral part of the global water cycle, with forested watersheds supplying 75% of the world's accessible freshwater. Stream flow regulation and recharge of groundwater will be achieved through restoration of degraded land and maintenance of forests. Forests filter water, affect rainfall patterns, provide 33% of drinking water to the largest cities of the world and reduce soil erosion (FAO, 2018a).But for the trees that capture and filter water, the intense but short duration rainfall associated with the semi-arid tropics would have resulted in soil erosion and land degradation (Tobella *et al.,* 2014; Ilstedt *et al*., 2016).Tree density, canopy cover and the spatial distribution of trees in dry land areas were submitted as key variables that affect hydrology by Tobella, *et al.* (2014) and Ilstedt *et al.* (2016). Qin *et al*. (2016) also linked drop in water quality to deterioration in tree cover and forest condition while Bruijnzeel (2014) and Ellison *et al*. (2017) observed a nexus between conversion of natural forests to other land uses and reduction in water storage capacity and groundwater recharge. Thus, access to clean water cannot be divested from sustainable forest management.

**Impact of COVID-19 on fisheries and aquaculture in Africa**

Identified impacts of the pandemic on Africa's fisheries and aquaculture sector include: highly significant reduction in the demand for her products from the hospitality, restaurant and catering (HORECA) sector; stagnant activity in the fish export market consequent upon the drop in domestic demand; and price hike in the local fish markets due to increase demand for locally-sourced fishes (OECD, 2020a).

Unlike their terrestrial counterpart, marine resources are not known to play any epidemiological role in the spread of Covid-19 to humans (Shahidi, 2020; WHO, 2020). However, infected human can contaminate marine resources. Thus, the need for immobilization of human through restriction of their movement as a key tool for containing COVID-19. While recognizing the import of industrial seafood systems to global food security and employment, FAO (2018b) pointed out the pivotal role of mobility to the success of the industry. Fishing is premised on the mobility of vessels, and mobility in the COVID-19 era is associated with risk of contamination. Vessels were among the first identified sources of global contagion: tight working and living quarters present risk for workers, and vessels can spread disease to multiple locations as they move through the sea. Usually, when fishing vessels arrive into port they offload catch, re-supply and rotate crew and aim to quickly return to sea. Today, this mobility is restricted in the interest of public health. Many ports either ban shore leaves and crew changes, or require 14-day quarantine either at sea or in designated onshore accommodations (ITF Seafarers, 2020; BIMCO, 2020). This has negative impact in that it stagnates and restricts activities in the fisheries sub-sector.

The aquaculture industry currently deals with a common disruption of demand causing dire penalties for the supply chain of fresh fish. Therefore, frozen seafood companies are facing strong demand. These companies may soon encounter some problems of re-stocking, if their logistics are constrained by restrictions (WHO, 2020).

**Consequences of the COVID-19 pandemic on the forestry enterprise**

As submitted by Sen (2020) the corona virus pandemic has woken the greatest global challenge in human history. This had resulted in an overstretched healthcare system and had a heavy negative toll on the

economic and social status of urban residents in cities and indigenous people deep in the forests (Attah, 2020). The increase in economic vulnerability is putting pressure on the forest's safety net role as more rural dwellers resort to meeting their subsistence needs using forest products. In the same vein, this group of forest dependents are also expected to be joined by millions of poor migrants' from cities struggling with unexpected loss of income and food insecurity. Forest industries are equally under pressure to meet demand for sanitary and disposable hygiene products like paper towels; tissues and ethanol used for sanitizers; personal protective equipment, like protective clothing; and masks for medical workers and the people (FAO, 2020c).

Africa had been posited as housing the extreme poor in the world, even prior to COVID-19. Of the extreme poor, 40% of those within rural areas are residents' in forest and savanna land areas (FAO, 2018a). IFAD (2016) reported 159 of the 284 million Africans eking their living in forest environments, as living below USD1.25/day. This may explain why any perturbation in the forest ecosystem will have dire consequences on these vulnerable group of people. Covid-19 pandemic is therefore a threat to the rural poor, most especially the indigenous peoples living in forests with no alternative to meeting their basic needs outside the forest resources. This may explain why indigenous peoples were observed retreating deeper into forests for food, fuel and shelter as a coping strategy against the risk of COVID-19 infection (Anderson, 2016). This people are however central to the continuous survival of forests because of their vast traditional knowledge on forest biodiversity (FAO/UNEP, 2020).

But, reliance on forest product and other biomass will increase as a result of covid-19 pandemic due to unavailability of affordable alternatives and decrease in income-generating opportunities with implication for sustainability of its supply. Forests had been observed to impact rainfall patterns, water filtration, soil erosion reduction and provision of most of the drinking water for more than one-third of the world's largest cities. Invariably, poor management of forest estates portend great danger for human not only from the angle of its nature nurturing services but also from the utilities derived from products there from. For example, UN/DESA (2020b) estimated the number of people that were unable to take basic measure against covid-19 due to lack of access to clean water at about 2.2 billion people. Therefore, there is need for SFM and the aquatic resources, which the forest is shedding.

**Sustainable aquaculture, fisheries and forest resources management in Africa: tool for resilience and recovery from the COVID-19 pandemic**

Sustainable natural resources management is the stewardship and use of the resources and associated bases in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems (PEFC, 2019). These resources hold a strong key position in Africa's resilience to and recovery from the covid-19 pandemic, being richly blessed with them. But this depends on the sustainable management and use of the resources. Sen (2020) reposed the identification of the forestry sector as potential for far reaching and sustainable solution to the covid-19 pandemic. Nair and Rutt (2009) had earlier linked the high employment generation potential of the sector to its labour intensive and low capital investments advantage. According to the World Bank (2021b) aquaculture and fisheries provide employment for over 12 million people while the AU's Agenda 2063 submitted the sector as "Africa's future. OECD (2020a) stated that 10% of the global population rely on the fisheries and aquaculture sector for livelihoods with hundreds of millions of people worldwide sourcing nutritious food from the sector. It is therefore evident that policy instrument directed at sustainable aquatic, fisheries and forest resources will chart reasonable course for Africa's resilience to and recovery from the COVID-19 pandemic.

One of the major tools in SFM, which has some potential to assist in the post COVID-19 recovery in Africa is the practice of agroforestry. The practice balance the nature nurturing attribute of forestry with the food security potential of agriculture. In addition, Africa's ability to become resilient would rely on reforestation, afforestation, conservation and improved management of natural forests. It had been observed that a rise in the occurrence of covid-19 can be caused by deforestation while reduction of the fragmentation and forest loss, forest restoration as well as land conservation, can reduce human-wild animal interaction and subsequently the risk of future disease outbreaks (Bloomfield, 2020). Earlier, 75% of current and emerging infectious diseases in humans had been linked to the transfer of pathogens from animal to humans (UNEP, 2016).Thus, given her incredibly rich natural resource base (Deininger, 2011; WWF, 2020; UNEP, 2019 and 2021) Africa's recovery plan from the pandemic must be woven

around sustainable natural resources management. To objectively tap into SFM as a recovery tool for Covid-19, FAO (2020a) suggested:

- ensuring that forest-dependent communities are protected;
- building momentum to halt deforestation, further overuse of forest resources and degradation; and
- leveraging action, building more sustainable production and resilient supply chains, providing more diverse livelihoods

Healthy and sustainable forest ecosystems and forest dependent resilient communities have been identified as a major pillar for the materialization of a green recovery from the coronavirus pandemic. The import of the custodians of forests as vital stakeholders in the achievement of SFM cannot be overstressed. Fayenuwo *et al.* (2007) had earlier submitted the evolvement of community-based forest management as an approach for the sustainable management of forest resources. Now that, sustainable management of all forests must be vigorously enforced in Africa, the need to consider "for whom the forest is managed" becomes apt. The United Nations Strategic Plan 2030 for forests and trees outside forests (UN, 2017) will be an ideal policy instrument for discussion and adaptation on natural resources management, if sustainability is desired.

***Understanding and tapping into the advantage of the multi-stakeholder nature of the sector***

By virtue of their multiple use nature, aquaculture, fisheries and forest resources use and management are multi-stakeholder based. It is therefore imperative that the interest of all stakeholders be protected if these nature's resources use and management are to be sustainable. For example, FAO (2020c) reported 22 percent of forests as being owned by corporate enterprises, individuals, small-holder farmers as well as local and indigenous communities who in addition, manages 15 per cent of global publicly owned forests. Similarly, one key submission by the World Bank (2017) is the need for nation-states and public-private sectors collaborations, if sustainable management of ocean resources is desired. Azeez and Amusa (2016) also observed a paradigm shift in natural resources management towards ensuring greater and effective participation of all stakeholders. Participation demands that rather than government taking initiative and people supporting, the reverse should be the case. People should be involved right from the project planning stage with government supplying the logistics of ensuring that corners are not cut using local governance

structure. Key indices for community participation in SFM activities include awareness, project planning and local empowerment (Azeez *et al.,* 2013). Awareness of development project is the first index of participation as it informs on level of participation or otherwise by different stakeholder' in the project. However, one may be aware through hearsay, thus the quality of planning that goes into a project determines the level of its impact and this is a function of the quality and diversity of participants in its planning. Local empowerments are gains of participation in development project.

There is therefore need to encourage private stakeholder participation in the development and management of renewable natural resources project to ensure their sustainability. This can be achieved through adoption of some fiscal measures, which will encourage them to cooperate with government agencies. For example, ITTO (2020) reported some West Africa Governments of supporting domestic forestry industries through reduction in tax, with the view to balancing their trade. Also, policymakers could partner with relevant stakeholder group to promote sustainable investment by mainstreaming sustainable forest management into national and international investment policies. This would not only inject fresh ideas into investment ideas, it may also boost the chance of such ideas accessing some international funds.

***Financing Africa's resilience and recovery plan from COVID-19***

Availability of adequate financial and human resources is germane to effective implementation of sustainable natural resources management. Availability of these may however be fruitless without good governance at all levels (UN, 2017). Funding national projects as summarized by WWF (2020) can be through the deployment of treasury fund or parleying with multilateral Organisations (like the IMF, World Bank, AfDB, US Development Finance Initiative's Rapid Response Liquidity fund and the EU Emergency Trust Fund for Africa) and other funding sources (such as bilateral funding from sovereign governments and institutions, private sector funding, Innovative Financing Mechanisms- IFM). The IFM include tapping into blended finance, trust funds, Peer-to-peer lending models, diaspora capital, and impact bonds financial resources (WWF, 2020). All these sources are always and readily available provided their caveats are met. Therefore, African countries seeking financial succor from any source must be fully prepared to meet stipulated condition(s) of access.

There are numerous packages from most, if not all the funding sources, most especially towards recovery from disasters such as covid-19.The best logical option open to most African countries is to invest in the green (terrestrial) and blue (aquatic) economy, using treasury fund because they will reap the investment benefit(s) 100 percent. Nigeria utilized this funding source though for a wrong idea - stimulating youth employment through agriculture practice. The package is expected to engender a 0.59% decline in GDP, but a 4.4% decline was forecasted for the same idea without the stimuli (WWF, 2020). This may be partly why WWF (2020) submitted that African countries cannot drive recovery from COVID-19 pandemic plan alone without partners.

To work with partners successfully, it is important to carry out inventory of natural resources stock of the base of the project. This is expected to inform apt valuation of the project and by extension the evolvement of a sustainable investment plans that will attract desired investors and intervention. It will also give officials that will negotiate the funding the needed confidence to discuss the viability of the project with investor and the latter, confidence in the former's proposal.

On the average, funding packages all over the world is between 10 and 15% of benefitting country's GDP. However, with the exception of Niger, South Africa and Togo, no other African nation is near the world average (Bruegel, 2021). This may further limit funding of projects in Africa where Covid-19 pandemic has triggered economic contraction, closed numerous businesses and thus reduced availability of private sector resources for natural resources development. Unfortunately, no African nation was listed among those that had integrated financing natural resources management into their covid-19 stimulus package and recovery plans (UN/DESA, 2020a). Invariably, if sustainable natural resources management is desired to recover from and be resilient against covid-19, the need for international partners for funding is non-negotiable. Central to achieving this however, is transparency and prudency on the part of African stakeholders.

**Conclusion and Recommendations**

It is imperative to respond to, and learn from the effects of the covid-19 pandemic with the view to accelerating transformations in the aquaculture, fisheries and forestry sectors with the view to building resilience to future shocks. For long-term recovery from coronavirus, aquatic and forest

resources will support a more resilient future provided all stakeholders' are involved in the planning and execution of management strategies. There must also be strong political will to support people-centred and government supported development in these sectors. Thus, the integration of aquatic and forest-based activities into national programmes in relation to other land uses will enhance the recovery of the fisheries and forestry sectors with positive implications for sustainable rebuilding strategies. Mobilising resources with sincerity of purpose among the political class for aquatic and forest resources is also imperative for covid-I9 recovery processes in Africa.

Specifically, time-limited, targeted, cash-based, and consistent policies responses based on longer-term sustainability objectives are imperative for the aquaculture, fisheries and forestry sectors (OECD, 2020b). Equally imperative are support policies, which discourage abuse of natural resources (for example, overfishing; illegal, unregulated and unreported fishing; as well as illegal felling, bush burning for wildlife, over exploitation of non-timber forest resources) or support practices, which encourages the sustainability of the resources. These are germane to the survival of stakeholders, most specially the vulnerable ones. Finally, monitoring of the economic and social impacts on aquaculture, fisheries and forestry production systems, associated supply chains, and consumption patterns of their resources is imperative, if support must get to those who need them most.

**References**

Anderson, I., B. Robson and M. Connolly *et al.* (2016). Indigenous and tribal peoples' health (The *Lancet*–Lowitja Institute Global Collaboration): a population study. *Lancet* 2016; 388: 131–57.

APB, (2021).Africa paper and Board available at - https://www.marketresearch.com/seek/Paper-Board-Africa/730/1150/1.html Sighted 10/03/2021.

Attah, A.N. (2020). Initial Assessment of the Impact of COVID-19 on Sustainable Forest Management African States.https://www.un.org/esa/forests/wp-content/uploads /2021 /01 /Covid-19-SFM-impact-Africa.pdf.

Azeez, I.O., G.A. Fayenuwo and L. Popoola (2013).Indices of Local Community Participation in Forest Management in Southwestern Nigeria.*Journal of Environmental Extension,* Vol. 11, 60 – 68.

Azeez, I.O. and T.O. Amusa (2014).Participatory Forestry Practices and Renewable Natural Resources Management. In: Ogunsanwo, O.Y., A.O. Akinwole, I.O. Azeez, V.A.J. Adekunle and N.O. Adewole (Eds.) *SudanoSahelian Landscape and Renewable Natural Resources Development in Nigeria*, Proceedings of the 37th Annual Conference of the Forestry Association of Nigeria, Minna, Niger State, Nigeria, Pp. 397 – 413.

Bernacsek, G.M. (1987). Policy options for development of the fisheries sector in Africa. FAO, Fisheries Department, Fishery Policy and Planning Division, Rome, 180p.

BIMCO, (2020).*Coronavirus (COVID-19) Crew Challenges*. https://www.bimco.org/ships-ports- and-voyage-planning/crew-support/health-and-medical-support/novel-coronavirus---crew challenges. Accessed 29/02/2021.

Bloomfield, L.S.P., T.L. McIntosh and E.F. Lambin (2020). Habitat fragmentation, livelihood behaviors, and contact between people and nonhuman primates in Africa. *Landscape Ecol*35, 985–1000. https://doi.org/10.1007/s10980-020-00995-w

Bondad-Reantaso, M.G., B. Mackinnon, H. Bin, H. Jie, K. Tang-Nelson, W. Surachetpong, V. Alday-Sanz, M. Salman, E. Brun, I. Karunasagar, L. Hanson, K. Sumption, M. Barange, A. Lovatelli, A. Sunarto, N. Fejzic, R. Subasinghe, A.M. Mathiesen and M. Shariff (2020). Viewpoint - SARS-CoV-2 (The Cause of COVID-19 in Humans). *Asian Fisheries Science* 33:74–78. https://doi.org/10.33997/j.afs. 2020.33.1.009.

Bruijnzeel, L.A. (2014). Hydrological functions of tropical forests: not seeing the soil for the trees? *Agriculture, Ecosystems and Environment,* 104:185–228.

Bruegel (2021).Covid National Data Set. Available at: https://www. bruegel.org/publications/datasets/covid-national-dataset/.Sighted 09/03/2021.

Colfer, C.J.P., M. Elias, B.S, Basnett and S.S. Hummel (Eds.) (2017). The Earthscan reader on Gender and Forests, ISBN: 978-1-138-23158-0 (hbk) and 978-1-138-23159-7 (Pbk), Routledge, 2 Park Square, Milion Park, Abingdon, Oxon OX 14 4 RN, UK. 376 pp.

Cornforth, A., E. Fatoyinbo, P. Freemantle and N. Pettorelli (2013). Advanced land observing satellite phased array type L-brand SAR (ALOS PALSAR) to inform the Conservation of Mangroves: Sundarbans as a case study. *Remote sensing* 5, 224-237.

Cunningham, A.B. (1993). African Medicinal Plants: setting priorities at the interface between conservation and primary health care. Paris: UNESCO; 1993. Working paper 1. 221pp.

Deininger, K (2011). Challenges posed by the new wave of farmland investment. *The Journal of Peasant Studies*, 38(2): 217–247.

Démurger, S. and M. Fournier (2011). Poverty and firewood consumption: A case study of rural households in northern China. *China Economic Review,* 22(4): 512–523.

Eba'aAtyi, R., J. NgouhouoPoufoun, J.P. MvondoAwono, A. NgoungoureManjeli and R. Sufo-Kankeu (2016).Economic and social importance of Fuelwood in Cameroon. *International Forestry Review,* 18(S1): 52–65.

EC, (2021).Fisheries, aquaculture and COVID-19 - Issues and Policy Responses.European Commission. Also available at: https://knowledge4policy.ec.europa.eu/publication/fisheries-aquaculture-covid-19-issues-policy_responses_en?language_content_entity_=en Retrieved on 28/1/2021.

Ellison, D., C.E. Morris, B. Locatelli, D. Sheil, J. Cohen, D. Murdiyarso, V. Gutierrez *et al.* (2017). Trees, forests and water: cool insights for a hot world. *Global Environmental Change,* 43: 51–61.

FAO, (2014).*State of the World's Forests 2014: Enhancing the socioeconomic benefits from forests.* Rome. (available at http://www.fao.org /3/a-i3710e.pdf).

FAO, (2014a).The State of World Fisheries and Aquaculture 2012.Food and Agriculture Organization of the United Nations, Rome.

FAO, (2015). Global forest resources assessment 2015 How are the world's forest changing? Second edition ISBN 978-92-5-109283-4.

FAO, (2017).*Sustainable woodfuel for food security*.FAO Working Paper. Rome. (available at http://www.fao.org/3/a-i7917e.pdf).

FAO, (2018a).The State of the World's Forests, 2018 - Forest pathways to sustainable development. FAO, Rome. ISBN 978-92-5-130561-4. 139 pp. Available at: http://www.fao.org/3/I9535EN/ i9535en. pdf Accessed 02/02/2020.

FAO, (2018b).The State of World Fisheries and Aquaculture 2018—Meeting the Sustainable Development Goals.Licence: CC BY-NC-SA 3.0 IGO. Rome: FAO.

FAO, (2020a). The impacts of COVID-19 on the forest sector: How to respond? Rome: FAO, 6pp.

FAO, (2020b). The State of World Fisheries and Aquaculture 2020: Sustainability in action. Rome. 224pp. https://doi.org/10.4060/ca 9229en.

FAO, (2020c).Building back better: COVID-19 pandemic recovery contributions from the forest sector.http://www.fao.org/ fileadmin/user_upload/idf/COFO25/COVID_Forestry Webinar Week_Chairs_su mmary_df-clean.pdf.

FAO, and UNEP (2020). The State of the World's Forests 2020.Forests, biodiversity and people. Rome: FAO, 214 pp.

FAOSTAT, (2021). Land Use Data – Visualize - Agricultural Land by Continent, Area between 1961 and 2018. Available at: http:// www.fao.org/faostat/en/#data/RL/visualize. Accessed on 22/02/2021.

Fayenuwo, G.A., I.O. Azeez and L. Popoola (2007). Status of Local Participation in Forest Resources Management in Southwest Nigeria, *Journal of Tropical Forest Resources*, Vol. 23(1), pp. 37 – 48.

Fisher, M. and G. Shively (2005). Can income Program reduce Tropical Forest Pressure? Income Shocks and Forest Use in Malawi! *World Development* 33(7):1115-1128.

Gond, V., E. Dubiez, M. Boulogne, M. Gigaud, A. Péroches, A. Pennec, N. Fauvet and R. Peltier (2016). Forest cover and carbon stock change dynamics in the Democratic Republic of Congo: case of the wood-fuel supply basin of Kinshasa. *Bois etForêts des Tropiques,* 327(1): 19–28.

Holmes, L., C.K. Strauss, K. de Vos and K. Bonzon (2014). Towards Investment in Sustainable Fisheries: A framework for financing the transition. Environmental Defense Fund and The Prince of Wales's International Sustainability Unit. 86p.

IFAD, (2016).Rural Development Report 2016 - Fostering inclusive rural transformation. International Fund for Agricultural Development, Rome.

Ilstedt, U., A.B. Tobella, H.R. Bazié, J. Bayala, E. Verbeeten, G. Nyberg, J. Sanou*et al.* (2016). Intermediate tree cover can maximize groundwater recharge in the seasonally dry tropics. *Scientific Reports,* 6: 21930.

IPCC, (2013).*Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (Eds.)]. Cambridge University Press, Cambridge, United

Kingdom and New York, NY, USA, 1535 pp. Also available at: https://www.ipcc.ch/report/ar5/wg1/ Accessed 02/02/2020.

ITF, Seafarers (2020). *COVID-19 Information for Seafarers*.https:// www.itfseafarers.org/en /embed/covid-19-country-information-seafarers. Accessed 29 May 2020.

ITTO (2020). No clear picture on how pandemic is affecting timber companies in Africa. Tropical Timber Market Report 24(7). P 2 – 5. Also available at: https://www.itto.int/files/user/mis/MIS_1-15_Apr2020.pdf. Accessed 15/02/2021.

Jiang, F., L. Deng, L. Zhang, Y. Cai, C.W. Cheung and Z. Xia (2020). Review of the clinical characteristics of Coronavirus Disease 2019 (COVID-19). *Journal of General Internal Medicine*.https://doi.org /10.1007/ s11606-020-05762-w.

Kandel, P., P.S. Chapagain, L.N. Sharma and O.R. Vetaas (2016). Consumption patterns of fuelwood in rural households of Dolakha district, Nepal: Reflections from Community Forest User Groups. *Small-scale Forestry*, 15(4): 481-495.

Kate, K.T. and S.A, Laird. (1999). The commercial use of biodiversity: access to genetic resources and benefit sharing. ISBN 1 85383 334 7. Earthscan Publications Limited, 120 Pentonville Road, London N1 9JN, UK.416 pp.

Kehlenbeck, K., B. Vinceti, N. van Vliet, G. Keding, B. Stadlmayr, P. Van Damme, S.T. Carsan, T. Sunderland, M. Njenga, A. Gyau, P. Cerruti, J. Schure, C. Kouame, B. Obiri-Darko, D. Ofori, B. Agarwal, H. Neufelt, A. Degrande and A. Serban (2015). *Forests, trees and landscapes for food security and nutrition: a global assessment report*, pp 25–50. IUFRO World Series, Volume 33. International Union of Forestry Research Organisations, Vienna. (Available at http:// www.iufro.org/science/gfep/forests-and-food-security-panel/ report/).

Kumar, C., S. Begeladze, M. Calmon and C. Saint-Laurent (Eds.) (2015). *Enhancing food security through forest landscape restoration: Lessons from Burkina Faso, Brazil, Guatemala, Viet Nam, Ghana, Ethiopia and Philippines.*International Union for the Conservation of Nature, Gland, Switzerland.

Mordor Intelligence, (2021). Africa Packaging Market - Growth, Trends, COVID-19 Impact, and Forecasts (2021 - 2026). Available at: https://www.mordorintelligence.com/industry-reports/Africa - packaging-market. Sighted 10/03/2021.

MRF, (2021).Globe News - Herbal Medicine Market Value prediction by Market Research Future. Available at: https://www. globenews wire.com/news-release/2019/04/03/1796359/0/en/ Herbal-Medicine-Market-Value-to-Surpass-USD-129-Billion-Revenue-Mark-by-2023-at-5-88-CAGR-Predicts-Market-Research-Future. html. Sighted 10/03/2021.

Nair, C.T.S. and R. Rutt (2009). Creating forestry jobs to boost the economy and build a green future. Rome: FAO, 8 pp.

OECD, (2020). COVID-19 and Africa: Socio-economic impacts and policy responses. Accessed on 09/02/2021 at: https://www.oecd.org/ coronavirus/policy-responses/covid-19-and- africa-socio-economic -implications-and-policy-responses-96e1b282/.

OECD, (2020a).Delpeuch, C. and W, Shymes (Eds.) Fisheries, aquaculture and COVID-19: Issues and Policy Responses. Tackling Corona Virus (Covid-19) – Contributing to a Global Effort by OECD. 04 June, 2020. 10pp. Available at: oecd.org/coronavirus.

OECD, (2020b).*Government Support and the COVID-19 Pandemic*, OECD Publishing, https://read.oecd-ilibrary.org/view/?ref=128_128572-w5qyf5699d&title=Government-support-and-the-COVID-19-pandemic.

Paul, A. (2020). Risk of hunger pandemic as coronavirus set to almost double acute hunger by end of 2020. World Food Programme Insight, 16 April 2020. Also available at: https://www. ahgingos.org/risk-of-hunger-pandemic-as-covid-19-set-to-almost-double-acute-hunger-by-end-of-2020/.

PEFC (2019).https://www.pefc.org/what-we-do/our-approach/what-is-sustainable-forest management, cited 16/10/2019

Qin, Y., T. Gartner, S. Minnemeyer, P. Reig and S. Sargent (2016).*Global forest watch water metadata document.* Technical Note. World Resources Institute, Washington, DC.

Shahidi, F. (2020). Does COVID-19 affect food safety and security? A summary report on the Extraordinary Scientific Roundtable of IUFoST-CIFST on March 21, 2020. *J. Food Bioact.* 2020;9:1–3. Available at: http://www.isnff-jfb.com/index.php/JFB/article /view/125/216.

Sen, M. (2020). Forests: At the Heart of a Green Recovery from the COVID-19 Pandemic. Source: UN Department of Economic and Social Affairs (DESA) Policy Briefs, 29 Jul 2020, 4 pages DOI: https://doi.org/10.18356/ca7463ff-enhttps://www.un-ilibrary. org/content/papers/27081990/23.

Tobella, A.B., H. Reese, A. Almaw, J. Bayala, A. Malmer, H. Laudon and U. Ilstedt (2014). The effect of trees on preferential flow and soil infiltrability in an agroforestry parkland in semiarid Burkina Faso. *Water Resources Research,* 50: 3342–3354.

UN, (2017).United Nations Strategic Plan for Forests – Briefing Notes. United Nations Forum on Forests. Accessed on 16/02/2021 at: https://www.un.org/esa/forests/wp-content/uploads/2017/09/ UNSPF-Briefing_Note.pdf.

UN/DESA, (2020a).Financing sustainable forest management: a key component of sustainable Covid-19 Recovery. Policy Brief No. 88: New York: United Nations Department of Economic and Social Affairs, 4 pp.

UN/DESA, (2020b).The Impact of COVID-19 on Indigenous Peoples. Policy Brief No. 60. New York: United Nations Department of Economic and Social Affairs, 3 pp.

UNEP, (2016). UNEP Frontiers 2016 Report: Emerging Issues of Environmental Concern. Nairobi, Kenya: United Nations Environment Programme, 77 pp.

UNEP, (2019).A Wealth of Green Opportunities. A UNEP GEO-6 For Youth – Africa Publication in association with CEDARE. 100pp.

UNEP, (2021).Our Work in Africa. Available at: https://www.unenvironment.org/regions/africa/our-work-africa.Sighted on 08/02/2021.

WHO, (2020).Coronavirus disease 2019 (COVID-19) Situation Report –32. The World Health Organisation.Sighted at: https://www.who.int/docs/default-source/coronaviruse/situation-reports/ 20200221-sitrep-32-covid-19.pdf?sfvrsn=4802d089_2 on 10/02/2021

World Bank, (2021a).Understanding Poverty – Forests Overview. Available at: https://www.worldbank.org/en/topic/forests/overview. Accessed on 12/02/2021.

World Bank (2021b).African Program for Fisheries.Sighted on the 10/02/2021 at: https://www.worldbank.org/en/programs/africa-program-for-fisheries.

WorldFish, (2020).WorldFish discussed COVID-19 impacts with Nigerian aquaculture community. Accessed on 25/01/2021 from https://fish.cgiar.org/news-and-updates/news/ worldfish-discussed-covid-19-impacts-nigerian-aquaculture-community

Wunder, S., J. Börner, G. Shively and M. Wyman (2014). Safety nets, gap-filling and forests: a global-comparative perspective. *World Development* 64: S29-S42.

WWF, (2020). Africa in the Context of Covid-19 - Economic Measures For a Green and Just Recovery. Messages for Governments and Pan-African Organisations by the World wide Fund for Nature, Avenue du Mont-Bland, 1196 Gland, Switzerland.. 17pp.

Zulu, L.C. and R.B. Richardson (2013). Charcoal, livelihoods, and poverty reduction: Evidence from sub-Saharan Africa. *Energy for Sustainable Development*, 17(2): 127-137.