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# Evaluation of the Impact of Burnt-Bricks Production on Vegetation and Potential Flood in Naka, Gwer-West Lga, Benue State

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***Keyword:***
*Evaluation, Impact, Burnt-Bricks Production, Vegetation, Potential Flood, Naka.*

**Abstract**
*This paper evaluates how burnt-brick production has impacted the vegetation and potential flood in Naka urban centre. Using a survey research design, it combines observational and questionnaire Data collecting instruments, where 30 questionnaires were distributed to the stakeholders in the production sector (10 to Land owners, 5 toland leasees, 5 to transport owners, 3 each to molders and loaders). Frequency distribution tables and graphs were employed for data presentation. Descriptive statistical tools were used for analyzing the data. From both literature content analysis and empirical analyses, the study finds that, burnt production activities are exerting adverse effects on the ecology of the sites and on the vegetation especially hardwood around Naka town as longer distances are being covered for the same quantity and at a costlier price. The investigation also shows that the repeated cases of flooding in southern part of Naka in the recent years are significantly caused by the continuous soil excavation and expansion of borrow-pits to get soil for molding. The research concludes that burnt-brick production has positive building economic benefits but exerts significant adverse effects on the*

*richness of stream ecology, underground organisms and air pollution at the kiln, depleting certain species of trees (vegetation) used for firing the bricks within 15 kilometers radius and is responsible for flooding of southern Naka. Therefore, the study recommends that government should regulate the burnt-brick activities from ownership of land, extent of excavation, felling of wood for firing at the kiln, and provide drainages to mitigate the perennial flood that has rendered thousands of resident homeless, destroyed hard-earned properties and human lives.*

## Introduction

When man moved out of caves, housing construction was man's first step towards self-protection from the hostile climatic elements and beasts. Whether these houses were constructed with stave and leaves or with bricks and grasses, they served their purposes. Besides, brick-making either with clay (raw of fired) or sancrete (sharp sand and cement) gradually became the popular building material. The use of burnt bricks dates back to the Stone age (ie 2500 BC) as narrated in the Bible story of "The Tower of Babel" (in Genesis chapter 11 verse 3), where the people were said to "make bricks and burn them thoroughly" for construction. In our contemporary time, the construction industry is still very vital and a reflection of the socioeconomic development. In many countries, the yardstick for the measurement of national progress is hinged on the degree of contributions of the construction industry. The building materials sector is also a major contributor to the construction industry of every nation because materials constitute the single largest input in construction often accounting for about half of the total cost of most or any construction products (Kern,2004; Okereke, 2003;Mogbo,2001; Sanusi,1993; Fellows, Langford, Newcombe & Urry, 1983). Literature shows that materials constitute the largest single input in housing construction, accounting for 60–70% of total cost in Ghana (Danso and Manu,2013),around 65% in Nigeria (Mogbo,1999), over76% in Tanzania (Wells *et al*, 1998) and68%inKenya (Syagga,1993).Furthermore, Adedeji (2010) noted that more than 60% of the total house construction cost goes towards the purchase of construction materials. Abanda et al (2014) posited that

the share of building materials often used in construction is huge and most other factors depend on them. A report by the United Nations Habitat(1992)revealed that the building materials sector was split into three production groups: (i) Modern or conventional building materials which are based on modern conventional production methods like sandcrete, concrete, steel, and glass; (ii) traditional materials which include those materials that have been in local production from ancient times using small-scale rudimentary technologies, for example, laterite, gravel, thatch, straw, stabilized mud, Azara, and raphia palm; and(iii) innovative materials which are materials developed through research efforts aimed at providing alternatives to import-based materials, for example, fibre-based concrete and ferrocement products (, Acheampong, 2014;Adogbo & Kolo, 2009; UNCH Report,1992; UNCH,1985). A number of researches have established the fact that escalating cost of building materials is one of the major factors responsible for the widening gap between demand and supply of affordable and adequate housing (Adedeji, 2007; Zami andLee,2010; Assaf etal.,2010., Kulkami *etal*, 2014; Okunade, 2008).Although there are modern building materials in the market, there is still the need to integrate traditional materials due to their availability, affordability and suitability. In Nigeria, for instance, Abiola (2000), Ahiabor (2014), identified building materials as one of the principal factors affecting the effective performance of the Nigerian construction industry. According to BRRI (2012), if part of the expenditure currently incurred in the importation of clinker is invested in the production and usage of burnt clay bricks, some substantial gains could be made in solving the nation's housing deficit. Though several researchers worldwide have called for the need to revert to indigenous building materials (Adogbo, 2000; BRRI; 2012; Peaktopraires,2005; lilly & Wai, 2000; Mourshed, Matipa, Keane & Kelliher, 2001), little is being said about the factors inhibiting the use of such materials in Nigeria (Mahgoub,1997).

Clay bricks are man-made building materials that are widely used in building, civil engineering work, landscape design and decoration (Adeola,1977). Burnt bricks are the most popular building material in Gwer-West local government, Benue state due to availability of suitable clay in all parts of the local government. There five main traditional stages in brick making, namely, (i) preparing the soil i.e. digging and mixing the clay soil, (ii) molding/shaping

the bricks, (iii) sun-drying the raw bricks, (iv) loading, and (v) logging and firing the bricks. The burnt brick industry in Gwer-west employs low technology, manual and less-efficient methods such as digging the soil with crude implements (hoes) and mixing using feet, hand molding, sun-drying and open clamp burning. The most promising method of decentralized burnt-brick production, vertical shaft brick kiln technology is yet to be employed in the study area. In the world leading brick producing countries like China and India, clay brick manufacturing is transforming into more energy-efficient production methods now than it was a few decades ago (National Institute of Standards and Technology, 2007). The reason for this significant transformation is that the modern brick manufacturing process adapts many practices intended to conserve resources and promote sustainability. Burnt-bricks are cheaper, stronger and are used to build houses, drainages, fences hardcore the roads and compounds and in the design of landscaping.Good brick must be hard, well burnt, uniform throughout, sound in texture and colour, and sharp in shape and dimension and should not break easily when stuck against another brick or dropped from a height of about one meter (Gopi, 2009). The colour may vary a little depending on the soil. In using burnt clay bricks for construction, certain desirable properties should be achieved; these desirable properties are compressive strength, density, thermal stability, porosity, sound insulation, fire resistance, durability, and so forth. Well-burnt bricks meet these properties and give aesthetics when used to beautify with paint. Benefits associated with this material are not fully explored because research outputs have not been properly brought together (Adogbo andKolo,2006).

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**Statement of Research Problem**

The traditional mining and wood-based production and firing of bricks result in resource depletion, environmental degradation, unprecedented and unsustainable fuel wood consumption, even though the process generates employment. These problems can be overcome and the process replaced by a more sustainable production system developed to improve the basic factor conditions in the local economy (Levi, 1990).Wood energy consumption that leads to extinction of some wood species and pollution are the two important environmental and cost concerns related to the brick industry. However, in

Naka town, the town has expanded and engulfed the mining fields along the two streams that have their sources within and this has made the proximate parts of the town vulnerable to flooding and subjected proximate areas to emissions of several harmful gases like carbon monoxide, sulphur dioxide, nitrogen oxide and particulate matter from burning of fuel wood in brick kilns that can cause serious respiratory diseases like bronchitis and asthma. Moreover, these pollutants weaken the immune system of the human beings and hurt their resistant power to fight various types of infections. The informal clay brick makers in Naka town lack formality, in terms of the licensing laws, tax laws, labour laws, and environmental health regulations. These informal operations are small scale, mostly family or household-based enterprises that are unregulated by government institution. They are just beginning to form local organization for social welfare purpose. As a livelihood activity, this enterprise employs quite a number of personnel in various phases such as excavation, molding, loading and firing in kilns, loading, transporting and off-loading, retailing among others.

Therefore, this study is carried out to evaluate and rank the key impact of fuel-wood-based burnt-brick production on vegetation and the potential flood. It assesses the perception of the producers, the perception of the users and how the residents of Naka, perceived the impact of brick making process on environment and human health of the citizenry. Review on an indigenous building material like this can inform policy in this part of the world where urbanization is putting pressure on economic, ecological and environmental resources (Wells, 1995; Wells *et al* 1998; Adegun, 2011).

**The Study Area**

The study was carried out on burnt-bricks industry in Naka, Gwer-west local government, Benue State, Nigeria, between December to March for dry season. Naka appears to be the home for the commercial wood-based clay bricks production because of the abundance of clay soil there. It is observed that more than 99.9% of the residential buildings there are built of clay and about 95% are built with burnt bricks while about 4.9% are built with raw and sometimes plastered. Only the local government secretariat and other few structures in Naka are built with sandcrete. Other proximate areas with streams with clay

such as Achagh (along Cweri and Kwebi streams), Rivers Chu, Nagi among others are rapidly emulating the massive burnt-bricks production with bigger and higher quality. These may be referred to but are not integral part of (Naka) the study.


**Fig. 1: Map of Benue State Showing the Studied Local Government Area**

## METHODOLOGY

Only Naka burnt brick centre was purposively selected for this research out of many other places in Gwer-west the local government Benue State. In the local government, it is the origin of the wood-based burnt-brick industries in the local government. The population of the workers was stratified into land owners, land leasers, brick producers, brick firing sector/loaders and the respondents were randomly selected through their chairmen from each stratum, making a total sample size of 150 respondents, randomly drawn from the brick producers. A structured questionnaire was administered on the respondents. Information on land ownership, land leasing conditions, brick production quantity and cost of (production including tree felling, timbering and transportation, sales of brick), challenges, effects and other key informants in the study area, using focused group discussions. The responses of the respondents were recorded and analyzed using descriptive statistics. Data obtained from the questionnaire

surveys were analysed with SPSS, Version 23 and presented in frequency distribution tables.

## ANALYSIS AND DISCUSSION

The analysis of the empirical data collected on materials used for the firing of the kiln showed that all the respondents agreed that they use logs of hardwood, water for choking the surface of the clamps, grasses and kerosene for initial flaming of the burning contents inside the holes of the kiln.

**Table1.0 Major species of trees used for firing bricks at the kiln**

| | | *Frequency* | *Percent* |
|---|---|---|---|
| *Valid* | Mahogany (Haa) | 2 | 6.7% |
| | Iron tree (Prossopis Africana) | 24 | 80% |
| | Kor(Erythrophleum Guineese) | 3 | 10% |
| | Maaki(Anogeissus Leiocarpus) | 1 | 3.3% |
| | Total | 30 | 100.0 |

**Source:** Fieldwork 2019.

In identifying the types of trees used for firing the bricks, table 1.0 shows that iron-tree is used by a greater number because of its hardness and fiery burning nature. This is followed by Anogeissus Leiocarpus, Erythrophleum Guineese, and mahogany trees.

**Table 2.0 TheNegative effect of burnt bricks on the types of trees used in making bricks**

| | | *Very adverse* | *Percent* |
|---|---|---|---|
| *Valid* | Iron tree (Prosopis Africana) | 20 | 66.7% |
| | Maaki (Anogeissus Leiocarpus) | 5 | 16.7% |
| | Kor (Erythrophleum Guineese) | 3 | 10.0% |
| | Mahogani | 2 | 0.6% |
| | Total | 30 | 100.0 |

**Source:** Fieldwork 2019.

Table 2.0 assessed the effect of burnt-brick on the types of trees used at the kiln and it shows that 20(66.7) agreed that they use logs of iron trees. 5(16.7) agreed that they also Anogeissus Leiocarpus (maaki) tree 3(10) included the use of kor

logs; while 2(0.6%) indicated using Mahogany because of their hard nature that sustain fire and heat in the kiln to produce quality bricks. However, they added that the choice/use of these other types of logs other than Prosopis Africana is due to its scarcity as this tree is often felled by charcoal producers and that a great deal of them.

**Table 3.0Effect of burnt-bricks on vegetation**

| | | *Frequency* | *Percent* |
|---|---|---|---|
| *Valid* | Loss of economic species | 24 | 80% |
| | Reduction of biodiversity | 2 | 6.7% |
| | Desert Encroachment | 1 | 3.3% |
| | Impoverishment of wildlife habitat | 3 | 10% |
| | Total | 30 | 100.0 |

**Source:** Fieldwork 2019.

Assessing the effect of burnt bricks on vegetation, table 3.0 shows that the industry has endangered the species of trees that are felled and sawn for firing the bricks, the economic value of the trees such as (Prosopis Africana) iron tree that produces condiment for cooking soups, for bridge construction and fencing is lost; the mahogany is used for herbal medicine when there are cases of fracture, while Erythrophleum Guineese has cultural value as is used to ascertain truth of any mystery of loss of items, mysterious death, cases of theft. Aside from the loss of economic importance, the industry is also impoverishing the biodiversity of vegetation and wildlife habitat thereby exacerbating desert encroachment.

Fig 1 Logs of Hard Wood Used for Firing the Bricks

Fig 2 Burnt Bricks Showing the Holes for Loading Logs

Fig 3 Burnt Bricks Kiln

Fig. 4 Affected Foundations of Proximate Buildings

**Table 4.0 Effect of burnt-bricks activities on flooding**

| | | *Frequency* | *Percent* |
|---|---|---|---|
| *Valid* | Widening and deepening of stream valley | 25 | 83.4% |
| | Erosion of riverbanks | 1 | 3.3% |
| | Overflow of water to buildings | 3 | 10.0% |
| | Disrupts normal flow system | 1 | 3.3% |
| | Total | 30 | 100.0 |

**Source:** Fieldwork 2019

In establishing the cause and effect on flooding, table 4.0 shows that 24(80%) and 2(6.7%) of the respondents agreed that the widening of the stream-course and erosion of the stream-banks respectively contribute to the flooding of the area and exerts a significant adverse effect on property and social well being of the people.

**Table 5.0Negative effects of brick making on plants and ground organism (ecology)**

| | | *Frequency* | *Percent* |
|---|---|---|---|
| *Valid* | Effect on plants | 20 | 66.7% |
| | Ground organism | 6 | 20.0% |
| | Soil loosening/erosion | 4 | 13.3% |

| | | |
|---|---|---|
| Total | 30 | 100.0 |

**Source:** Fieldwork 2019

Weighted Opinion assessment of the respondents on other negative effects of the burnt-bricks especially on plants, ground organisms and soil loosening/erosion capacity; table 5.0 indicates that all the three variables are perceived to be negatively affected in the proportion of 20(66.7%), 6(20.0% ) and 4(13.3% ) respectively.

**Table6.0 Effect on seasonal water retention**

| | | *Frequency* | *Percent* |
|---|---|---|---|
| *Valid V.* | High effect on seasonal water retention | 27 | 90% |
| | High effect on seasonal water retention | | |
| | Undecided | 2 | 6.6% |
| | No effect on seasonal water retention | 1 | 3.3% |
| | Total | 30 | 100.0 |

**Source:** Fieldwork 2019

Table6.0 shows that 27(90%) of the respondents indicate that there is positive significant effect of water retention capacity as more aqueduct wells are dug in the deep trenches to get water for burnt-bricks activities. Owners of such wells draw waters from such wells all round the year and some sell the water, which increased their revenue generation capacity.

**Table7.0 Effect of burnt bricks on human health**

| | | *Frequency* | *Percent* |
|---|---|---|---|
| *Valid V.* | High effect on human health | 30 | 100% |
| | No High effect on human health | 0.0 | 0.0% |
| | Total | 30 | 100% |

**Source:** Fieldwork 2019

Table 7.0 shows that 20(100%) of the respondents indicate that there is positive significant effect of water retention as some aqueduct wells retains water throughout the dry season thereby supporting life.

## SUMMARY OF FINDINGS

Bricks are mainly made of soil. The use of immense amount of soil causes soil degradation. The paper discusses the effect of the burnt-brick industries on the environment and human health and suggests more sustainable strategies for the kiln process, so that economic development and environmental protection can be simultaneously be integrated.

Lack of environmental regulation in the industrial arrangements and the dearth of public awareness on the array of environmental problems(degradation, land and air pollution, ecological devastation) and health hazards of brick production and absence of mitigation measures and strategic planning involving all stakeholders in the brick industry recorded reticence and very low responses from the respondents.

Increased scarcity and cost of the preferred fuel wood-species(hardwood) indicates increasing severity as people have to travel far from Naka to get the preferred wood and at a costlier price for same tractor-load than before.

As the preferred wood is becoming increasingly scarce, people are turning to alternatives trees that may not burn thoroughly. This may produce lower quality of bricks, though it is increasing deforestation and desertification.

Benefits associated with this material are not fully explored because research outputs have not been properly brought together (Adogbo & Kolo,2006).

The results show that there are adverse effects of these industries on soil, water, air, vegetation and human health.

## DISCUSSION

Due to the seasonal nature of the brick industry in the local government in particular, the workforce for burnt-bricks is engaged for a limited period of about four to five months annually depending on the early stops and or starts of rainfall (November to February/march each year). When rainfall starts, usually (April to October), the burnt brick workforce move to their agricultural fields as farmers or get engaged as agricultural labourers and traditional brick burning process is suspended. Until the onset of the next brick-making season, there is no guarantee to get employment in the same kiln, since they are not on the payrolls of the kiln owners, they are not covered under the current labour laws, e.g. Minimum Wages Act. For jobs such as loading of green bricks and transportation which are done by both males and females, there are no separate

wages for women. There is no practice of systematic spending or savings by those involved in brick making processes.

The social impact of brick making is linked to workforce, which may be categorized into at least six based on the scale of operation: landlords/owners, land leasee, brick molders/loaders into kiln, tree-feller/timbering and transporters to kiln, firing members and transporters with loading and off-loading from vehicles. Open clamp kilns are owned and operated by land owners in brick-producing communities or to people they lease to. These communities live in permanent settlements and partly earn their living through selling bricks. Furthermore, large brick producers employ labour on contract which is paid for completion of specific tasks such as provision of logs of firewood, molding, loading in kiln for firing, usually calculated per1000 bricks, loading and off-loading of bricks in thousands on and/or from vehicles etc. During these years of heightened herdsmen-farmers crises, brick workers are abundantly available as many rural areas have relocated to Naka from their rural settlements. The labour composition is made up of Men, children and women that participate in the brick producing industries where shelter may or may not be provided. They all look for means of survival in addition to self-sponsoring pupils and students that look for money to pay their fees and meet other needs.

Marginal profit in the brick market coupled with rising costs of fuel-wood due to scarcity result in poor remuneration for majority of brick workers and deterioration in the quality of life. The labourers work under severe conditions of dust and pollutions, cold water and harmattan, heat of fire from the kilns and pollutants. Since the brick producers are using only their local skills, there are no avenues for brick workers to acquire new and upgraded skills.

Sometimes, children and wives accompany their parents/husbands to the work place instead of attending school for the former and alternative work for the later. During December holidays, pupils/students (who age 6-17 years) participate in molding bricks to raise money for their needs. Land owners have not made provision for toilet facilities, thus, some brick producers in the study area defecate openly, while others may damn the shame and go to nearby houses to seek permission for use of toilets. Open defecation causes major environmental, health and social hazzards.

Burnt-bricks have significant positive impact on availability of strong bricks for building, seasonaljob creation, poverty alleviation, and income generation and

have positively influenced water availability in Naka as some of the aqueduct wells dug inside these deep trenches supply and retain water all year round.
Average annual incomes, number of children sponsored in school and health facility patronage is an indication that the industry has significantly reduced the misery of brick producers in Naka, Benue State.
Surely, competition for wood within a region is an important factor when considering the traditional firing method. This is particularly an issue for existing small-diameter wood-using industries such as burnt-brick industries. From an economic perspective, however, an increase in competition has increased the price of wood higher, which should encourage more forest landowners to plant trees for future feedstock needs.
And while woody biomass is a new and potentially revolutionary forestry product, there are many additional uses and benefits of forests, including recreation, timber, paper production, and wildlife habitat. Communities must prioritize local economic, ecological, and social needs and values regarding forest use and decide how to allocate forest resources.
Wood bio-energy is typically grown in proximity to where it is used, therefore, community members may be more aware of their energy source and thus, more cognizant of how they use it.
This days, government is encouraging both individuals and communities to work toward self-sufficiency through diverse economies, therefore, locally grown food, small scale industries such as burnt-bricks and locally produced energy can provide yet another way for communities to be self-reliant.
The natural water-dependent, crude techniques used in brick-making combined with harmattan cold season cause considerable worker drudgery. For example, manual brick molders are exposed to cold and high concentrations of dust during harmattan; they are further exposed to fiery furnace and scorching sun for long hours.
Many of the workers have had accidents or got injured in the course of loading or off-loadingof wood/burnt-bricks or transporting them. There is also the risk of exposure to open fire during manual feeding of the kiln with wood.
The workers are also exposed to high concentrations of respirable suspended particulate matters (RSPM), during monitoring and regulating the fire. Transporting logs of wood and fired bricks by head load on a regular basis has caused health problems, especially in women. Sadly, the exposure of the brick

workers to these occupational hazards is never covered by any sort of insurance or medical facilities.

This felling and logging of trees has not only endangered the preferred species, but has also significantly affected specie-diversity just as regular excavations have degraded the environment and ecological richness that combine to gradually subjects the area to desert encroachment. The specie tree-loss is increasing in magnitude and intensity, thus, longer distances are being covered now than before to obtain same quantity. Besides, the cost per tree has significantly increased from 2000 to about 10,000 within this period of ten years.

The buildings near the brickfield need special foundations to withstand storm water, flood and avoid collapse. Using woody biomass for burnt-bricks production also creates concerns about aesthetics and health. Smoke, dust and particles from brick sites can be hard to contain/inhale, both of which aggravate vulnerability of nearby residents'.

Worse still, since logs of wood are transported by trucks, many small-scale wood-powered facilities may require increased truck traffic. This combined with timer vehicles have worsened the condition of many feeder roads, create concerns about noise, safety and traffic issues.

There is also public concern about environmental and visual impacts that wood harvesting can leave on the environment and human minds. These issues may seem less important to business people operating burnt-bricks than those whose health and natural resources are being directly affected, and the industrialists may influence public opinion about wood-use in industrial production.

Koenig (2014 and 2019) noted increases in incidences of asthma and other respiratory diseases and declines in lung function among children exposed to wood-smoke. Lung-function declines cases were higher during wintertime wood burning periods and in children who lived in smoke trapping valleys. As much as 90 percent of the winter particulate levels were produced by wood burning. Zelikoff (1994) found that rats suffered significantly lower rates of lung bacterial clearance and lung phagocytic (ie. microbe killing) activity when exposed to wood smoke at concentrations typically found indoors during residential wood burning period.

Brick production in Naka has converted large areas of fertile, rice producing land along Ana-stream to brick production. Mining areas in southern Naka

witnessed loss or reduction of farmlands as one of the impacts of burnt brick mining (Musah and Kjorn, 2007).

Other significant impacts of brick mining in the area are: water contained in the pits serve as breeding grounds for mosquitoes, disposal of sanitary pads and other such house wastes in the water body that is not fast-flowing contaminates the stream waterthat can cause and spread water-borne diseases.

The excavation has caused erosion, loss of vegetation and loss of important economic trees. Like many other building materials, burnt bricks usually become a scarce resource when it is not its season of production due to high demand for construction and developmental activities.

Using woody biomass for energy production in the burnt-brick industry affects air quality, land use, forest health, and other natural resources in different ways and at different intensity levels. Implementation of a woody biomass production and utilization plan has both environmental costs and benefits. The costs and benefits should be compared with those of other energy options, such as fossil fuels for industrial products. Based on the trend of tree felling, it is observed that the growing demand for wood, especially for energy production, will lead to rampant harvesting and removal of forests around brick sites. Certainly, competition for wood and long-term supply within the region is an important factor to consider when thinking about using woody biomass. Using wood for energy in the emerging markets may allow landowners to maintain their forests rather than sell their land for development. Working forests provide environmental benefits such as soil protection, clean air and ground water, carbon sequestration, and wildlife habitat. The continuous expansion of this type of industrial practice of this traditional method of local material production implies that the effect will continue to increase in scope, magnitude and intensity.

## CONCLUSION

Low or poor operating capital appeared to be the most limiting challenge to burnt brick producers in Naka. Other important challenges identified are: increasing scarcity of preferred wood species for firing the bricks, increasing cost of procuring the wood, Poor prices of bricks during production season, Seasonality and scarcity of skilled/migrant labour, absence of collaterals for loans from banks, dearth of mechanization/drudgery in operations, lack of government assistance/recognition, Poor infrastructure (bad roads, lack of

health facilities etc), Seasonality in operations which reduces income, degradation of agricultural land, air pollutions that is causative to respiratory and heart diseases, deforestation that has made hardwood endangered species, destruction of sub-soil organisms and ecological impoverization among others.

**RECOMMENDATIONS**

1. To drastically reduce the volume of wood used in burnt bricks production, there is need to use modern kilns which utilize fossil fuels (like the Otukpo Burnt Bricks). Burnt-bricks industry in Naka, needs to be regulated for urgent revitalization and regeneration of the site.
2. There is need for environmental management including degraded roads and bricks sites.
3. There is need to provide buffer strips (vegetation) around water bodies adjourning brick sites to stem soil erosion, flooding, future water shortages and erosion of critical genetic of flora species around brick sites.
4. The paper also recommends electricity firing of the bricks to reduce deforestation and environmental regeneration to revamp the degraded ecology and reduce the potential risk of skin diseases for workers at the firing kiln.
5. The Federal and State Governments should enact and enforce laws regulating burnt bricks production and afforestation programme or policy of 'if you fell one tree, plant four'.
6. Stringent requirements for collaterals by banks need to be relaxed to enable brick producers to have access to operational capital.
7. The challenge of poor infrastructure, especially access roads and transportation services should be addressed by the State and Local governments, communal efforts, the organized private sector.
8. The stakeholders should make adequate provision for toilet facilities at the brick sites to avoid open defecation in the stream valley.
9. Also, because of energy consumption and greenhouse gas emissions, new ways are to be sought by the brick industry owners to promote environmental healthiness and certain time honoured practices.

Finally, it is expected that bricks should produce quality buildings with high performance; sustainable buildings should consider certain design components such as environmentally responsive site planning, thermal comfort, renewable

energy, water efficiency, safety and security, and acoustic comfort, which constructions with burnt-bricks affords.

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