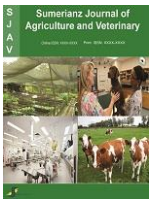
Sumerianz Journal of Agriculture and Veterinary, 2022, Vol. 5, No. 1, pp. 1-5
ISSN(e): 2617-3077, ISSN(p): 2617-3131
Website: https://www.sumerianz.com
DOI: https://doi.org/10.47752/sjav.51.1.5



Original Article Open Access

The Ecological Role of Deadwood Materials as Habitat Providers at Kanawa Forest

Abubakar Sadiq Yakubu
Department of Botany, Faculty of Science, Gombe State University, PMB0127 Gombe, Nigeria
Email: asykurba1998@gmail.com

Ahmad Nasiru Muhammad
Department of Botany, Faculty of Science, Gombe State University, PMB0127 Gombe, Nigeria
Email: ahmadnasiru450@gmail.com

Sulaiman Mohammed *
Department of Biological Science, Faculty of Science, Gombe State University, PMB0127 Gombe, Nigeria
Email: sumulsu@yahoo.com

Istifanus Jesse
Department of Biological Science, Faculty of Science, Gombe State University, PMB0127 Gombe, Nigeria
Email: istifanushena2@gmail.com

Amina Haruna Aliyu
Department of Biological Science, Faculty of Science, Gombe State University, PMB0127 Gombe, Nigeria
Email: aliyuamina50@gmail.com

Danladi Mohammed Umar
Department of Biological Science, Faculty of Science, Gombe State University, PMB0127 Gombe, Nigeria
Email: danladiumar97@gmail.com

*(Corresponding author)

Article History

Received: 11 December 2021

Revised: 15 January 2022

Accepted: 19 January 2022

Published: 24 January 2022

How to Cite

Sulaiman, Mohammed., Abubakar, Sadiq. Yakubu., Ahmad, Nasiru. Muhammad., Istifanus, Jesse., Amina, Haruna. Aliyu., Danladi, Mohammed. Umar. (2022). The Ecological Role of Deadwood Materials as Habitat Providers at Kanawa Forest. *Sumerianz Journal of Agriculture and Veterinary,* Vol. 5, No. 1, pp. 1-5.

Abstract

Deadwood; snags or downed coarse are important habitat features for many forest-dwellers. They influence ecological activities and biodiversity. This study reported on the ecological role of snags and downed coarse as habitat providers. The research was conducted at Kanawa forest reserve. Systematic random sampling method was employed to lay 4,000m line transects (500m each) across the forest edge (FE) and core forest (CF) of the reverse. On each transect, five 20m x 20m plots were established at 100m interval to assess the deadwood, their colonizers and relationship. Different animal species were recovered using snags as their prepared home or hiding place. Salamander (31%) was found in significantly greater frequencies in the core forest as colonizer. Downed coarse accommodate diverse animal species with only one plant, Chick wee. Forest edge has the transect with higher numbers of colonizers, whereas core forest has the optimum percent of downed coarse. On colonization and relationship, the interaction is either as saprophyte, use as niches or habitat. The organisms are Reptiles, Isopoda, Hymenoptera and Herbs. Among the animate thing, forest edge possess more and diverse colonizers.

Keywords: Snag; Downed coarse; Ecological role; Kanawa forest.

1. Introduction

Trees continue to influence ecological processes and biodiversity of forest ecosystems even after their death. Dead woody plants are divided into snags (dead standing tree) and downed coarse (dead fallen tree) [1]. Snags are important structural component in forest communities, while down coarse provides substrate for some living plants [2]. The ecological roles and importance of such dead or dying woody plants in forest niches have been the subject of conservative interest and the impact cannot be over emphasized. For many chordates, both snags (standing dead trees) and downed coarse woody debris provide biogenic habitat in the form of cover, as well food. Snags or down coarse with internal pockets of decay have been reported to provide insulated and protected nest, roost or hiding place for mostly the preys [3, 4]. These forest components serves as environs for animal species, lessen overflow of water and prevent erosion from slopes [5].

The dead plants equally contributes to soil development, and provides long-term phytochemical action of carbon cycle and other necessary nutrients [6]. Given the abundance of such dead woody plants in mature forests ecosystem, it is conceivable that many species evolved to rely on them as habitats [7]. Accessibility, patch size and abundance of snags are critical to supporting and maintaining diverse natural communities [8]. An emergent property across ecological scales strongly influences the population and met population dynamics of multiple taxa. Reports replete with differences among species regarding the importance of down coarse and snags .

Furthermore, the two non-living trees due provides essential foraging resource for wildlife in forest ecosystems. As certain tree species ageing, they develop deep furrows that support increased of invertebrate densities for foraging birds [9]. These indicated how importance the snags and downed coarse woody debris are toward providing habitat features for many forest-dwelling species, hence, their reductions in can lead to the loss of biodiversity, while others increase in forest ecosystems. For snags, are intentional created manage much forests to mitigate the long-run declines of naturally created dead trees. Absence of either of the dead trees species within the forest habitat remain a major limiting factor for some dependent wildlife populations, their abundance and diversity, as well as forest vegetation features [2].

Many people around forest reserves are not aware of the important, value and ecological roles of downed and standing dead trees in the forest ecosystem. Whereas, in some perception they does not play any role in the forest rather than to use as firewood. However, removing the dead woody trees in the forest causes a lots of ecological distraction such as lack of nutrient for plant species and microorganism. Eliminating the such plants in the forest habitat leads to extinction of many animals and fungal species. Therefore, identifying the kind of organism(s) that uses the dead trees as habitat is essential and would provide an insight on conservation biology. Thus, it is ecologically wise to look into the optimum usage of the trees in providing ecosystem and maintaining biodiversity through conservation. This research aimed at bringing out a clear role of snags and downed coarse in Kanawa forest reserve.

2. Materials and Methods

2.1. Study Area

Kanawa Forest Reserve (KFR) is located at Yamaltu-Deba Local Government Area of Gombe State, Nigeria It lies in the Southern part of the Sudan Savanna between latitude $10^{o}16'$N and longitude $11^{o}18'$ E with an altitude of 336m-390m above sea level**.** The mean annual temperature of Kanawa forest ranges between 32.2 ^{0}C to 32.8^{0}C, with the vegetation of mostly mosaic made up of dense sudan savanna especially around the hilly part of the reserve. The forest size is 53 hectares with sedimentary rocks which comprises varied soils ranges from fine to medium and coarse grained sandstones, clay and silt [10]. Kanawa forest forms part of Gongola basin of the upper Benue, Northern Nigeria. The topography of the area is generally undulating, while the drainage pattern is generally dendritic in nature and shallow v-shaped stream channels that tend to broaden into plains as the streams in the area approaches the lowlands [11, 12].

The vegetation of the study area is mosaic which made up of dense Sudan savanna vegetation; marshy, lowland rainforest, riparian vegetation, tall grassland area and tropical rain forests (at the drier part of the forest). The weather condition of the Kanawa forest was characterized by two distinct seasons including humid and wet season (April - October), then dry season (November - March). While, the climatic factors such as temperature, relative humidity and rainfall is normally determine by the exert influence of the vegetation [13].

2.2. Determination of Sangs and Downed Coarse Woody Debris

Systematic random sampling method was used to lay a transects across the selected habitat types i.e forest edge (FE) and core forest (CF). A total of four thousand (4,000) meter line transects was measured for the analysis [14]. Each transect is 500 m laid systematically, and on each transect, five 20m x 20m plots were established at 100m interval to assess the snags and downed coarse debris and their colonizers (Figure 1). The data were collected from the 20m squares. Geographical Positioning System (GPS) device was used to mark the sampling points before collection of data. Data was collected using direct count of the dead woody trees found within the design plots. Field guide and species identification source of information was used to identify, count and grouped the organism colonizing the deadwoood materials, as well determine the relationship existing between the dead trees and colonizers [15].

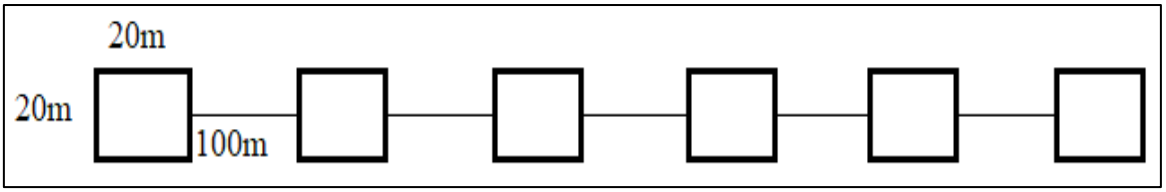


Figure-1. Illustration of line transects showing sampling plots

2.3. Statistical Analysis

The result of the research was analyzed using a descriptive statistical analysis among the habitats (forest edge or core forest) [16].

3. Results and Discussion

3.1. Role of Snags at Kanawa Forest Reserve

Few number of snag was found within both the core forest and forest edge habitats' of Kanawa forest. Different type of animals was observed to be using snags as their prepared home or hiding place in the forest reserve. Figure 2 showed the kind of organisms that uses the snags in the forest ecosystem**,** as well as, their abundance and distribution in the different habitats (Figure 2). In the core forest, salamander (31%) was found the most abundant colonizer of the snags with the total of 58 including Baikia africana species**,** while forest edge was found to have less number colonizers consisting of 3 different species of animals such as ants, termites and lizards (example of species includes Insecta, Isoptera, Agamidae and Lacertilia spcies).

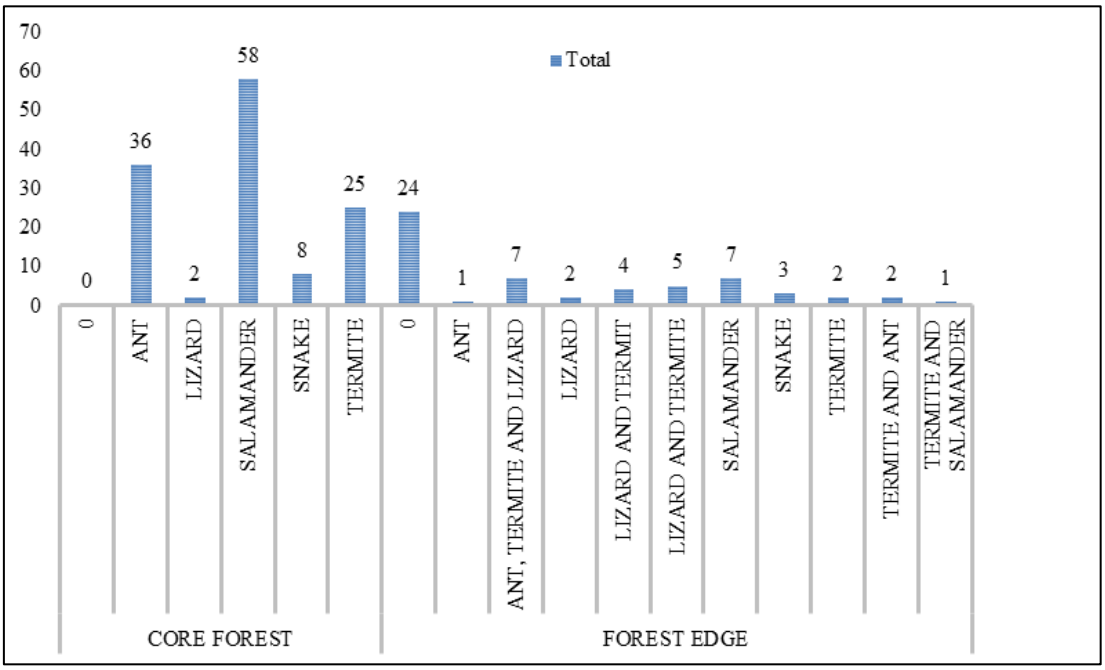


Figure-2. The snags' colonizers at both core forest and forest edge of Kanawa forest

At Kanawa forest reserve, different kind of organisms that colonized snags as their habitat for survival and other mutualistic relationship was exhibited. Core forest habitat had the highest colonizers for survival on snags due to enough spaces for the colonizers and abundace of deadwood material. Forest edge also had different colonizers in which salamander was the most abundant followed by lizard and termite. Other organisms like fungi are considered as zero (0) colonizers (Figure 2). These indicated that core forest contain more colonizers of snags in terms of relationship and survival. The main source of snags varies with stage of succession and forest type. Factors account for the creation of snags in most forests of advanced ages, particularly lightening, beetles and disease. In-contrast, some snags occur in early post disturbance forest conditions due to disturbance physical phenomenon [17].

Snags are vital component of every forest ecosystem that provide habitat for many species of wildlife. One of the significant characteristics of snags is hardness which really help in determining its value for nesting and/or foraging. Both soft and rotten snags are used by cavity–nesting wildlife [18]. Small preys mostly depend on snags for foraging and protection from predators. Lombardi, *et al.* [19], studied the relationship between lower animals and deadwood in forest habitat and discovered deer mice, marten, voles and meadow as major colonizers. For the present study, it observed that snags at Kanawa forest play an important role for many wildlife habitats as hiding environment against predators. Considering the existence of this paramount habitat provider, lots of animals and even fungal species are getting nutrient for surviving and use them as shelter.

3.2. Downed Coarse as Habitat Provider for Animal Species at Kanawa Forest Reserve

Lots of downed coarse was recovered, as well their colonizers at different transects of the two selected habitats. This research found the organisms that colonizes the death fallen trees (down coarse) at Kanawa forest they includes Ant, Crick weed, Lizard, Salamander and Termite. Such demonstrate that most of the organisms that colonize the fallen trees in the forest are animals [20]. The result was analyzed which shown that the forest edge has the transect with higher numbers of colonizers (Table 1), whereas the core forest has the optimum sum of the downed coarse within the forest reserve. This may be due to its size and other factors such as age, human activities and abiotic factors.

Table-1. Species colonizers per each transect of forest edge (FE) and core forest (CF) of Kanawa forest

Transect	No. of Downed coarse	No. of species	Name of organisms
FE 1	8	3	Ant, Lizard, Termite
FE 2	10	2	Ant, Lizard
FE 3	20	4	Ant, Lizard, Salamander
FE 4	3	3	Ant, Lizard, Termite
CF 1	18	3	Ant, Lizard, Salamander
CF 2	6	3	Ant, Lizard, Salamander
CF 3	2	2	Lizard, Termite
CF 4	17	3	Ant, Lizard, Salamander

Data on the down coarse, their colonizers and relationship existing between the two (colonizers and down coarse) were determined. The existing relationship between the downed dead trees and their colonizers at each transect of the habitats was well determined and presented (Table 2).

Table-2. The relationship between downed coarse woody debris and their colonizers at Kanawa forest

Forest habitat	Colonizer(s)	Relationship
Forest edge	Ants	Saprophyte
	Lizards	Niche
	Termites	Saprophyte
	Salamanders	Niche
	Chickweed	Habitat
Core forest	Ants	Saprophyte
	Lizards	Niche
	Salamanders	Niche
	Termites	Saprophyte

Concerning the ecological relationship that exist between the downed coarse and their colonizers at Kanawa forest, they relate as saprophyte, or use as niches and habitat for living [14, 21]. The organisms are normally grouped as Reptiles, Isopoda, Hymenoptera, and Herbs respectively. Among the animate thing, forest edge possess more and diverse colonizers. Those using dead fallen trees as niches and show saprophytic relationship has the highest abundance and distribution in the forest as they were determined in almost all the transects. Reports indicated that some fungal and plants species are associated with downed coarse in wet ecosystem[22]. Considerably, tree seedlings with best chance of success do germinate on large pieces of deadwood debris [5, 23]. They also serves in providing habitat for small mammals and arthropods or hiding covers for predators (for example Lizard), then protective cover for preys like insects. Hence, the research succeeded in finding the ecological importance of down coarse at Kanawa forest toward identifying the organisms that use it as their preference for survival. It equally shows that most of the organisms associated with the deadwood uses them as either niche or food source for saprophytic relationship.

4. Conclusion

Conclusively, snags at Kanawa forest plays an important role toward providing habitat for many animal species, for example as hiding area for preys from predators. Core forest was found to have the highest number of both snags and down coarse than the forest edge. Salamander was found as the most abundant colonizer (31%), followed by ants, termites, snake, lizard. The downed coarse showed a paramount ecological role in the forest as preference for survival for so many organisms as in the case of snags, in addition to Chickweed. The analysis ascertained that the organisms depend on them for daily activities as habitat, niche and saprophytic relationship. For that, further studies should be carry out to identify the plant species that become the deadwood colonizers, which plant has the highest number of colonizers or possible create more deadwood for conservation of lower animal and plant species, apart from microbes.

References

[1] Lombardi, F., Chirici, G., Marchetti, M., Tognetti, R., Lasserre, B., Corona, P., Barbati, A., Ferrari, B., Di Paolo, S., *et al.*, 2010. "Deadwood in forest stands close to old-growthness under Mediterranean conditions in the Italian Peninsula." *L'Italia Forestale e Montana,* vol. 65, pp. 481-504.

[2] Barry, A. M., Hagar, J. C., and Rivers, J. W., 2018. "Use of created snags by cavity-nesting birds across 25 years." *The Journal of Wildlife Management,* vol. 82, pp. 1376-1384.

[3] Sherman, L. and Hagar, J., 2021. "The snag's the limit: Habitat selection modeling for the western purple martin in a managed forest landscape." *Forest Ecology and Management,* vol. 480, p. 118689.

[4] Lohr, S. M., Gauthreaux, S. A., and Kilgo, J. C., 2002. "Importance of coarse woody debris to avian communities in loblolly pine forests." *Conservation Biology,* vol. 16, pp. 767-777.

[5] Harmon, M. E., Fasth, B., Woodall, C. W., and Sexton, J., 2013. "Carbon concentration of standing and downed woody detritus: Effects of tree taxa, decay class, position, and tissue type." *Forest Ecology and Management,* vol. 291, pp. 259-267.

[6] Weiss, S. A., Corace Iii, R. G., Toman, E. L., Herms, D. A., and Goebel, P. C., 2018. "Wildlife implications across snag treatment types in jack pine stands of Upper Michigan. Forest Ecology and Management, 409, 407-416mature Douglas-fir forest fragments and surrounding plantations and its relation to coarse woody debris and animal mycophagy." *Canadian Journal of Forest Research,* vol. 24, pp. 2157-2165.

[7] Edman, M. and Jonsson, B. G., 2001. "Spatial pattern of downed logs and wood-decaying fungi in an old-growth Picea abies forest." *Journal of Vegetation Science,* vol. 12, pp. 609-620.

[8] Turner, M. G., Gardner, R. H., O'neill, R. V., and O'neill, R. V., 2001. *Landscape ecology in theory and practice*. Springer.

[9] Barry, A. M., 2017. "Created snag dynamics and influence on cavity-nesting bird communities over 25 years in Western Oregon." Available: https://ir.library.oregonstate.edu/concern/graduate_thesis_or_dissertations/c821gn068

[10] Abba, H., Sawa, F., Gani, A., Abdul, S., and Zhigila, A., 2015. "An assessment of the shrub species of kanawa forest reserve (kfr) in gombe state, Nigeria." *Greener Journal of Biological Sciences,* vol. 5, pp. 2026-036.

[11] Mohammed, Jahun, S. F. B., Mohammed, G. A., and Dangana, A. S., 2015. "Herbaceous species diversity in kanawa forest reserve (kfr) in gombe state, Nigeria." *American Journal of Agriculture and Forestry,* vol. 3, p. 140.

[12] Mohammed, Naziru, A., Mohammed, K., Saidu, H., Muntari, M., and Andrawus, D., 2016. "Evaluation of bacteriostatic effect of methanolic extract of guiera senegalensis on some clinical bacteria." *Journal of Advanced Research in Materials Science,* vol. 18, pp. 10-17.

[13] Abba, H., Sawa, F., Gani, A., Abdul, S., and Iliya, M., 2016. "Soil physico-chemical characteristics of kanawa forest reserve (kfr), gombe state, Nigeria." *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT),* vol. 10, pp. 68-75.

[14] Ferro, M. L., 2018. *It's the end of the wood as we know it: Insects in veteris (highly decomposed) wood*. Springer: Saproxylic Insects.

[15] Draijer, G., Kalfs, N., and Perdok, J., 2000. "Global positioning system as data collection method for travel research." *Transportation Research Record,* vol. 1719, pp. 147-153.

[16] Błońska, E., Kacprzyk, M., and Spolnik, A., 2017. "Effect of deadwood of different tree species in various stages of decomposition on biochemical soil properties and carbon storage." *Ecological Research,* vol. 32, pp. 193-203.

[17] Hutto, R. L., 2006. "Toward meaningful snag-management guidelines for postfire salvage logging in North American conifer forests." *Conservation Biology,* vol. 20, pp. 984-993.

[18] Arnett, E. B., Kroll, A. J., and Duke, S. D., 2010. "Avian foraging and nesting use of created snags in intensively-managed forests of western Oregon, USA." *Forest Ecology and Management,* vol. 260, pp. 1773-9.

[19] Lombardi, F., Lasserre, B., Chirici, G., Tognetti, R., and Marchetti, M., 2012. "Deadwood occurrence and forest structure as indicators of old-growth forest conditions in Mediterranean mountainous ecosystems." *Ecoscience,* vol. 19, pp. 344-355.

[20] Borkowski, A. and Skrzecz, I., 2016. "Ecological segregation of bark beetle (Coleoptera, Curculionidae, Scolytinae) infested Scots pine." *Ecological Research,* vol. 31, pp. 135-144.

[21] Persiani, A. M., Lombardi, F., Lunghini, D., Granito, V. M., Tognetti, R., Maggi, O., Pioli, S., and Marchetti, M., 2015. "Stand structure and deadwood amount influences saproxylic fungal biodiversity in Mediterranean mountain unmanaged forests." *iForest-Biogeosciences and Forestry,* vol. 9, p. 115.

[22] Amaranthus, M., Trappe, J. M., Bednar, L., and Arthur, D., 1994. "Hypogeous fungal production in NETT, E. B., KROLL, A. J. & DUKE, S. D. 2010. Avian foraging and nesting use of created snags in intensively-managed forests of western Oregon, USA." *Forest Ecology and Management,* vol. 206, pp. 1773-1779.

[23] Riffell, S., Verschuyl, J., Miller, D., and Wigley, T. B., 2011. "Biofuel harvests, coarse woody debris, and biodiversity–a meta-analysis." *Forest Ecology and Management,* vol. 261, pp. 878-887.