PARAMOUNT ECOLOGICAL RESOURCES

A Publication of PER https://paramountecologicalresources.com/

Review

EFFECTS OF LAND USE ON COMPOSITION OF BIRDS SPECIES

Egwumah F.A.*, Edet D.I and Okechukwu O.C

Department of Forestry and Wildlife Technology, Federal University of Technology Owerri, Nigeria.
*Correspondence e-mail: egwumahattah@gmail.com, Tel: +2347064621278

Received 10th October, 2021
Accepted for publication 24th January, 2022
Published 20th February, 2022
Recommended citation: Egwumah F.A., Edet D.I. and Okechukwu O.C. (2022). Effects of Land use on Composition of Birds Species, *Paramount Ecological Resources*, 2 (1):1-8.

Abstract

Land use can be defined as a perception with respect to the various actions carried out on the land to produce one or multiple products or services that are beneficial to the populace. This paper aims to discuss the effects of land use on bird species composition in the bionetwork using theoretical and empirical evidence provided in different literature and its influence on the survival and conservation of bird species. Land use can be classified into two simple categories: metropolitan (urban) Land-use and countryside (rural) Land-use. One major cause of global biodiversity decline is habitat degradation and destruction because of anthropogenic actions. Forest birds are mostly disposed to modifications in plants assemblage and the degree of forestland, because of their dependence on vertical vegetation structure. Vital roles are played by avian species in maintaining the ecological. However, the survival of given bird species is threatened by demand for land based on different uses resulting to intensive loss of habitat, habitat fragmentation, habitat degradation and pollution Therefore, to manage the aforementioned problems and its ecological impact, it is imperative that bird's conservation programme must be based on scientific knowledge on the degree of damages melted on bird species by land use, especially in developing countries.

Keywords: Bird species; land use; habitat degradation; habitat fragmentation; climate change; habitat loss

INTRODUCTION

Land use can be defined as a perception with respect to the various actions carried out on the land to produce one or multiple products or services that are beneficial to the populace. It can also be defined from the angle of a vibrant proceedings concerning the features of global biophysical and activities of the populace (Aspinall and Staiano, 2017), making land use a simple component of anthropogenic activity. The main drive for utilizing a land coupled with activities of the populace on the land can be used to define land use. In line with that, similar uses in which a land can be put into may cut across on different portions of land, jointly the equivalent land could be utilized in numerous ways (Souza *et al.*, 2015).

Land use changes began in the 20th century inform of international campaign (Tian, 2015) since societal advancement requires indiscriminate use of natural resources to make them operational through transformation. Land does not comprise the natural soil only but also all underneath and all spreading to the atmosphere and beyond it. Provision of proceeds, means of support, foodstuff, refuge, ethnic uniqueness and security are all considered to be benefits of land in any community. Land is a very simple property that can be used as a financial liberation to underprivileged populace and a backup in trying periods. It can be used to define the authority in dealings with personalities and groups in the societal. Apart from that, it comes with huge dogmatic consequences (Dzanja *et al.*, 2015).

According to Turner *et al.* (1993) merely engagement of land by the populace can be used to define land. Equally, Peter *et al.* (2018) stretched the meaning to accommodate, both the way and drive behind using features of the biophysical. He reiterated by adding in between association, among the actions, arising from human behavior and essential elements for instance, the quest to put a land into use, the size of the land, technical know-how, socioeconomic and environmental connects. Limited biological revisions on the effects of land use on bird species have remained specific in diverse ecological work for a very long period of time, but the logical appreciation of land use and it associated effects on birds remained deficient. This paper aims to discuss the effects of land use on

bird species composition in a bionetwork using theoretical and empirical evidence provided in different literature and its influence on the survival and conservation of bird species.

Different Forms of Land Use

The whereabouts, determines the kinds of land use, coupled with access to water source and soil, humidity, soil fecundity, or nearness to extra man's activities. Series of work has been done by different researchers from diverse area of studies on dissimilar forms of land-use. The evidence needed to generate a contextual framework to forecasting the planning and supervision of terrestrial resources involves grouping of land with respect to their different uses, coupled with periodic variation in uses (Smith *et al.,* 2016). Balasubramanian (2015), classified land use into two simple categories:

i. Metropolitan (urban) Land-use
ii. Countryside (rural) Land-use.

Metropolitan (urban) land-use

Metropolitan land-use is made up of communications, residential, transportation, commercial, industrial, institutional, and overall amenities.

Countryside (rural) land-use

All other forms of land use not categorized in the discussed above belongs to countryside land use of which land use for different agricultural purpose such as forest land, rangeland and cropland are inclusive.

Classification of Land Use:

In mainland stages land use can be categorized using agro-climatic surroundings, shape of the land, and soil types coupled with precipitation gotten from weather-related factors (Balasubramanian, 2015). Similarly, the rates of precipitation and drought could be also to categorize agro-meteorological areas, but established background, finances, and physical appearance of the land determines the design of land use in different nations (Balasubramanian, 2015). The land use grouping listed in Table 1 are permitted in most nations including developing countries.

Table 1: Major Land Use Categories

Land use Types	**Examples**
1. Built-Up land in Metropolitan (urban) Areas	Multistory rooms/flats
a. Residential/ Elevated Density/Average Density Living houses/ Small Density	Regular rooms/Flats
	Single-story rooms/Flats
Living houses	Single-story racket houses, Single-story cluster houses
	Slums/Clusters
b. Commercial	Trade and overall commercial
	Communal center
	Wholesale and warehousing
	Main Shopping Plaza/ mall
	Key Guesthouses
	Car parks space
	Marketplace
	Exposition galleries
	Gasoline bunks
	Financial institutions
c. Industrial	Packaging industry
	Electricity industry
	General industry
	Heavyweight industry
	Harmful industry
d. Leisure	Parks/Green areas
	Sports ground
	Play area
	Golf course/Contest course
	Zoo
	Botanical Garden
	Museum
	Planetarium
	Key spring gallery
	Swimming Pool
	Key motion pictures halls/Playhouses
e. Public/and Semi-Public	Key Learning institution
	Cantonment
	Key health care centres
	Cremation/Cemetries

	Socialization/traditional center
	Worship centers
	Key public workplaces
	Gasoline/Gas dispensing stations
	Police departments
	Fire-fighting workplaces
	Circuit House
	Power supply substation
	Prison
	Water purification plant

	Landfill / Dump sites
	Power supply plant
	Waste management plant

4. Flora/Wooded zone and etc	Forested land
	Savannah
	Agricultural estate
	Mangroves
Rangeland	-

2. Built-Up land in Countryside or rural areas	Traditional multifaceted place of worship
	Multistoried buildings
	Stockrooms
	Communal Halls
	Huts and hamlets
	Library or book archive
	Colleges

3. Countryside Farming	Land nurtured for crop farming
	Uncultivated Land
	Agricultural estate (plantation)

5. Conveyance and Communication	Automobile station
	Railway station
	Bridges
	Marine port
	Aerodrome
	Flyovers
	Road and rail network
	Lorry station
	Breakwaters or Jetties
	Mailing workplaces
	Phone trade-off
	Telegraph workplaces
	Radio and television broadcasting houses

6. Water bodies	Unused excavations filled with water
	Reservoirs
	Ponds or lakes
	Channel
	Tanks
	Swimming pools
	Stream/ river

7. Unproductive land	Salt licks
	Gullied/Ravines
	Land with or without undergrowth
	Unproductive rocky areas
	Sandy
Marshland	Muddy/Moist
	Mudflats
	Water saturated areas
	Salt pans

8. Undeveloped areas & Others	Quarry
	Brick Kilns
	Dam/Barrage
	Coral Reef / Atoll
Land recovered from natural water bodies	-
Unoccupied Land	-

Effects of Land Use on Birds

The paramount pivot behind biodiversity loss and dreadful conditions in riparian ecosystems are land use modifications and climate variability resulting to drastic reduction in populations of diverse plants and animals (Titeux *et al.*, 2016). The little and average danger to species perseverance is land use modifications (Srinivasan and Wilcove, 2021) due to transformation of natural home range of bird species to supplementary land uses such as farming, manufacturing, metropolitan, and derived forms of land use. For instance, in Obudu Plateau the following bird species; Bannerman's weaver (*Ploceus bannermani*) and the White-throated Mountain Babbler (*Kupeoruis Gilberti*) are vulnerable right now due to disappearance of very vital hill top forest covers. At present, of the approximately 37 avian species found in Nigeria, falls into the ecological resources that the global community may announce their extinction due the aforementioned threat and associated actions (Kolawole and Okosodo, 2018).

In the classification of threats to biodiversity, land-use modifications fall into the key categories, but shortage of records wrecks evaluation of their biological effect globally. For avian species once you mention land-use modifications, the first thing that comes to mind is habitat loss or breaking up of habitat into small patches (fragmentation), alteration in accessibility of resources, and disruption in living components of the environment (biotic) which may stop their relationship or spreading corridors. Therefore, population figures of avian species, and their ability to gather in the natural habitat coupled with their diversity may decline, especially in rural areas advancing to be urban centers, intense farming and global disappearance (Fusco *et al.*, 2021).

Effects of Habitat Degradation on Bird Species

One major cause of global biodiversity decline is habitat degradation and destruction because of anthropogenic actions (Giam, 2017). Understanding the responses of biodiversity components, such as birds, to disruption emanating from activities of the populace is very vital to enabling informed conservation policymaking (Asefa *et al.,* 2017). In forest ecosystems, modification of plants assemblage and breaking up of habitat into small patches with the help of indiscriminate felling of trees and loss of forest quality due to settlement and cultivation land expansion and livestock overgrazing are part of the key threats to biodiversity (Asefa *et al.*, 2017). Forest birds are mostly disposed to modifications in plants assemblage and the degree of forestland, because of their dependence on vertical vegetation structure (Asefa *et al.*, 2017).

However, diverse research work on forest birds demonstrated variation in their ability to react to different levels of anthropogenic activities with respect to species diversity, based on their biological traits which is specific to species coupled with the nature and the degree of disruption (Newbold *et al.*, 2020). Human activities such as the spray of treatments to control pest in agriculture has resulted to alteration in foraging rates of little bee-eaters *Merops pusillus* and pied kingfishers *Ceryl Orudis* that depends on insects that fly during the day and trivial fish as good source of prey respectively (Adebayo and Halidu, 2019). Feeding on insects could be killed by fenitr-othions and the insects becomes contaminated and unfit for avian consumption once such feeding item is eaten by bird species it kills them resulting to decline in bird populations. The rise in death toll of insectivorous birds is a product of the aforementioned problems due to severe poisoning which the sub-lethal effects may inhibit their reproductive fecundity and successful breeding proceedings.

Other birds that are threaten by destructive insecticides are *piscivorous* birds that depends on fish for survival. *Granivorous* birds are not left out especially when seeds robed with insecticides are fed on (Adebayo and Halidu, 2019). On the other hand, diverse bird species that are forest specialist are also victims of forest disruption in no small measure (Asefa *et al.,* 2017) whereas diverse bird species that are habitat generalist have better ability to adapt to varieties of home range, such as open/shrub home range and woodland. Habitat generalist better ability to confidently utilized habitat modifications prompted by anthropogenic activities.

Effects of Habitat loss on Bird Species

In countries like Nigeria where bird diversity and endemism are high, drastic negative change in bird habitat is taking place at an overwhelming rate (Asefa *et al.,* 2017). For example, insectivorous birds, seed-eaters, frugivores, and nectarivores are facing the brunt of habitat loss as the changes in the environment make them lose their source of feeding (BirdLife International, 2018).

According to the 2017 BirdLife International's status assessment report, 276 bird species (11% of bird species of the total 2,477 species known to occur in Africa) are globally threatened with extinction from habitat loss and other factors (BirdLife International, 2018) resulting to the absence of shelter, food, breeding grounds, and all necessary requirements for bird breeding. Land-use changes may not bring about all these all at once, but for instance when there is an absence of shelter for a native bird species in a location, it may lead to the species inability to escape from predators, lack of access to mating partners and shortage of nesting materials resulting to continuous degraded lifecycle of a given bird species.

Effects of Habitat Fragmentation and Degradation on Bird Species

The greatest threat that is imperative to forested ecosystems or biological networks is habitat fragmentation. Under normal circumstances habitat fragmentation can result from fire and windfall, but on a very large-scale increase in demand for land for different uses by human happens to be the major culprit (Jacobson *et al.,* 2019). As far as decline in population of avian species is concerned, habitat fragmentation has been indicted a major element. Fortunately, few avian species may thrive in a medium of fragmented patches, minor understory, and great patches that occur in forestland, in some cases, increase in population could be recorded in fragmented habitat. Population changes in avian species dwelling in fragmented home range is a function of the degree of connects among forest patches that are split into fragments due to anthropogenic processes (Haddad *et al.,* 2015). The vital implications of fragmented habitat in bird species conservation are; total reduction in proportions of home range that are accessible to bird species and splitting of remnant home range into secluded forest patches or small pockets (Hanski, 2015).

Secluded forest patches or small pockets can dislocate dispersal arrays of avian species and encouraged affected birds to move from corner to corner in search of food, water, shelter, breeding ground and escape route from predators. This is a serious danger associated with secluded forest patches if compared with seemly habitat patches and it may bring about extinction of endemic species because they are known for narrow home range (Opoku, 2018).

Birds falls into the categories of perfect biological indicators that could be used to investigate long-standing responses of global bionetworks to environmental alteration. The moveable nature of birds in different home range coupled with their varied physique, foraging and social characteristics, systematic community assemblage and composition are rapidly modified, once there is a distress in the habitat (Allen *et al.,* 2019). Birds are one of the animals with backbone that lives for a very protracted period, and they may adjust to environmental modification or may not, but specific residents' responses could infringe measurement of extensive period (Hardesty-Moore *et al.,* 2018). They equally accomplish variety of vital ecology proceedings that are inclusive, for example fertilization of green plants through the process of pollination, seed dispersal, and might be imperative in case of top-down regulations on trophic categories that are lesser (Zanata *et al.,*2017).

Birds that forage on fruits (frugivore) are excellent contributors to reestablishment of normal tropical woodland. Approximately 60-90 % of tree species in normal tropical woodland are known for their fruits and seeds with unique trait adjusted for dispersal by avian species. Continuous supply of forest seeds and seedlings is a function of birds' ability to disperse seeds. However, restarting savannahs trees are giving below (Mayhew, 2017).

Frugivores species in Nigeria include *Pycnonotus barbatus* or common bulbul, *Turdus periods* or true thrush, *Streptopelia semitorquata* or Red-eyed dove, *Laniarius aethiopicus* or tropical boubou, and *Treron calva* also known as African green pigeon. Others include *Chrysococcyx capris* or Diederik cuckoo, *Zosterops senegalensis* or African yellow white-eye, and *Lagonosticta rubricates* also known as the African Firefinch (Francis *et al.,* 2019).

Therefore, modifications in avian species community composition and assemblage have excellent prospect to echo all the way through bionetworks (Bregman *et al.,* 2015). Globally, there is an alteration in population of bird species which in turn affects the community composition and assemblage based on data from prolong research. For example, Stephens *et al.* (2016) utilized prolong record collected to show some avian species with modified climate correctness and how it has been growing due to environmental alterations by human with more positive results from developed countries compared to developing countries. The variation between developed and developing countries is that the formal is more conscious about the ecosystems with more ecological research carried out compare to developing countries that are battling to overcome hunger, poverty, HIV and AIDS due to poor economic instability and landlessness due to rapid population growth.

Effects of Land-Use on Climate Change and its Resultant Effect on Bird Species

One of the anthropogenic processes that add to climate change is land use activity coupled with the modifications in outlines of plants covering the land are just one of the forms in which climate change effects are manifested on the landscape. Land-use impacts with respect to climate alteration take in account of consequences of land-use modification on the change of CO_2 in

the environment and its successive influence on climate and its changes. Apart from that land conservation may also be affected by the impacts of climate alteration. Excessive land use could result in desertification, which occurs when overgrazing of savanna vegetation alters quantifiable volume of natural water bodies, resulting to variations in local flow and rainfall patterns. The quantity of dust flying in the environment could be promoted by overgrazing, resulting to radiative cooling coupled with drastic fall in rainfall pattern in the environment. Increase in the amount of suspended dust can also affect the photosynthetic rate of plants resulting to reduction in food production which may affect bird species.

Food shortage may occur in few habitats where bird dwell resulting to drastic fall in feeding items to raise young ones due to climate alteration. In Australian continent, Zebra finches (*Taeniopygia guttata*) raise young ones more than 45 percent, of which few varied arid and semiarid deserts with erratic rainfalls are inclusive (Gibson, 2018) and the sole feeding item available to the said species all year round are grass seeds. However, they only breed once there is adequate rainfall to promote more seeds in the subsequent year. Laying eggs within weeks is a common attributes of Zebra finches once there is few weeks of precipitation. This is due to absence gonads relapse after preceding breeding venture. Semi-developed is sustain as a substitute to encourage prompt follicular advancement, which can easily arise in a more rapid manner compared to a condition when there is a complete relapse of the ovaries. Therefore, variation in climate conditions in the environment will partly or totally alter the breeding fecundity of the said species (Gibson, 2018).

CONCLUSION AND RECOMMENDATIONS

Conclusion

Vital roles are played by avian species in maintaining the ecological. This could be achieved by providing various ecological services, such as pollination, seed dispersal, ecosystem indicator, pest control, and so on. However, the survival of given bird species is threatened by demand for land based on different uses resulting to intensive loss of habitat, habitat fragmentation, habitat degradation and pollution Therefore, to manage the aforementioned problems and its ecological impact, it is imperative that birds conservation programme must be based on scientific knowledge on the degree of damages melted on bird species by land use, especially in developing countries where, the pattern and cause of habitat destruction can be linked to poverty and landlessness among the local human population.

Recommendations

Future research work should examine the correlation between bird's species and ozone layers' depletion in different land use. Land-use plans and allocations should be designed to accommodate conservation of avian species in Africa to enable us know which of the land-use type is favourable to bird species to promote adoption of such land-use both at local and internal level as a means of avian conservation.

REFERENCES

Adebayo, O. A., & Halidu, S. K. (2019). Avifauna Species Diversity and Abundance in Kainji Lake National Park, Niger State, Nigeria. *Journal of Wildlife and Biodiversity*, *3*(4), 16–26.

Allen, D. C., Bateman, H. L., Warren, P. S., de Albuquerque, F. S., Arnett-Romero, S., & Harding, B. (2019). Long-term effects of land-use change on bird communities depend on spatial scale and land-use type. *Ecosphere*, 10(11), e02952.

Asefa, A., Davies, A. B., McKechnie, A. E., Kinahan, A. A., & van Rensburg, B. J. (2017). Effects of anthropogenic disturbance on bird diversity in Ethiopian montane forests. *The Condor: Ornithological Applications*, *119*(3), 416–430.

Aspinall, R., & Staiano, M. (2017). A conceptual model for land system dynamics as a coupled human-environment system. *Land*, *6*(4), 81.

Balasubramanian, A. (2015). *Categories of Landuse*. https://doi.org/10.13140/RG.2.2.22403.09763 *11*(13)

Bregman, T. P., Lees, A. C., Seddon, N., MacGregor, H. E. A., Darski, B., Aleixo, A., Bonsall, M. B., & Tobias, J. A. (2015). Species interactions regulate the collapse of biodiversity and ecosystem function in tropical forest fragments. *Ecology*, *96*(10), 2692–2704.

Dzanja, J., Christie, M., Fazey, I., & Hyde, T. (2015). The Role of social capital in rural household food security: The case study of Dowa and Lilongwe Districts in Central Malawi. *Journal of Agricultural Science*, *7*(12), 165–176.

Francis, M. J., Dami, F. D., Kambai, C., & Habila, M. A. (2019). Birds Species Abundance, Richness and Diversity in Federal College of Forestry, Jos, Plateau State, Nigeria. *African Journal Of Natural Sciences (AJNS) ISSN 1119-1104*, *20*. *12*(8)

Fusco, J., Walker, E., Papaïx, J., Debolini, M., Bondeau, A., & Barnagaud, J.-Y. (2021). Land Use Changes Threaten Bird Taxonomic and Functional Diversity Across the Mediterranean Basin: A Spatial Analysis to Prioritize Monitoring for Conservation. *Frontiers in Ecology and Evolution*, *9*, 135.

Giam, X. (2017). Global biodiversity loss from tropical deforestation. *Proceedings of the National Academy of Sciences*, *114*(23), 5775–5777.

Gibson, M. (2018). *Movement ecology of Australian arid-zone birds*. Durham University. 10(5)

Haddad, N. M., Brudvig, L. A., Clobert, J., Davies, K. F., Gonzalez, A., Holt, R. D., Lovejoy, T. E., Sexton, J. O., Austin, M. P., & Collins, C. D. (2015). Habitat fragmentation and its lasting impact on Earth's ecosystems. *Science Advances*, *1*(2), e1500052.

Hanski, I. (2015). Habitat fragmentation and species richness. *Journal of Biogeography*, *42*(5), 989–993.

Hardesty-Moore, M., Deinet, S., Freeman, R., Titcomb, G. C., Dillon, E. M., Stears, K., Klope, M., Bui, A., Orr, D., & Young, H. S. (2018). Migration in the Anthropocene: how collective navigation, environmental system and taxonomy shape the vulnerability of migratory species. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *373*(1746), 20170017.

Birdlife International,(2018). *BirdLife International*. Species factsheet Amazilia versicolor. *1*(2)

Jacobson, A. P., Riggio, J., M Tait, A., & EM Baillie, J. (2019). Global areas of low human impact ('Low Impact Areas') and fragmentation of the natural world. *Scientific Reports*, *9*(1), 1–13.

Kolawole, O. O., & Okosodo, E. F. (2018). *Influence of Different Land Use Types on Bird Species Diversity and Richness in Two Agro-Ecological Zones Edo state Nigeria*.1(1)

Marhaento, H., Booij, M. J., & Hoekstra, A. Y. (2018). Hydrological response to future land-use change and climate change in a tropical catchment. *Hydrological Sciences Journal*, *63*(9), 1368–1385.

Mayhew, R. J. (2017). *The species and functional composition of bird communities in regenerating tropical forests*.*2*(10)

Newbold, T., Bentley, L. F., Hill, S. L. L., Edgar, M. J., Horton, M., Su, G., Şekercioğlu, Ç. H., Collen, B., & Purvis, A. (2020). Global effects of land use on biodiversity differ among functional groups. *Functional Ecology*, *34*(3), 684–693.

Opoku, B. (2018). *Bird Assemblages and Vegetation Structre along Urbanization Gradient in Central Region, Ghana*. University of Cape Coast. *1*(2)

Peter, N. J., Fateye, O. B., Oloke, C. O., & Iyanda, P. (2018). Changing urban land use and neighbourhood quality: evidence from Federal Capital Territory (FCT), Abuja, Nigeria. *International Journal of Civil Engineering and Technology*, *9*(11), 23–36.

Smith, P., House, J. I., Bustamante, M., Sobocká, J., Harper, R., Pan, G., West, P. C., Clark, J. M., Adhya, T., & Rumpel, C. (2016). Global change pressures on soils from land use and management. *Global Change Biology*, *22*(3), 1008–1028.

Souza, D. M., Teixeira, R. F. M., & Ostermann, O. P. (2015). Assessing biodiversity loss due to land use with Life Cycle Assessment: are we there yet? *Global Change Biology*, *21*(1), 32–47.

Srinivasan, U., & Wilcove, D. S. (2021). Interactive impacts of climate change and land-use change on the demography of montane birds. *Ecology*, *102*(1), e03223.

Stephens, P. A., Mason, L. R., Green, R. E., Gregory, R. D., Sauer, J. R., Alison, J., Aunins, A., Brotons, L., Butchart, S. H. M., & Campedelli, T. (2016). Consistent response of bird populations to climate change on two continents. *Science*, *352*(6281), 84–87.

Tian, L. (2015). Land use dynamics driven by rural industrialization and land finance in the peri-urban areas of China:"The examples of Jiangyin and Shunde." *Land Use Policy*, *45*, 117–127.

Titeux, N., Henle, K., Mihoub, J., Regos, A., Geijzendorffer, I. R., Cramer, W., Verburg, P. H., & Brotons, L. (2016). Biodiversity scenarios neglect future land-use changes. *Global Change Biology*, *22*(7), 2505–2515.

Turner, B., Moss, R. H., & Skole, D. L. (1993). Relating land use and global land-cover change. *9*(10)

Zanata, T. B., Dalsgaard, B. O., Passos, F. C., Cotton, P. A., Roper, J. J., Maruyama, P. K., Fischer, E., Schleuning, M., Martín González, A. M., & Vizentin-Bugoni, J. (2017). Global patterns of interaction specialization in bird–flower networks. *Journal of Biogeography*, *44*(8), 1891–1910.