

# Research Article Influence of Public Participation on Sustainable Forest Management in Sokoto State, Nigeria

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# **About Article**

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# ABSTRACT

This study investigates the influence of public participation on sustainable forest management (SFM) in Sokoto State, Nigeria. A region faced with severe forest degradation due to anthropogenic and climatic pressures. The research focuses on the demographic characteristics of the respondents, the effects of public participation on sustainable forest management practices (Plantation establishment and management, harvesting practices, Afforestation and Reforestation and Forest Restoration), benefits and challenges of involving local communities in forest management. Data were collected through structured questionnaires involving 115 participants. An interview was also conducted in 10 organizations on SFM. The data were analyzed descriptively. The research reveals a nearly equal gender distribution (51.3%, male, and 48.7%, female) with the majority (89.5%) between 21-30 years and majorly (72.2%) students by occupation. The research also highlights plantation establishment (57.4%) and afforestation/reforestation (29.6%) as the predominant sustainable forest management practices in Sokoto. Findings reveal that public participation significantly enhances SFM, with 77.4% of respondents reporting a positive impact. Environmental (57.4%) and educational (27.8%) benefits were the most perceived benefits. Micro-climate regulation (43.5%) was the major environmental benefit observed. Despite these gains, key challenges such as lack of awareness (45.2%) and funding constraints (32.2%) hinder broader engagement and effective public participation. The study concludes that economic incentives and public awareness should be emphasized, to sustain SFM initiatives. This paper draws attention to the essence of participatory approaches that align local community involvement with environmental restoration strategies, providing a blueprint for forest management in semiarid regions.

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# **1. INTRODUCTION**

Public participation (community engagement), which is a key SFM practice, is very important as forest resource policies and interventions are often formulated without the active and sustained participation of communities and local resource users. Policies, programs, and projects have served as sources or arenas of conflicts, even though their intention was to ameliorate such conflicts. This situation generally arises when there is inadequate local participation in all phases of interventions, they emanate from programs designed to benefit the local people but does not consider the rights of the people in terms of incentives and compensation.

Most environmental issues arise from the irresponsible behaviors of humans (Vicente-Molina et al., 2013), where changes in forest landscapes have been connected with human activities for centuries (Krajewski et al., 2018). Many scholars argue that the key cause of environmental problems is the human actions (Bijaniet al., 2017; Salari et al., 2019; Monfared et al., 2015). This is the reason why the modern age is known as the era of environmental crises as excessive use of natural resources has inflicted irreparable damages to natural resources (Savari & Gharechaee, 2020; Azadi et al., 2019a, 2019b). Therefore, to achieve sustainable development and conservation of forest resources, it is necessary to solicit for people's participation, especially those who utilize natural resources (Marchi et al., 2018). This research aims to assess the influence of public participation on sustainable forest management in Sokoto State, Nigeria.

# 2. LITERATURE REVIEW

The United Nations General Assembly in 2007 recognizes SFM as a dynamic and evolving concept that aims to maintain and enhance the economic, social and environmental values of all types of forests for the benefit of present and future generations (Putz & Thompson, 2020). Sustainable forest management practices include; Plantation establishment and management, Ex-situ conservation, Review of forest laws, Forest certification, Ecosystem-based management, Forest Fire management, Forest restoration, Afforestation and Reforestation, Sustainable harvesting practices, Integrated Pest management (IPM), Community engagement (Gbadebo et al., 2022; Areo et al., 2023). Renewable natural resources play a key role in different aspects of human life (Jafari et al., 2018; FAO 2016a). Forests are an essential component of natural resources (Marchi et al., 2018) with a huge role in the livelihood of local communities (Ghoochani et al., 2020). However, the heavy dependence of these communities on forest resources has been a cause for the degradation of these resources (FAO, 2016b). Other causes are associated with increasing population growth, expansion of urban areas, people's ill practices, poor management and the lack of a sound plan in place (Martire et al., 2015).

Forest degradation has been accelerated in recent decades and has emerged as a critical issue throughout the world (Jafari *et al.*, 2018; Azadi *et al.*, 2013). Through encroachment and destruction of forest resources, agricultural lands have expanded by a factor of about six over the last 250 years (Tirivayi *et al.*, 2018). The numerous implications of forest degradation include global warming, air pollution, soil erosion, loss of natural resources,

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loss of biodiversity, and desertification (Lange & Dewitte, 2019; Thondhlana & Hlatshwayo, 2018; Raeisi *et al.*, 2018), this calls for sustainable forest management (SFM).

The contribution of local communities in forest conservation is widely acknowledged. Azadi et al. (2013) emphasized, that successful environmental rehabilitation relies on the active involvement of village members, who possess unique knowledge, skills, and experiences, as well as a deep understanding of the forest ecosystem. Indigenous communities have developed a rich understanding of forest management through historical, social, and ecological experiences. Their willingness to participate, provide leadership and organizational capacity are essential for effective forest management. By engaging local populations, government and non-governmental organizations can tap from their collective strengths, building on their knowledge, initiatives, and social networks to enhance forest conservation and management. Community participation ensures that local values, beliefs, and practices are integrated into the conservation process, promoting trust, cooperation, and a sense of ownership among stakeholders. This collaborative approach promotes social justice, and supports sustainable forest management outcomes that benefit both people and the environment.

Researchers have focused on the participation of local communities in sound and sustainable use of forest resources (Colombo *et al.*, 2012) and have concluded that local communities play a profound role in controlling forest degradation (FFF, 2014; FAO & Agricord, 2016a). Presently, community participation in forest resources management is the only way to alleviate environmental problems (Elliott & Young, 2016). However, different communities vary in the limitations of participation depending on their socioeconomic structure (DeMarsh *et al.*, 2014).

# **3. METHODOLOGY**

# 3.1. Study area

Sokoto state lies in the extreme north western part of Nigeria with a land area of 28,232.37sq kilometer, Sokoto State is located between longitudes 40 to 60 East and latitude 110 30` to 130 50` North. It is bordered in the North by Niger Republic, Zamfara State to the East and Kebbi State to the South and West (History of sokoto, 2024). As of 2022 it has an estimated population of more than 6.3 million (Sokoto, 2024). There are two major seasons in the State namely; wet and dry. The dry season starts from October and lasts up to April in some parts but may extend to May or June in other parts. The wet season on the other hand, begins in most part of the State in May and lasts up to September or October (History of sokoto, 2024). The Harmattan, a dry, cold and dusty wind is experienced in the State between November and February. Heat is more severe in the State in March and April. But the weather in the State is always cold in the morning and hot in the afternoon except at the peak of harmattan (History of sokoto, 2024). The area is also characterized by the Sudan Savannah type of vegetation, with abundant grasses and shrubs interspaced by short woody trees. Grasses looks green in the rainy season, but eventually withered and die during the dry season (Abubakar et al., 2011). Rearing of animal and crop cultivation are the major sources of livelihood (Maishanu, et al., 2017).



**Figure 1.** Map of sokoto state *Source: Abubakar et al. (2011)* 

# 3.2. Reconnaissance survey

A reconnaissance survey was carried out to identify the organizations practicing SFM in Sokoto State. This survey shows that the following organizations were involved in SFM programs in the state; Sokoto State Ministry of Environment, Forestry Department UDUS, NAGGW, JCIN UDUS, ACRESAL, UNICEF, IFAD, SADP, FORESTRY (II), Sokoto Tree Forum, Climate Action Group, First Bank of Nigeria Limited, Kadadi World Goes Green, Danbaiwa Community Service, Tangaza Local Government Youth and Student's Forum. Information gathered during this survey reveals that 288 persons in total participated in the SFM programs carried out by these organizations.

# 3.3. Sampling procedure and sampling size

Complete enumeration of all 288 participants from the local communities was intended for this study, questionnaires were administered to all identified respondents. However, despite efforts to achieve a 100% response rate, not all participants responded to the questionnaire. Consequently, the final dataset consisted of 115 responses from the participants and 10 responses from the different organizations, which formed the basis for the analysis. The sample size is made up of respondents from both communities and organizations making a total of 125 Respondents.

# 3.4. Data collection

Data were collected from both primary and secondary sources. The primary data were generated by means of a survey and structured questionnaire with relevant questions that are consistent with the aim and objectives of the research work. The questionnaire was categorized into two. The first category of the questionnaire was administered to the identified organizations while the second category was administered to community members who participated in sustainable forest management. Secondary information was gathered from textbooks, relevant past projects, journals, and the internet.

# 3.5. Data analysis

Data collected were analyzed using descriptive statistics (tables, frequencies, and percentages). Microsoft Excel was used for the analysis.

# 4. RESULTS AND DISCUSSION

# 4.1. Demographic characteristics

Table 1 reveals that 51.3% of respondents were male, and 48.7% were female. It also reveals the age distribution among respondents where the majority (89.5%) were aged 21–30 years, followed by 6.2% aged 31–40 years. The table shows the occupation of the respondents where Students dominated at 72.2%, while farmers and civil servants each represented



4.35%. It also reveals that most respondents (93%) had tertiary education, with only 6.1% having secondary education.

| Table 1. D | emographic | characteristic | of the | respondents |
|------------|------------|----------------|--------|-------------|
|------------|------------|----------------|--------|-------------|

| Characteristics      | Frequency | Percentage (%) |
|----------------------|-----------|----------------|
| Gender               |           |                |
| Male                 | 59        | 51.3           |
| Female               | 56        | 48.7           |
| Total                | 115       | 100            |
| Age class            |           |                |
| <20                  | 4         | 3.4            |
| 21-30                | 103       | 89.5           |
| 31-40                | 7         | 6.2            |
| 41-50                | 1         | 0.9            |
| Total                | 115       | 100            |
| Occupation           |           |                |
| Farmer               | 5         | 4.35           |
| Civil servant        | 5         | 4.35           |
| Student              | 83        | 72.20          |
| Self employed        | 19        | 16.50          |
| Corp member          | 1         | 0.90           |
| Unemployed           | 2         | 1.70           |
| Total                | 115       | 100            |
| Level of Education   |           |                |
| Secondary            | 7         | 6.1            |
| Tertiary             | 107       | 93             |
| Vocational/Technical | 1         | 0.9            |
| Total                | 115       | 100            |

Source: field survey, 2024

Table 2. Organizations involved in SFM in the state

The near-equal gender distribution indicates potential for inclusive participation. However, women were facing cultural or societal barriers to active involvement. Research highlights that gender inclusivity is important for successful SFM as women often hold valued indigenous knowledge about forest management (FAO, 2022).

The domination of young respondents suggests a youthful workforce, which is an asset for implementing physically demanding SFM activities. However, the significant representation of students suggests high theoretical awareness but limited field experience. Putz and Redford (2010) stress the need to bridge knowledge with hands-on forest management practices. Azadi *et al.* (2013) also emphasized that successful environmental rehabilitation relies on the active involvement of village members, who possess unique knowledge, skills, and experiences, as well as a deep understanding of the forest ecosystem.

The high proportion of respondents with tertiary education is promising for adopting scientific methods and innovations in SFM. DeMarsh *et al.* (2014) reports that higher education correlates with better awareness and acceptance of sustainable practices.

#### 4.2. Organizations involved in SFM in sokoto state

Table 2 highlights that out of the interviewed organizations involved in SFM within Sokoto State, 30% were government affiliated agencies, 30% were community-based organizations, while NGOs and private companies comprised 10% and 20%, respectively. And the key areas where this organization focuses, included desertification control (30%), climate change mitigation (20%), and conservation (10%).

The significant involvement of government agencies and community-based organizations highlights a structured and localized approach to SFM. These organizations focus on critical areas like desertification control and climate change mitigation, aligning with international strategies for forest sustainability (FAO, 2022). Although only a few of the organizations focus on sustainable environmental campaigns, which is an SFM practice. This narrow focus of the organization on SFM is a

| Organization  | Affiliation                     | Primary focus                      |
|---|---------------------------------|------------------------------------|
| Sokoto state ministry of environment                | Government agency               | Conservation of natural resources  |
| National Agency for the Great Green Wall            | Government agency               | Desertification control            |
| Kadadadi World Goes Green                           | Community-based organization    | Climate Change                     |
| Sokoto Tree Forum                                   | Individual Community Campaigner | Sustainable environmental campaign |
| Danbaiwa Community Service                          | Private company                 | Desertification Control            |
| First Bank of Nigeria LTD                           | Private Company                 | Financial transaction              |
| Forestry Department UDUS                            | Government agency               | Research & Education               |
| Junior Chambers International (JCIN) UDUS           | NGO                             | Climate change                     |
| Tangaza Local Government Youth and Student<br>Forum | Community based organization    | Desertification Control            |



Agro-Climatic Resilience in Semi-Arid Landscapes (ACReSAL) United Nations Children's Fund (UNICEF) International Fund for Agricultural Development (IFAD) Sustainable Agricultural Development Program (SADP) Afforestation Program (FORESTRY II)

Source: field survey, 2024

drawback towards local peoples' participation. Expanding organizational mandates to integrate SFM practices such as education, conservation, and community engagement is important for holistic forest management (Reed *et al.*, 2020).

The limited involvement of NGOs might hinder the adoption of innovative and community-focused practices, as NGOs often act as catalysts for grassroots mobilization and advocacy for comprehensive forest management (Reed *et al.*, 2020).

# 4.3. SFM practices carried out by the identified organizations

Table 3 reveals the following SFM activities carried out by the different organizations in the state, Plantation establishment and management 40%, Afforestation and Reforestation 30%; with Forest restoration, wildlife domestication and awareness campaign each 10%.

**Table 3.** SFM practices carried out by the identified organizations

| Practices                               | Frequency | Percentage (%) |
|---|-----------|----------------|
| Plantation establishment and management | 4         | 40             |
| Afforestation and Reforestation         | 3         | 30             |
| Forest restoration                      | 1         | 10             |
| Awareness campaign                      | 1         | 10             |
| Wildlife domestication                  | 1         | 10             |
| Total                                   | 10        | 100            |

Source: field survey, 2024

# 4.4. Participation of respondents in SFM

Table 4 reveals that most respondents (79.1%) participated occasionally, while 10.4% participated frequently or not at all.

# Table 4. Frequency of participation

| Participation | Frequency | Percentage (%) |
|---------------|-----------|----------------|
| Never         | 12        | 10.4           |
| Occasionally  | 91        | 79.1           |
| Always        | 12        | 10.4           |
| Total         | 115       | 100            |

Source: Field survey, 2024

Most respondents participate occasionally in SFM activities, while a small minority is consistently engaged. This suggests that while public participation exists, it may not be sustained or consistent enough to drive long-term changes in forest management. This inconsistency may be as a result of the concentration of organizations majorly on students as workforce for their SFM activities and also limited use of financial incentives. This aligns with the study of Reed *et al.* (2020), which highlights that occasional participation often stems from low incentives and sporadic organizational engagement.

# 4.5. Sustainable forest management practices engaged in by respondents

Table 5 highlights that Plantation establishment and management was the most practiced (57.4%), followed by afforestation and reforestation (29.6%), Harvesting practices, and Forest Restoration with 8% and 7% respectively.

| SFM Practices                           | Frequency | Percentages (%) |
|---|-----------|-----------------|
| Plantation establishment and management | 66        | 57.4            |
| Harvesting Practices                    | 8         | 7.0             |
| Afforestation and reforestation         | 34        | 29.6            |
| Forest Restoration                      | 7         | 6.0             |
| Total                                   | 115       | 100             |

Source: Field survey, 2024

The focus on plantation establishment and afforestation indicates an emphasis on combating desertification, a critical issue in Sokoto State. These efforts are timely and crucial towards augmenting the vegetation cover in a semi-arid region like sokoto, but require deeper community engagement to sustain momentum. However, the low adoption of sustainable harvesting practices and forest restoration results from the little or no provision for such by existing organizations as Table 3 highlights and this indicates an underutilization of critical components for maintaining forest health and biodiversity (Putz & Redford, 2010).

# 4.6. Effect of public participation on SFM

Table 6 shows that Positive effects were observed by 77.4% of respondents, while 9.6% noted negative effects and 13% no effect.



| Tuble of Effect of public public public public fution of of the |           |                |  |  |
|---|-----------|----------------|--|--|
| Effect  | Frequency | Percentage (%) |  |  |
| Positively  | 89        | 77.4           |  |  |
| Negatively  | 11        | 9.6            |  |  |
| No effect   | 15        | 13.0           |  |  |
| Total   | 115       | 100            |  |  |

**Table 6.** Effect of public participation on SFM

Source: Field Survey, 2024

The results show significant positive impacts of public participation. This aligns with Azadi *et al.*, 2013, which found that community involvement significantly enhances forest restoration and plantation practices. However, Marchi *et al.* (2018) caution that poorly structured participation processes can lead to minimal long-term effects, particularly in areas requiring technical expertise like forest restoration.

# 4.7. Benefits enjoyed from involvement in SFM

Table 7 shows that Environmental benefits were most prominent (57.4%), followed by educational benefits (27.8%), economic, and social benefits with 8.7% and 4.4 respectively.

Table 7. Benefits Enjoyed

| Benefits             | Frequency | Percentage (%) |
|----------------------|-----------|----------------|
| Economic             | 10        | 8.7            |
| Environmental        | 66        | 57.4           |
| Social               | 5         | 4.4            |
| Educational          | 32        | 27.8           |
| No benefits observed | 2         | 1.7            |
| Total                | 115       | 100            |

Source: Field Survey, 2024

This finding shows that environmental and educational benefits dominate. Elliott and Young (2016) find that participation in forest management enhances environmental benefits, similar to this finding. They also identify education as a key outcome of community involvement. Nyamekye *et al.* (2021) argue that economic benefits often drive participation more than environmental concerns. These findings of limited economic benefits may indicate a disconnection in the value local communities derive from their involvement. They report that where economic benefits are prioritized, community participation significantly increases, suggesting room for enhancing perceived economic returns in Sokoto State.

# 4.8. Environmental benefits perceived by respondents

Table 8 highlights micro-climate regulation (43.5%) as the most perceived environmental benefit by the respondents followed by biodiversity enhancement (38.0%), improved air quality (13.0%), soil, and water conservation (10.5%).

# Table 8. Environmental benefits

| Benefits                    | Frequency | Percentage (%) |
|-----------------------------|-----------|----------------|
| Micro-climate regulation    | 50        | 43.5           |
| Soil and water conservation | 12        | 10.5           |
| Biodiversity<br>enhancement | 38        | 33.0           |
| Improved air quality        | 15        | 13.0           |
| Total                       | 115       | 100            |
|                             |           |                |

Source: field survey 2024

Microclimate regulation was the most perceived environmental benefit in the study area; this is a result of the ability of trees to sequester carbon dioxide from the atmosphere, which can influence local and global climates. This study agrees with the findings of Lorenz (2010) noting that trees are carbon sinks; they circle damaging carbon out of the atmosphere and transform it into biomass through photosynthesis. This process slows the impact of climate change.

# 4.9. Challenges encountered participating in SFM

Table 9 reveals that Lack of awareness (45.2%) and funding (32.2%) were the primary challenges, 11.2% and 6.1% of the respondents identified unfavorable government policies and community conflicts respectively as challenges encountered participating in SFM, while 5.2% reported no challenge.

# **Table 9.** Challenges encountered by respondents

| Challenges                      | Frequency | Percentage (%) |
|---------------------------------|-----------|----------------|
| Lack of awareness               | 52        | 45.2           |
| Lack of funding                 | 37        | 32.2           |
| Unfavorable government policies | 13        | 11.3           |
| Community Conflict              | 7         | 6.1            |
| No challenge                    | 6         | 5.2            |
| Total                           | 115       | 100            |

Source: Field Survey, 2024

Challenges in funding and awareness resonate with FAO's (2021) global review, which identifies these as persistent barriers. This is also in line with the study by DeMarsh *et al.* (2014) who found that limited access to information is a significant barrier to public participation in forest management decision-making processes.

# 4.10. Ways challenges can be addressed to enhance community participation in SFM

Table 10 reveals that Increasing awareness and education (47%) was the most suggested solution, followed by providing



financial support (33.9%), improved government policies and regulations (16%), promote conflict and resolution (3%).

| <b>Tuble 10.</b> Conditions to racinine a chantenges | Table | 10. | Solutions | to | identified | challenges |
|--|-------|-----|-----------|----|------------|------------|
|--|-------|-----|-----------|----|------------|------------|

| Solutions                                   | Frequency | Percentage (%) |
|---|-----------|----------------|
| Increasing awareness and education          | 54        | 47.0           |
| Provide financial support and incentives    | 39        | 33.9           |
| Improve government policies and regulations | 16        | 13.9           |
| Promote conflict resolution                 | 3         | 2.6            |
| No suggestions                              | 3         | 2.6            |
| Total                                       | 115       | 100            |

Source: Field survey, 2024

In order to enhance public participation in SFM in sokoto state, increasing awareness and education was mostly suggested followed by the provision of financial support and incentives, these critical aspects, which are very essential were not captured in the broad focus of the organizations practicing SFM in the state, showing a need for these organizations to integrate awareness campaigns and financial attractive programs for a more sustainable outcome.

# **5. CONCLUSIONS**

These findings resonate with many studies emphasizing the benefits of participatory approaches, it highlight the positive impact of public participation on sustainable forest management in Sokoto State but also identified gaps like economic incentives, sustained engagement, and lack of awareness. Addressing these challenges will improve the efficacy of sustainable forest management in Sokoto State. This study clearly suggests that empowering local communities through education, participation, and resource provision is important for the success of forest management practices.

#### RECOMMENDATIONS

Based on the findings of this research the following are recommended;

i. Sokoto State SFM programs should broaden scope to cut across different occupations and explore partnerships with elders and indigenous leaders to document and integrate traditional knowledge systems.

ii. SFM organizations in Sokoto should incorporate SFM practices that emphasizes economic benefits (such as Orchard plantation, Agroforestry and Ecotourism) in other to ensure long term community support as economic empowerment is key.

iii. Efforts should be made to increase awareness through targeted campaigns to educate the public on the importance of forest management and sustainable practices, particularly given that lack of awareness is the most cited challenge.

iv. Forest restoration and Harvesting practices should be emphasized in the state, as most of the forest reserves in the state are degraded and lost to timber theft and illegal loggers for charcoal and fuel wood.

v. For innovative solution and diversified funding sources, NGOs and Private sectors engagement should be increased in the state.

# REFERENCES

- Abubakar, G. A., Dikko, A. U., Yakubu, M., & Tajudeen, M. K. (2011). Effects of different land uses on soil quality in Sokoto Urban Fringes. European Journal of Developing Country Sides, 10. https://www.scribd.com/document/124647792/ Effects-of-Different-Land-Uses-on-Soil-Quality-in-Sokoto-Urban-Fringes
- Areo, O. S., Omole, A. O., Ayodeji, A. F., Adewale, A., & Lukeman, O. G. F. (2023). Modern forest operation techniques in Nigeria: Challenges and solutions. *Australian Journal of Science and Technology*, 7(2), 76-82. https://aujst.com/vol-7-2/1.pdf
- Azadi, H., Samari, D., Zarafshani, K., Hosseininia, G., & Witlox, F. (2013). Sustainable forest management in Iran: a factor analysis. *Sustainability science*, *8*, 543-551. https://doi. org/10.1007/s11625-012-0190-4
- Azadi, Y., Yazdanpanah, M., Forouzani, M., & Mahmoudi, H. (2019). Farmers' adaptation choices to climate change: a case study of wheat growers in Western Iran. *Journal of Water* and Climate Change, 10(1), 102-116. https://doi.org/10.2166/ wcc.2018.242
- Azadi, Y., Yazdanpanah, M., & Mahmoudi, H. (2019). Understanding smallholder farmers' adaptation behaviors through climate change beliefs, risk perception, trust, and psychological distance: Evidence from wheat growers in Iran. *Journal of environmental management, 250*, 109456. https://doi.org/10.1016/j.jenvman.2019.109456
- Bijani, M., Ghazani, E., Valizadeh, N., & Haghighi, N. F. (2017). Pro-environmental analysis of farmers' concerns and behaviors towards soil conservation in central district of Sari County, Iran. *International Soil and Water Conservation Research*, 5(1), 43-49. https://doi.org/10.1016/j. iswcr.2017.03.001
- Colombo, S. J., Chen, J., Ter-Mikaelian, M. T., McKechnie, J., Elkie, P. C., MacLean, H. L., & Heath, L. S. (2012). Forest protection and forest harvest as strategies for ecological sustainability and climate change mitigation. *Forest Ecology* and Management, 281, 140-151. https://doi.org/10.1016/j. foreco.2012.06.016
- deMarsh, P., Boscolo, M., Savenije, H., Grouwels, S., Zapata, J., Campbell, J. Y., & Macqueen, D. J. (2018). Making change happen: what can governments do to strengthen forest producer organizations?. *Forest.* https://www.iied.org/ g03804
- Elliott, S., & Young, T. (2016). Nature by default in early childhood education for sustainability. *Australian journal*



of environmental education, 32(1), 57-64. https://doi. org/10.1017/aee.2015.44

- Evans, J. (2010). *Plantation forestry in the tropics*. Oxford University Press.
- FAO, AgriCord. (2016a). Forest and farm producer organizations operating systems for the sustainable development goals (SDGs): strength in numbers. FAO, Forestry Economics and Policy Division, AgriCord., Rome. https://www.iied.org/ sites/default/files/pdfs/2022-11/21186iied.pdf
- FAO. (2016b). Agriculture Organization. Livestock primary. Food and Agriculture Organization of the United Nations, Rome. https://www.fao.org/faostat/en/#data/QL
- FAO. (2022). The state of the world's forests 2022. https://www.fao.org/family-farming/detail/en/c/1507071/
- FFF (Forest and Farm Facility). (2014). *Roadmap for strengthening Forest and farm organizations*. Policy Brief, Forest and Farm Facility, Rome. https://reliefweb.int/report/world/roadmapstrengthening-forest-and-farm-producer-organizations
- Gbadebo, O. V., Oyewole, A. L., & Adegbayi, O. R. (2022, August). Sustainable Forest Management Practices: A Viable Panacea to the Challenges of Climate Change in Nigeria. In Proceedings of the 8 TH Biennial Conference of Forests and Forest Products Society of Nigeria (FFPS). FRIN IBADAN, 14th (pp. 259-262).
- Ghoochani, M. O., Ghanian, M., Khosravipour, B., & Crotts, J. C. (2020). Sustainable tourism development performance in the wetland areas: a proposed composite index. *Tourism Review*, 75(5), 745-764. https://doi.org/10.1108/TR-02-2019-0061
- History of Sokoto. (n. d.) *Official About Sokoto State*. https://sokotostate.gov.ng/history-of-sokoto
- Jafari, A., Kaji, H. S., Azadi, H., Gebrehiwot, K., Aghamir, F., & Van Passel, S. (2018). Assessing the sustainability of community forest management: A case study from Iran. *Forest Policy and Economics*, 96, 1-8. https://doi.org/10.1016/j. forpol.2018.08.001
- Krajewski, P., Solecka, I., & Mrozik, K. (2018). Forest landscape change and preliminary study on its driving forces in Ślęża Landscape Park (Southwestern Poland) in 1883–2013. Sustainability, 10(12), 4526. https://ideas.repec.org/a/gam/ jsusta/v10y2018i12p4526-d186867.html
- Lange, F., & Dewitte, S. (2019). Measuring pro-environmental behavior: Review and recommendations. *Journal of Environmental Psychology*, 63, 92-100. https://doi. org/10.1016/j.jenvp.2019.04.009
- Lorenz, K. (2010). Carbon sequetration in forest ecosystems. Springer. https://link.springer.com/book/10.1007/978-90-481-3266-9
- Maishanu, H. M., Mainasara, M. M., Aliero, B. L., Isah, A.

D., & OJONUQWA, S. (2017). Effect of fire on biomass accumulation and productivity of herbaceous plants in the permanent site, Usmanu Danfodiyo University Sokoto, Sokoto State, Nigeria. *International Journal of Research and Review*, *4*(3), 1-8.

- Marchi, E., Chung, W., Visser, R., Abbas, D., Nordfjell, T., Mederski, P. S., ... & Laschi, A. (2018). Sustainable Forest Operations (SFO): A new paradigm in a changing world and climate. *Science of the Total Environment*, 634, 1385-1397. https://doi.org/10.1016/j.scitotenv.2018.04.084
- Martire, S., Castellani, V., & Sala, S. (2015). Carrying capacity assessment of forest resources: Enhancing environmental sustainability in energy production at local scale. *Resources, Conservation and Recycling, 94*, 11-20. https://doi. org/10.1016/j.resconrec.2014.11.002
- Monfared, N., Yazdanpanah, M., & Tavakoli, K. (2018). Why do they continue to use pesticides? The case of tomato growers in Boushehr Province in Southern Iran. Jomo Kenyatta University of Agriculture and Technology, Digital Repository. http:// ir.jkuat.ac.ke/handle/123456789/4207?show=full
- Nyamekye, A. P., Tian, Z., & Cheng, F. (2021). Analysis on the contribution of agricultural sector on the economic development of Ghana. Open Journal of Business and Management, 9(3), 1297-1311. https://doi.org/10.4236/ ojbm.2021.93070
- Putz, F. E., & Redford, K. H. (2010). The importance of defining 'forest': Tropical forest degradation, deforestation, longterm phase shifts, and further transitions. *Biotropica*, 42(1), 10-20. http://dx.doi.org/10.1111/j.1744-7429.2009.00567.x
- Putz, F. E., & Thompson, I. D. (2020). Defining sustainable forest management (SFM) in the tropics. *book: Achieving sustainable management of tropical forests*, 10. httpd://doi. org/10.19103/as.2020.0074.19
- Raeisi, A., Bijani, M., & Chizari, M. (2018). The mediating role of environmental emotions in transition from knowledge to sustainable use of groundwater resources in Iran's agriculture. *International Soil and Water Conservation Research*, 6(2), 143-152. https://doi.org/10.1016/j. iswcr.2018.01.002
- Reed, J., van Vianen, J., Barlow, J., & Sunderland, T. (2020). Beyond environmental management: Recognizing the social and economic roles of forests. *Global Environmental Change*, 62, 102086. https://doi.org/10.17528/cifor/007800
- Salari, F., Yazdanpanah, M., Yaghoubi, J., & Forouzani, M. (2019). Understanding Iranian livestock breeders' intentions and behavior regarding nonhuman animal welfare. *Society* & animals, 29(3), 246-267. https://doi.org/10.1163/15685306-12341592
- Savari, M., & Gharechaee, H. (2020). Application of the extended theory of planned behavior to predict Iranian farmers' intention for safe use of chemical fertilizers. *Journal of*

*Cleaner Production, 263,* 121512. https://doi.org/10.1016/j. jclepro.2020.121512

- Sokoto (State, Nigeria). (n. d.). *Population Statistics, Charts, Map and Location*. https://www.citypopulation.de/en/nigeria/ admin/NGA034\_\_sokoto
- Thondhlana, G., & Hlatshwayo, T. N. (2018). Pro-environmental behaviour in student residences at Rhodes University, South Africa. Sustainability, 10(8), 2746. https://doi.org/10.3390/ su10082746
- Tirivayi, N., Nennen, L., Tesfaye, W., & Ma, Q. (2018). The benefits of collective action: Exploring the role of forest producer organizations in social protection. *Forest Policy* and Economics, 90, 106-114. https://ideas.repec.org/a/eee/ forpol/v90y2018icp106-114.html
- Vicente-Molina, M. A., Fernández-Sáinz, A., & Izagirre-Olaizola, J. (2013). Environmental knowledge and other variables affecting pro-environmental behaviour: comparison of university students from emerging and advanced countries. *Journal of Cleaner Production*, 61, 130-138. https://doi. org/10.1016/j.jclepro.2013.05.015

