Bush Burning: Implications for Crop Yield and Sustainable Livelihood of Farmers in Benue State, Nigeria

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Abstract
Bush burning is the willful burning of farmland. In the savannah ecological zone of West Africa, Nigeria, and Benue state by extension, annual bush burning has become a concern. Numerous hectares of land are burned yearly, often without consideration for the advantages or long-term repercussions of how it would affect the soil's fertility. Changes occur as a result of soil heating, but how much do these changes impact the soil's ability to yield crops and, by implication, the farmers' ability to make a living is not known? In the light of this, this study examined how bushfires in Benue State affected farmers' crop yield and quality of life. The study is cross-sectional and descriptive. Respondents were chosen using a multi-

stage sampling procedure, and data was gathered via questionnaire. At a p-value of 0.05, descriptive and chi-square tests were employed to analyze the results. The study found that the respondents' primary occupation (40.5%) was agricultural work. The majority (94.6%) of the respondents had engaged in bush burning at one point in the course of their farming activities. The effects of bush burning range from destruction of soil structure and nutrients, pollution of the environment, erosion, decrease in income of farmers, decrease in quality and crop yield, destruction of household properties and agricultural produce. The study found a significant link between livelihood actions and bush fire (x^2 = 35.60) ($p \leq 0.000$) and bush burning and the perceived effect of bush burning (x^2 = 21.65) ($p \leq 0.003$). The nation's food security is therefore threatened by bush burning. Bush burning has a negative influence on the ecology, agricultural output, and public health. This study therefore, suggests that farmers be taught about eco-friendly farming practices and safer growing techniques that can boost resilience and sustainably increase productivity.

Keywords: Bush, yields, livelihood, farmers, Benue

Introduction

One of the major threats to the quality of the environment continues to be how human activity brought on by an increasing population endangers the environment. According to Ezekwesili-Ofili and Okaka[1], bush burning is a necessary cultural ritual that cannot be abandoned in any part of Nigeria. For hundreds of years, humans have used bushfires and tree cutting in Nigeria; they utilise bushfires to manage their land and as a hunting tool. Bush burning is the arbitrary lighting of vegetation on fire and the destruction of grassland and forest resources. It is the most affordable method of clearing farmland for the peasant farmer. The hunters claim that it is a technique for hunting wildlife. To the nomad, it is the simplest way to eliminate waste so that early sprouting of food for the animals is possible.

This method can be considered as the act of clearing, collecting, and burning forestland to make room for the development of agricultural land or the care of livestock. According to Aluko, et. al.[2], every year, the bulk of the savanna's natural zones are burned and removed to make room for farming, hunting, and cattle grazing. The negative harm of bush burning need not be overemphasized because it not only endangers human health but also has an adverse influence on the environment as a whole by releasing a variety of toxins[3]. In addition to destroying soil and allowing deserts to encroach, bush burning has significantly increased global warming because it releases harmful gases that have a negative impact on the ozone layer and cause acid rain that harms plant life, damages calcium-containing soils, and raises the acidity of nearby lakes[4]. Bush fires can have a significant negative impact on people, communities, and public and private assets by posing a threat to the life expectancy and assets, agricultural and forest production, wildlife,

[1] Ezekwesili-Ofili, J. O., & Okaka, A. N. C. (2019). Herbal medicines in African Traditional Medicine. Herbal Medicine. IntechOpen. Doi:10.5772/intechopn.80348.
[2] Aluko, C., Bobadoye, A. O., Shaib-Rahim, H. O., Adebawo, F. G., & Osalusi, C. S. (2019). Perceived effect of bush-burning on households' livelihood security in Agale Local Government Area of Niger State, Nigeria. Journal of Research in Forestry, Wildlife and Environment, 11, No.3: 48-56.
[3] Otitoju, O., Yakubu, O. E., Otitoju, G. T. O, and Uka D. 2019. "A Review of Impact of Recurrent Bush Burning on the Climate Change Paradigm: The Nigerian Experience." International Journal of Biology Research 4, no. 4: 92-101.
[4] Ibid.

biodiversity, air and water quality, lowering crop yield and quality, altering the soil's microbial composition, and infrastructure[5].

Loss of shelter due to wildfires has frequently traumatised families on a household level. People who are exposed to forest fires could become sad. Loss of possessions, homes, and crop harvest for smallholder farmers who lack resources and are susceptible exacerbates their already precarious food and income security and may send them spiraling further into poverty. Bush burning has emerged as the simplest and most practical technique that is frequently used as more fields are cleared each year and made ready for farming, hunting, and grazing[6].

Bush burning can adversely lower the income of household farmers and impede agricultural production, not leaving out the numerous hazards it poses to the environment. All these directly affect crop yield and the sustainable livelihood of farmers.

A crucial element supporting the scientific debate on sustainable development has been the security of one's livelihood[7],[8]. The Food and Agricultural Organisation[9], defined households' livelihood security as the ability to meet their basic needs as well as their access to appropriate and sustainable sources of income and other necessities of life (such as obtaining adequate food, clean water, access to healthcare facilities, educational opportunities, a minimum level of income, a place to live, and time to engage in community activities and social integration).

[5] Ezihe, J. A. C., Agbugba, I. K., Eigege, S, and Etowa, E. B. 2020. "Effect of bush burning on farming households in Makurdi local government area of Benue state, Nigeria." The International Journal of Agriculture, Management and Technology 4, no. 1.
[6] Op cit., p.3.
[7] Frankenberger, T., & McCaston, M. (1999). Rapid food and livelihood security assessment: A comprehensive approach for diagnosing nutritional security. Overcoming malnutrition in developing countries. Amsterdam: Overseas Publishers Association.
[8] Lindenberg, M. 2002. "Measuring Household Livelihood Security at the Family and Community Level in the Developing World." University of Washington, Seattle, WA, USA World Development 30, no. 2:301-318.
[9] FAO (1996a). Forestry and food security. Ed. Gillman, H., and Hart, N. Rome (Pamphlet).

Livelihoods refers to all activities that an individual engages in for their daily survival. The activities are the means to food, housing, clothing, cash and other needs of man for sustenance. These survival and coping strategies of man could be endangered in the face of fire disaster which can lead to the destruction of lives and properties, contaminating the soil and polluting the air with the release of toxic waste. The threat of farmers and hunters burning bush carelessly is not limited to the nation's food basket, Benue State. Unrestrained and irresponsible. During the dry seasons, bush burning has become a regular and annual practice[10]. The damage and extent of bush burning's impact on the ecology are escalating to an alarming level. In order to develop strategies that will address the negative consequences of bush burning with respect to arable agriculture, rangeland, and soil conservation, a better understanding of the implications of bush burning is thus necessary. Although there have been numerous studies on bush burning operations in Nigeria, the majority of them focused on the detrimental effects of bush burning on farmlands and the state of the soil in the affected areas without taking into account the impact on crop output and the long-term viability of farmers. Hence, the need to investigate the effects of bush burning on agricultural productivity and the perceived effect of damages caused by bush burning on the livelihood security of farmers.

Objectives

1. To examine the livelihood activities of farmers in Benue state
2. To highlight the perceived effect of bush burning activities on crop yield and farmer's viability

Materials and Methods

Study Area

Benue State was created on the 3rd of February, 1976. The population of Benue is 4,780,389 (Census, 2006) but with the projection of 6%, population growth the current population stands at 5,067,212. About 32,518 square km of land make up Benue State which comprises of twenty-three (23) Local Government areas [11] ., Fourteen (14) of the local government areas are occupied by the Tiv ethnic community while the

[10] Op cit., p.3.
[11] Ibid.

remaining 9 comprise of Idoma, Igede, Agatu and Etilo. They are predominantly farmers. Farmland in Tiv community is held sacred and any external encroachment causes provocation that can lead to war. The socio-economic status of the state can be said to be on the lower class but the literacy level is high.

Research Design

This study is cross-sectional and descriptive. The target population is Tiv males and females in the purposively selected study locations who have adequate knowledge and experience about bush burning and farming activities.

Sampling Size and Procedure

A total of 440 respondents made up the study's sample size. Using Taro Yamane's formula and a population estimate for 2006 multiplied by 6%, or 1,230,000, the sample size was determined. Respondents were drowned from the fourteen (14) Local Government Areas that the Tiv ethnic group occupies in Benue State. Using the multi-stage sampling technique, the following steps were used to draw out the units of analysis.

First stage: Using the two senatorial districts (Benue North-East and Benue North-West Senatorial Districts) that are made up of the Tiv ethnic group, the fourteen (14) local government areas were divided into two (2) clusters. *Second stage:* From each of the senatorial districts, two local government areas were chosen at random, totaling four LGAs.

Third stage: From each of the four LGAs, two council wards were purposefully chosen, creating a total of eight wards. Systematically choosing homes from both sides of the roadways was done in each of the eight villages. The first and every second house were chosen, and in each of the households, the heads or representatives of the families that fit the requirements for the study were purposefully chosen. The proportion of respondents/households in each community was determined by the total number of respondents from each local government.

Table 1: Senatorial districts and selected local government areas

Benue-North-East Senatorial District	Simple Random Sampling Decision	Benue-North-West Senatorial District	Simple Random Sampling Decision
Katsina-Ala		Buruku	**Selected**
Konshisha		Gboko	
Kwande		Guma	**Selected**
Logo		Gwer East	
Ukum	**Selected**	Gwer West	
Ushongo		Makurdi	
Vandeikya	**Selected**	Tarka	

Table 2: Distribution of the target population of the selected wards

Selected LGAs	Total No. of Wards	Purposive Sampling Decision		No. of Selected Wards	Selected No of Quantitative Respondents in Each LGA
Buruku	13	Mbayaa	Mbaapen	**2**	**107**
Guma	10	Uvir	Mbabai	**2**	**100**
Ukum	13	Tsaav	Aterayange	**2**	**112**
Vandeikya	12	Mbakyaha	Mbadede	**2**	**121**
Total	**48**	**4**	**4**	**8**	**440**

Instruments of Data Collection and Analysis

A structured questionnaire was used for the study to obtain data needed for the research. Three hundred and ninety (390) of the four hundred and forty (440) questionnaires that were given to respondents in the study region were properly completed and used for analysis. Analysis methods included descriptive statistics (frequency counts, percentages), as well as inferential statistics (chi-square).

Results

Table 3: Socio-demographic characteristics of the respondents (n=390)

Variables	Frequency	Percentage (%)
Age		
21-30yrs	43	11.0
31-40yrs	106	27.2
41-50yrs	127	32.6
51yrs and above	114	29.2
Sex		
Female	86	22.0
Male	304	78.0
Educational status		
No formal	51	13.0
Primary	121	31.0
Secondary	129	33.0
Tertiary	88	23.0
Monthly Income		
< N18, 000.00	124	31.0
N18,000.00-25,000.00	41	11.0
N26,000.00-35,000.00	63	16.0
N36,000.00-45,000.00	39	10.0
N46,000.00-55,000.00	65	17.0
N56,000.00-65,000.00	39	10.0
>N66,000.00	19	5.0
Family size		
≤ 5	86	22.0
6-10	265	68.0
11-15	39	10.0
Farm size (hectares)		
≤1.00	65	17.0
1.00-1.50	150	38.0
1.51-2.00	78	20.0
>2.01	97	25.0
Farming experience		
≤10 yrs	163	42.0

11-20 yrs	86	22.0
21-30 yrs	78	20.0
>30 yrs	63	16.0

Source: Field Survey, 2023

Table 4: Livelihood Activities of Respondents

Livelihood Activities	Yes (%)
Crop farming	113 (29.0)
Cassava processing	45 (11.5)
Trading Livestock farming	44 (11.3)
	52 (13.3)
Fishing	29 (7.4)
Lumbering works	33 (8.5)
Artisan	33 (8.5)
Hunting	41 (10.5)

Source: Field Survey, 2023.

Table 5: Ever practiced bush burning as a farmer

Ever Practiced	Frequency	Percentages
Yes	376	96.4
No	14	3.6

Source: Field Survey, 2023

Table 6: Perceived effect of bush burning

Effects	Frequency (%)
Destruction of soil structure and nutrients	93 (23.8)
Reduces crop yields	45 (11.5)
Destruction of agricultural produce	48 (12.3)
Reduces income of farmers	59 (15.1)
Pollution of the environment (air and water)	32 (8.2)
Killing of wildlife and other animals	37 (9.5)
Destruction of household properties	37 (9.5)
Increases chances of soil erosion	39 (10.0)

Source: Field Survey 2023

Table 7: Chi-Square test of relationships between bush burning on farmer's livelihood and its perceived negative effects.

		Bush Burning		
		Yes	**No**	**X^2; df; p-value**
Livelihood Activities of Farmers*	Crop farming	99	14	35.60; 7; 0.00
	Cassava processing	45	0	
	Trading	44	0	
	Animal Farming	52	0	
	Fishing	29	0	
	Lumbering works	33	0	
	Artisan	33	0	
	Hunting	41	0	
Perceived Effect of Bush Burning*	Destruction of soil structure and nutrients	93	0	21.653; 7; 0.003
	Reduces crop yields	39	0	
	Destruction of agricultural produce	48	0	
	Reduces income of farmers	58	1	
	Pollution of environment	29	3	
	Killing wildlife and other animals	33	4	
	Destruction of household properties	33	4	
	Increases chances of soil erosion	43	2	

Source: Field Survey 2023

Discussion

Bush burning is a traditional agricultural practice in many parts of the world, including Nigeria. It is the intentional burning of vegetation, usually in the dry season, to clear land for farming or to improve crop yields. However, bush burning can have a number of negative implications for crop yield and the sustainable livelihoods of farmers.

The socio-demographic characteristics of the farmers considered in the study were age, sex, marital status, educational qualification, monthly income, household size, farm size and years of experience in farming. The age distribution shows that (59.8%) were 31-50 years old. More than half of the respondents (78%) were male, a possible reason could be that, farm activities are tedious hence less participation of women also Tiv society is highly patriarchal and men are assumed to own all farmlands even though the women folk may be very active participants in the farming activities.

Eighty-seven percent (87%) of the respondents had formal education while a minute (13%) did not have any kind of formal education. The findings of Onoja and Achike[12] indicated that individuals with educational attainments are usually faster adopters of innovations and willing to learn. By implication, farmers from the study area are more likely to use novel innovations for their farming activities. Income of (31%) of farmers was below the government standardized minimum wage. This has implications for the overall livelihood and security of farmers. Their desire to afford life's basic necessities such as health, education and conducive accommodation for sustainable living cannot be achieved and are farfetched. Majority (68.0%) of the respondents have a family size of 6-10 persons. Obviously, the household size in the study area is large. Sadiq *et al*.[13] argued that large household sizes is a major source of free labour and manpower for farm work in African societies and Tiv communities are not an exception. Thirty-eight percent (38.0%) of the respondents claimed to possess 1-1.5 hectares

[12] Onoja, A. O, and Achike, A. I. 2011. "Resource Productivity in Small-Scale Catfish (Clariasgariepinus) Farming in Rivers State, Nigeria: A translog Model Approach." Journal of Agriculture and Social Research 11, no. 2:201.
[13] Sadiq, M. S., Singh, I.P, and Kolo, M.D. 2015. "Resource Optimization in Small-Scale Fish Farming in Minna Agricultural Zone of Niger State, Nigeria." International Journal of Innovative Research & Development 4, no. 1: 123-128.

of farmland. The large farmlands are to a large extent enough to sustain the farmer's basic needs after the sale of produce. Farming experience accounted for (42%) of the respondents claiming to have had 10 years of farming experience and below while 58.0% have had farming experience greater than 10 years. This result shows that farmers must have experienced one or more of the negative impacts of bush burning in the course of their farming activities which must have affected their livelihood and security as humans. Rahji [14] asserted that there is a correlation between technical proficiency and experience.

Livelihood activities of the respondents show that, (29.0%) of the respondents engaged in crop farming which is in consonance with Kamanga *et al*.[15], who stated that small holding crop farming households, the majority of whom live in rural areas, dominate the agriculture sector. While 11.5% are into cassava processing;11.3% engage in trading which is mostly buying and selling of raw or finished farm produce. Animal farming such as piggery, poultry, goat/sheep breeders as a source of livelihood accounted for13.3%. A minute percentage engaged in fishing (7.4%), lumbering works (8.5%), artisan (8.5%) and hunting (10.5%) which could be explained by the fact that more than 90% of farmers burn their land to get creatures like rodents, wild rabbits, and cane rats out of the wild so they would be easier to trap. Gnado[16], also asserted that, despite the known lasting and long-term devastating effects of bush burning, farmers still engage in the practice of hunting for games or meat.

The majority of the respondents (96.4%) agreed to have engaged in bush burning practices during their farming activities at one time or the other. This is regarded as one of the best and fastest mediums of clearing farmland for cultivation and it is believed that, the ashes add to /soil nutrients. Some farmers burn the brush because they believe it can disinfect and eliminate

[14] Rahji, M. 2000. "An Analysis of the Determinants of Agricultural Credit Approval/Loan Size by Commercial Bank in South Western Nigeria." Journal of Nigerian Development Studies 2, no. 1: 6-25.
[15] Kamanga et al., 2009. Forest income and rural livelihood in Chiraszulu District, Malawi. *Ecological Economics*, 68(3), 613-624
[16] Gnado J. 2004. "GIA/NABIO Agro Forestry Development Organization".GNADO Report Bolgatanga. Ghana For.Res. no.1:21-25.

bugs, pathogens, and weed seeds as well as promote new growth of lush grass for livestock.

A small proportion (23.8%) of the respondents agreed that bush burning causes the soil to lose its structure and nutrients. This in turn can lead to the reduction of the yield of farmers at the end of the farming season. Also, 12.3% of the respondents noted that, agricultural products were destroyed as a result of bush burning. This is consistent with Izah *et al*.'s[17] report that fire destruction was a negative effect of bush burning on farmlands' unharvested crops. This suggests that if bush burning is not adequately controlled, it could slow down the nation's agricultural production. This may be explained by the fact that bush burning depletes the soil's nutrient content, which may lead to low yields. Furthermore, bush burning was also noted to cause, environmental pollution, destruction of wildlife and other animals, destruction of household properties and increases the chances of soil erosion. According to Barnabas *et al*.'s report[18], bush burning decreases soil fertility, encourages soil erosion, lowers the quality and yield of crops, and also annihilates soil microorganisms. This shows that bush burning is dangerous and can deplete the environment's resources if immediate action is not taken to stop it.

Bush burning and livelihood activities, as well as the perceived effects of bush burning, are significantly correlated. This suggests that the type of livelihood practices of the locals influence bush fire activity in the research areas. 'Man vs. environment' disputes can be difficult, and bush burning is one of them. Many communities, particularly in Northern Nigeria, still practice bush burning as part of their traditional farming practices and cultural beliefs. Bushfires have severe and pervasive consequences on the ecosystem and on farmers' means of subsistence. Even while farmers themselves are aware of the detrimental effects the activity has on their security and environment, it has been challenging to curtail or eradicate it. This is in line with a study conducted by Ezihe *et. al*.[19] who stated that,

[17] Izah, S. C., Angaye, T. C. N, Aigberua, A. O, and Nduka, J.O. 2017. "Uncontrolled Bush Burning in The Niger Delta Region of Nigeria: Potential Causes and Impacts on Biodiversity." International Journal of Molecular Ecology and Conservation. 7(1) doi: 10.5376/ijmec.2017.07.0001.

[18] Barnabas, B., Jibril, S. A., and Abubakar, N. B. 2019. "Perceived effects of bush burning on arable crop production in Bauchi local government area of Bauchi state, Nigeria." African Scholar Journal of Agriculture and Agricultural Technology 15, no. 1:250-260.

[19] Ezihe, J. A. C., Agbugba, I. K., Eigege, S, and Etowa, E. B. 2020. "Effect of bush burning on

farmers lost a great percentage of assets to bush burning and farmers were aware that loss of crop was one of the perceived negative effects of bush burning. In the same vein, a study conducted by MyAgricWorld[20], noted that the destruction of crops is one of bush burning's most important effects on food security. When farmers burn their farmlands to prepare them for cultivation, the fire may spiral out of control and spread to neighbouring farms. This may result in decreased yields and, in rare situations, a complete loss of the crop by destroying crops and farms. Both the food supply chain and farmers' livelihoods may suffer greatly as a result of this.

Conclusion and Recommendation

In Nigeria, especially in the north-central region, bush burning is a common practice. Farmers do this to prepare land for cultivation and to get rid of dry grasses and leaves. However, the country's food security is now seriously threatened by the indiscriminate nature of bush fires. Continuous burning of bushes has a major negative impact on both the environment and agricultural output. It lowers the quality of the soil, lessens the fertility of the land, and harms crops, which lowers agricultural productivity. Farmers who burn their land to prepare it for cultivation run the risk of the fire getting out of control and spreading to nearby farms, destroying crops and farmlands. This has a terrible impact on the farmers' livelihoods as well as the food supply chain. Additionally, bush burning has the potential to worsen heat waves, increase the risk of skin cancer, and provide more conducive environmental conditions for disease conditions and their vectors. Bush-burning-related sulphur and nitrogen oxides continue to be dangerous because they create a respiratory condition marked by increased bronchial mucus discharge. Sulphur and nitrogen oxides both pose a risk to health since they can irritate the skin and create respiratory problems.

.. . Farmers need to be made more aware of the detrimental effects that bush burning has on the environment and agricultural productivity. Farmers need

farming households in Makurdi local government area of Benue state, Nigeria." The International Journal of Agriculture, Management and Technology 4, no. 1.

[20] MyAgricWorld (2023). Incessant bush-burning: Threat to food security in Nigeria. Retrieved on 07/11/2023. From www.myagricworld.com.

to be informed about more environmentally friendly land-clearing techniques, such as those that involve manual work or machinery.

The environment and property are at risk when fire is used inappropriately, especially when it is lit too frequently, overly widely, too intensely, at the wrong time, or carelessly. Government regulatory policies and educational materials should pay particular attention to this threat. The government should pass and execute legislation outlawing bush burning and punishing those who breach the law. This can encourage prudent land management techniques and help discourage farmers from using the practice.

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