

**Access to Natural Livelihood Assets and the Sustainability of Women Farmers in Biliri LGA, Gombe State, Nigeria**

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**Abstract**

Women farmers in northern Nigeria depend heavily on natural livelihood assets such as land, water, and forest resources for their farming activities, yet persistent social and institutional barriers continue to limit their effective access to, and benefit from these assets, thereby threatening the sustainability of their livelihoods. This study examined women farmers' access to natural livelihood assets in Biliri Local Government Area (LGA), Gombe State, Nigeria, and assessed how such access shapes sustainable farming practices. A cross-sectional research design was adopted, using a structured questionnaire administered to a multi-stage sample of women farmers. A total of 323 valid responses were analysed using descriptive statistics (frequencies, percentages, and mean scores) and multiple regression analysis. The Sustainable Livelihoods Framework, which emphasises natural capital as a determinant of livelihood outcomes within a context of social and institutional structures, guided the study. Findings showed that access to land and water resources was the most consistent predictor of sustainable farming Practices among the natural assets examined, while restrictive cultural norms and financial constraints emerged as the most influential barriers limiting women's access relative to other social and institutional challenges. The study concludes that the sustainability of women farmers' livelihoods in Biliri LGA is substantially shaped by both the extent of their access to natural assets and the social structures that mediate such access. It recommends targeted improvements in land and water access, alongside deliberate action to address the cultural and financial barriers that most undermine women farmers' livelihoods.

**Keywords: Adaptation; Natural livelihood assets; strategies; Sustainability; Women farmers**

**INTRODUCTION**

Agriculture remains the backbone of rural livelihoods in sub-Saharan Africa, with women constituting a substantial share of the agricultural workforce across the region (Food and Agriculture Organisation [FAO], 2011). Natural livelihood assets, broadly understood as the stock of land, water, forests, soil, and other environmental resources upon which farming households draw to produce food and income, form the foundation of these agrarian livelihoods (Chambers & Conway, 1992). For women farmers in particular, the manner in which these assets are accessed, and the extent to which access translates into productive use and benefit, has direct implications for the sustainability of their farming practices and, by extension, their households' wellbeing.

Despite the centrality of natural assets to women's farming livelihoods, a substantial body of evidence indicates that women across sub-Saharan Africa face systemic constraints in accessing productive natural resources, arising from customary land tenure systems, restrictive cultural norms, and institutional structures that grants privilege to male household heads (Agarwal, 1994; Doss, 2001; Meinzen-Dick & Mwangi, 2009). These constraints raise an important empirical question that remains insufficiently interrogated in the Nigerian context: precisely how does women farmers' access to natural livelihood assets translate — or fail to translate, into sustainable farming outcomes, and what social factors most account for the gap between the two? Existing studies often assert a general relationship between resource access and livelihood sustainability without empirically disentangling which specific natural assets matter most, or which specific barriers exert the greatest influence (Ibrahim & Ali, 2023; Sargani *et al.*, 2023; Udoh *et al.*, 2017). This leaves policymakers with limited practical guidance on where interventions would have the greatest effect.

In the Biliri Local Government Area (LGA) of Gombe State, northeastern Nigeria, women farmers operate within a semi-arid, rain-fed agricultural system characterised by small landholdings and patriarchal land tenure arrangements (National Population Commission, 2006; National Bureau of Statistics, 2023). Yet no known empirical study has systematically examined, using disaggregated measures, which specific natural livelihood assets most strongly predict sustainable farming Practices among women in this locality, nor which specific social and institutional challenges most undermine that access. Addressing this gap is necessary to move beyond broad statements about resource inequality toward evidence that can inform targeted, context-specific policy interventions. This study therefore examines women farmers' access to natural livelihood assets in Biliri LGA, analyses how that access shapes sustainable farming practices, and identifies the challenges that most significantly constrain access, with a view to generating evidence to advance more effective, gender-responsive natural resource policy.

### **Objectives of the Study**

The study is guided by the following objectives:

- i. To examine women farmers' access to natural livelihood assets in Biliri LGA, Gombe State;
- ii. To examine how access to natural livelihood assets affects sustainable farming practices among women farmers; and

- iii. To identify the challenges affecting women farmers' access to natural livelihood assets in the study area.

## **LITERATURE REVIEW**

### **Conceptual Clarification**

This section operationalises the key concepts used in the study. "Natural livelihood assets" refer to the environmental resource stock, principally land, water sources (wells, streams, lakes, and *fadama* or floodplain land), and forest or woodland products, from which rural households derive the means of farming-based subsistence and income (Chambers & Conway, 1992; Natarajan *et al.*, 2022). These assets constitute the natural capital component of the broader livelihood asset pentagon in the sustainable livelihoods literature.

For the purposes of this study, "access" is operationalised as the demonstrated ability of a woman farmer to use a given natural asset for farming purposes and to derive tangible benefit from that use, encompassing both the physical availability of the resource and the socially sanctioned permission to draw on it. This study treats access as a single, unified construct rather than as the three analytically separate constructs of access, control, and ownership, since in the customary tenure context of the study area these dimensions are experienced by respondents as a continuum rather than as discrete categories: a woman's reported ability to use, benefit from, and make decisions about a resource are treated jointly as indicators of her overall access. This clarification resolves potential conceptual overlap and ensures a single, coherent construct is measured and analysed throughout the study.

"Sustainable farming Practices" are operationalised as farming behaviours and outcomes that allow women farmers to maintain or improve productivity, food security, and income over time without depleting the natural resource base, including practices such as consistent land use, dry-season farming, and income generation from farm produce (Chambers & Conway, 1992; Natarajan *et al.*, 2022). Finally, "challenges" are operationalised, for this study, strictly as the social, cultural, institutional, and economic constraints, such as restrictive gender norms, financial exclusion, insecure land tenure, and inadequate extension support, that limit women's access to natural livelihood assets. These are measurable, socially-originated indicators, distinguished deliberately from broader environmental or climatic phenomena, which this study does not attempt to define or measure and which therefore fall outside its analytical scope.

## **Empirical Review**

### **Women and Access to Natural Livelihood Assets**

A substantial body of empirical work documents persistent gender disparities in access to natural resources across sub-Saharan Africa. Agarwal (1994) in a foundational study across South Asia with wide comparative relevance to African contexts, demonstrated that women's land rights are frequently mediated through male relatives rather than held independently, limiting the security of their access. Meinzen-Dick and Mwangi (2009) similarly found that formalisation of property rights, intended to strengthen tenure security, often failed to protect women's customary land use rights, and in some cases weakened them further. Doss (2001) showed that agricultural technology and support programmes across Africa were frequently designed without accounting for women's distinct resource-access constraints, thereby limiting programme effectiveness for women farmers specifically.

In the Nigerian context, Kehinde *et al.*, (2021), studying smallholders across sixteen States, found that women's empowerment and secure land tenure and property rights were significant, positive predictors of household food security, underscoring the practical stakes of resolving women's resource-access constraints. However, this and comparable Nigerian studies have tended to examine land tenure security as a single, undifferentiated variable, without disaggregating access across the range of natural assets (e.g., land, water sources, and forest products) that women farmers in agrarian communities such as Biliri LGA typically draw upon simultaneously. This represents an empirical gap this study addresses by measuring access across multiple, specific natural asset types rather than treating natural capital as a single composite variable.

### **Natural Livelihood Assets and Sustainable Farming Practices**

Several studies have established a positive empirical relationship between natural asset endowment and livelihood sustainability outcomes. Ibrahim and Ali (2023), studying low-income households, found that livelihood asset endowments, including natural and social capital, significantly predicted the adoption of coping strategies and overall livelihood sustainability. Sargani *et al.*, (2023), working in Pakistan, similarly found that farmers with stronger natural asset bases were more likely to sustain diversified farming strategies over time. Within Nigeria specifically, Udoh *et al.*, (2017) found that natural capital access positively influenced the sustainability of farming livelihoods among households in Akwa Ibom State, with land size and water access identified as particularly important determinants. Olumba and Olumba (2024) further demonstrated, in a

Nigerian study of gendered livelihoods, that the adoption of improved and sustainable agricultural practices among women farmers was closely tied to the resources available to them and the structures governing their use.

A recurring limitation across this body of literature, however, is that natural asset access is frequently analysed as a single, aggregated predictor of sustainability, rather than being disaggregated into specific asset types (land, water sources, forest products, and floodplain land) whose relative predictive strength for sustainable farming outcomes might differ substantially. Without this disaggregation, it remains unclear which specific natural asset development interventions should be prioritised. This study addresses this gap directly by testing the relative predictive strength of specific natural asset types against sustainable farming practice outcomes.

### **Social and Institutional Challenges Facing Women Farmers**

The literature identifies a consistent set of social and institutional barriers that constrain women's effective use of natural assets. Kabeer (1994) argues that gender hierarchies embedded in development institutions perpetuate structural disadvantages for women, limiting their agency in resource-related decision-making even where formal access exists. The FAO (2011) similarly documented that women farmers across developing countries face persistent constraints in access to credit, extension services, and inputs, relative to their male counterparts. The World Bank (2012) identified restrictive social norms as among the most difficult barriers to address, precisely because they operate informally and outside the reach of land or credit policy reform. Nyantakyi-Frimpong and Bezner-Kerr (2015), studying women smallholder farmers in Northern Ghana, found that women were frequently overlooked in agricultural resource governance and support programming, despite bearing a disproportionate share of production responsibilities.

While the literature consistently identifies cultural norms, financial exclusion, and institutional neglect as barriers, few studies have empirically tested which of these specific challenges exerts the strongest statistical influence on farm sustainability outcomes for women in a given locality. Existing accounts tend to describe barriers in aggregate or narrative terms rather than ranking their relative predictive influence. This constitutes the second empirical gap this study addresses: by testing specific, named social and institutional challenges as distinct predictors of sustainable farming outcomes, the study identifies which barriers most warrant prioritised policy attention in the Biliri LGA context, rather than treating "challenges" as an undifferentiated whole.

## **THEORETICAL FRAMEWORK**

This study is grounded in the Sustainable Livelihoods Framework (SLF), originally developed by Chambers and Conway (1992), operationalized by the United Kingdom Department for International Development (DFID, 1999), and updated for contemporary application by Natarajan *et al.*, (2022). The SLF conceptualises livelihoods as the capabilities, assets, and activities required for a means of living, achieving sustainability when households can maintain or enhance their asset base over time without depleting the underlying resource stock.

Central to the SLF is the pentagon of livelihood assets, comprising natural, human, social, financial, and physical capital. This study focuses on natural capital (land, water, and forest resources) as the primary asset category under investigation, examining how women farmers' access to these assets shapes their sustainable farming practices. The framework further recognises that livelihood outcomes are mediated by a vulnerability context and by transformational structures and processes, namely the institutions, policies, and social norms that determine who can access and benefit from available assets.

In applying the SLF to this study, the vulnerability context and transformation structures are conceptualised specifically in social and institutional terms, restrictive cultural norms, financial exclusion, insecure land tenure, and inadequate extension support, rather than in terms of climatic or environmental variables. This departure from the more common climate-oriented application of the SLF in the literature is deliberate: this study's objectives are concerned with socially originated, measurable constraints on access, which lend themselves to empirical measurement through structured indicators, unlike climate variability, whose operationalisation and measurement lie outside the study's scope. The SLF, viewed through this social-institutional lens, thus provides the theoretical basis for the study's central proposition: that women farmers' sustainable farming practices are jointly determined by the extent of their natural asset access and by the social structures that mediate that access, a proposition tested empirically in the results section and returned to directly in the discussion.

## **METHODOLOGY**

Biliri LGA is located in Gombe State, Nigeria, comprising ten wards: Baganje North, Baganje South, Bare, Billiri North, Billiri South, Kalmai, Tal, Tanglang, Todi, and Tudu Kwaya. The LGA lies between latitudes 9°41'30"N–9°57'50"N and longitudes 11°01'00"E–11°15'40"E, with a population of 202,144 recorded at the last national census (National Population Commission,

2006), projected to have grown substantially in the intervening period based on subsequent national demographic estimates (National Bureau of Statistics, 2023). The area has a tropical climate with wet and dry seasons, and agriculture that is predominantly rain-fed and remains the dominant economic activity. The Tangale people constitute the majority of inhabitants, alongside minority groups including Wurkun, Waja, Hausa, Fulani, Tula, and Kanuri.

A cross-sectional research design was adopted for this study, involving the collection of quantitative data from women farmers at a single point in time using a structured questionnaire. The design was considered appropriate given the study's objective of measuring and statistically analysing the relationship between natural asset access, sustainable farming practices, and social and institutional challenges across a defined population at one point in time.

The target population comprised women farmers across the ten wards of Biliri LGA. A multi-stage sampling procedure was adopted. In the first stage, five of the ten wards were selected using simple random sampling to ensure unbiased geographic representation across the LGA. In the second stage, two villages were randomly selected from each of the five selected wards, yielding ten villages in total. In the third stage, women farmers were selected from household lists within each selected village using systematic random sampling, with a sampling interval calculated by dividing each village's farming household population by the proportionate quota allocated to that village. The overall sample size was determined using Yamane's (1967) formula for finite populations at a 95% confidence level and 5% margin of error, yielding a target of 380 respondents proportionately distributed across the ten selected villages.

A structured questionnaire was the sole instrument used for data collection, comprising five sections: Section A (socio-demographic characteristics), Section B (access to natural livelihood assets), Section C (indicators of sustainable farming practices) Section D (social and institutional challenges to access), and Section E (composite items used to construct the sustainability index applied in the regression analysis). Access items were measured on a dichotomous Yes/No scale, while sustainability and challenge items were measured on a five-point Likert scale. Given that literacy levels varied among respondents, the questionnaire was administered on a face-to-face, interviewer-administered basis by trained research assistants fluent in Tangale and Hausa, who read each item aloud and recorded responses verbatim, ensuring that respondents with limited formal reading ability could participate fully and meaningfully. The instrument was validated by research supervisors and two subject-matter experts in agricultural sociology and environmental

studies. A pre-test conducted with 30 women farmers outside the main sample yielded a Pearson Product Moment Correlation reliability coefficient of  $r = 0.67$ , indicating adequate internal consistency.

Descriptive statistics (frequencies, percentages, and mean scores) were used to summarise respondents' socio-demographic characteristics and their responses on natural asset access, sustainable farming practice indicators, and social and institutional challenges. Inferential statistics, specifically multiple regression analysis, were used to determine the relative predictive strength of (i) specific natural livelihood asset types and (ii) specific social and institutional challenges, each tested as independent variables against a composite sustainability index (constructed from Section E items) as the dependent variable, in two separate regression models. Data were processed and analysed using the Statistical Package for Social Sciences (SPSS), version 26, with statistical significance set at  $p \leq 0.05$ . Of the 380 questionnaires administered, 323 were correctly completed, returned, and found valid for analysis, representing a response rate of 92.1%; this figure forms the basis of the sample size ( $n = 323$ ) reported throughout the Results section.

## **RESULTS**

### **Socio-Demographic Characteristics of Respondents**

Descriptive statistics (frequencies and percentages) are used to open this subsection, presenting the socio-demographic profile of the 323 respondents in Table 1.

**Table 1: Socio-Demographic Characteristics of Respondents (n=323)**

| Variable           | Category           | Frequency | Percentage (%) |
|--------------------|--------------------|-----------|----------------|
| Age (years)        | 18–24              | 27        | 8.4            |
|                    | 25–34              | 116       | 35.9           |
|                    | 35–44              | 88        | 27.2           |
|                    | 45–54              | 49        | 15.2           |
|                    | 55+                | 43        | 13.3           |
| Marital Status     | Single             | 150       | 46.4           |
|                    | Married            | 146       | 45.2           |
|                    | Widowed/Divorced   | 27        | 8.4            |
| Education Level    | No formal/Primary  | 118       | 36.5           |
|                    | Secondary/Tertiary | 196       | 60.7           |
|                    | No response        | 9         | 2.8            |
| Primary Occupation | Farming            | 134       | 41.5           |
|                    | Trading            | 89        | 27.6           |
|                    | Artisan/Other      | 100       | 30.9           |
| Duration of Stay   | 1–10 years         | 71        | 22.0           |
|                    | 11–20 years        | 168       | 52.0           |
|                    | 21+ years          | 84        | 26.0           |

*Source: Field Survey, 2025*

The comparatively high proportion of respondents with secondary or tertiary education (60.7%) and the correspondingly high response rate (92.1%) may appear unexpected in a predominantly rural, agrarian LGA, where lower literacy levels are typically anticipated. Two factors help account for this pattern. First, the interviewer-administered method of data collection meant that respondents' ability to participate meaningfully did not depend on their capacity to read or write, since trained research assistants read each item aloud in the respondent's preferred language and recorded answers directly; this decoupled the response rate from literacy level. Second, the sampled villages were drawn from wards that include Billiri town, the LGA headquarters, where the historical presence of mission- and government-established schools has produced comparatively greater access to formal education than in more remote outlying settlements not covered by this study's sample. Readers should note this as a boundary condition on the generalisability of the socio-demographic profile to more remote parts of the LGA.

### Access to Natural Livelihood Assets

Table 2 presents a composite summary of women farmers' access to natural livelihood assets, combining land, water source, Fadama, and forest resource indicators with seasonal water access patterns to allow a deeper, integrated interpretation of access across asset types.

**Table 2: Composite Access to Natural Livelihood Assets among Women Farmers (n=323)**

| Natural Asset / Indicator                       | Wet Season / Overall (%) | Dry Season (%) | Mean Score | Rank            |
|-------------------------------------------------|--------------------------|----------------|------------|-----------------|
| Land access for farming                         | 89.8                     | ,              | 3.61       | 1st             |
| Well water access                               | 91.6                     | 8.4            | 3.55       | 2nd             |
| Stream/river water access                       | 85.1                     | 14.9           | 3.31       | 3rd             |
| Lake/pond water access                          | 84.5                     | 11.5           | 3.28       | 4th             |
| Fadama (floodplain) land access                 | 74.6                     | ,              | 2.98       | 5th             |
| Forest/woodland product access                  | 67.5                     | ,              | 2.71       | 6th             |
| Reported control over benefits from assets used | 88.5                     | ,              | 3.47       | 2nd (composite) |

*Source: Field Survey, 2025*

The composite pattern in Table 2 shows that access is not uniform across asset types: land and well water recorded the highest access and mean scores, while forest and *fadama* access were comparatively lower. Seasonal water access was sharply polarised for all water-dependent assets, with access rates collapsing during the dry season across wells, streams, and lakes alike. Read together, these figures indicate that women farmers' access to natural assets in Billiri LGA is strongest for land and least secure for water during the dry season and for forest resources overall, a pattern with direct implications for which assets should be prioritised in intervention design.

### Access to Natural Assets and Sustainable Farming Practices

Table 3 presents indicators of sustainable farming practices reported by women farmers, reflecting the extent to which their farming activities remain productive, food-secure, and income-generating.

**Table 3: Indicators of Sustainable Farming Practices among Women Farmers (n=323)**

| Sustainability Indicator                                   | Frequency | Percentage (%) | Ranking |
|------------------------------------------------------------|-----------|----------------|---------|
| Natural assets provide primary source of household income  | 289       | 89.5           | 1st     |
| Farming activities ensure household food security          | 275       | 85.1           | 2nd     |
| Farm produce generates income through market sales         | 241       | 74.6           | 3rd     |
| Land use supports dry-season (Fadama) farming continuity   | 198       | 61.3           | 4th     |
| Farming practices maintain land productivity over time     | 187       | 57.9           | 5th     |
| Natural resource use supports household raw material needs | 154       | 47.7           | 6th     |

*Source: Field Survey, 2025*

Sustainable farming practice were most strongly reflected in natural assets serving as the primary source of household income (89.5%) and in supporting household food security (85.1%). Dry-season farming continuity was maintained by a smaller majority (61.3%), directly reflecting the dry-season water access constraints identified in Table 2, and suggesting a link between seasonal asset access and the consistency of sustainable farming outcomes across the year.

#### **Challenges Affecting Access to Natural Livelihood Assets**

Table 4 presents the social and institutional challenges women farmers reported as constraints on their access to natural livelihood assets.

**Table 4: Challenges Affecting Women Farmers' Access to Natural Livelihood Assets (n=323)**

| Challenge                                               | Frequency | Percentage (%) | Ranking |
|---------------------------------------------------------|-----------|----------------|---------|
| Restrictive cultural and gender norms                   | 257       | 79.6           | 1st     |
| Financial constraints (lack of capital/credit)          | 250       | 77.4           | 2nd     |
| Limited formal land rights/tenure security              | 242       | 74.9           | 3rd     |
| Inadequate extension services and technical support     | 221       | 68.4           | 4th     |
| Limited participation in decision-making over resources | 176       | 54.5           | 5th     |

*Source: Field Survey, 2025*

Restrictive cultural and gender norms (79.6%) and financial constraints (77.4%) were the most widely reported challenges, followed by limited formal land rights (74.9%). These descriptive rankings are tested for their relative statistical influence on sustainable farming practices in the regression analysis that follows.

### **Regression Analysis: Predictors of Sustainable Farming Practices**

Two separate multiple regression analyses (MRA) were conducted, in accordance with the study's objectives, to determine the relative predictive strength of specific variables on the composite sustainability index (dependent variable). The first analysis tested specific natural livelihood asset types as independent variables; the second tested specific social and institutional challenges as independent variables.

**Table 5: MRA 1— Natural Livelihood Assets as Predictors of Sustainable Farming Practices**

| <b>Predictor (Natural Asset)</b> | <b><math>\beta</math></b> | <b>t</b> | <b>p-value</b> | <b>Decision</b> |
|----------------------------------|---------------------------|----------|----------------|-----------------|
| Land access                      | 0.398                     | 7.812    | <0.001         | Significant     |
| Well water access                | 0.276                     | 5.104    | <0.001         | Significant     |
| Fadama land access               | 0.189                     | 3.665    | <0.001         | Significant     |
| Stream/river access              | 0.112                     | 2.201    | 0.028          | Significant     |
| Forest/woodland access           | 0.068                     | 1.284    | 0.200          | Not significant |
| (Constant)                       | ,                         | ,        | ,              | ,               |

*R = 0.712, R<sup>2</sup> = 0.507, Adjusted R<sup>2</sup> = 0.499, F(5, 317) = 65.234, p < 0.001, Source: Field Survey, 2025*

Model 1 was statistically significant, with the five natural asset types jointly explaining approximately 50.7% of the variance in sustainable farming practices. Land access emerged as the strongest predictor of sustainability, followed by well water access and Fadama land access; forest and woodland access, while positively associated, did not reach statistical significance. The clear direction of this finding is that improving women farmers' access to land and to reliable water sources would yield the greatest gains in sustainable farming outcomes among the natural assets examined.

**Table 6: MRA 2— Social and Institutional Challenges as Predictors of Sustainable Farming Practices**

| Predictor (Challenge)                 | $\beta$ | t      | p-value | Decision        |
|---------------------------------------|---------|--------|---------|-----------------|
| Restrictive cultural/gender norms     | −0.354  | −6.532 | <0.001  | Significant     |
| Financial constraints                 | −0.298  | −5.416 | <0.001  | Significant     |
| Limited land tenure security          | −0.221  | −4.023 | <0.001  | Significant     |
| Inadequate extension services         | −0.147  | −2.687 | 0.008   | Significant     |
| Limited decision-making participation | −0.089  | −1.594 | 0.112   | Not significant |
| (Constant)                            | ,       | ,      | ,       | ,               |

$R = 0.689$ ,  $R^2 = 0.475$ ,  $Adjusted\ R^2 = 0.466$ ,  $F(5, 317) = 57.198$ ,  $p < 0.001$ , Source: Field Survey, 2025

Model 2 was also statistically significant, with the five challenge variables jointly explaining approximately 47.5% of the variance in sustainable farming practices. All coefficients were negative, confirming that each challenge, where significant, reduces sustainable farming practice. Restrictive cultural and gender norms emerged as the strongest predictor, exerting the greatest negative influence on sustainability, followed by financial constraints and limited land tenure security; limited decision-making participation did not reach statistical significance. The clear direction of this finding is that interventions addressing cultural and gender norms, followed by financial exclusion, would most effectively improve sustainable farming outcomes among the challenges examined.

## DISCUSSION OF FINDINGS

The findings of this study, read together, provide direct empirical support for the study's theoretical proposition, grounded in the Sustainable Livelihoods Framework (SLF), that women farmers' sustainable farming practices are jointly shaped by the extent of their natural asset access and by the social structures mediating that access (Chambers & Conway, 1992; DFID, 1999; Natarajan *et al.*, 2022). Objective 1 showed that access was strongest for land and weakest for forest resources and dry-season water; Objective 2 showed that sustainable farming practices were correspondingly strongest where reliable income and food security were derived from assets, but weakest for dry-season farming continuity, precisely the domain where Table 2 showed access was most constrained. This correspondence between access and sustainability findings is not coincidental: it is exactly the relationship the SLF predicts, in which natural capital availability directly conditions livelihood outcomes.

The first regression model reinforces this reading empirically: land access was the strongest predictor of sustainable farming practices, consistent with findings by Udoh *et al.*, (2017) in Akwa Ibom State and by Ibrahim and Ali (2023) among low-income households more broadly, both of which identified natural capital, and land in particular, as central to livelihood sustainability. The comparatively weaker and non-significant effect of forest access may reflect the more supplementary role that woodland products play relative to land and water in this farming system, a pattern consistent with Olumba and Olumba's (2024) observation that the specific resource composition available to women farmers, not merely the aggregate resource endowment, determines which sustainable practices are adopted.

The second regression model directly operationalises the SLF's transforming structures and processes component: by testing named social and institutional challenges rather than treating barriers as an undifferentiated category, the analysis identifies restrictive cultural and gender norms as the single most influential constraint on sustainable farming practices, ahead of financial exclusion and land tenure insecurity. This finding extends the theoretical and empirical literature on gendered resource access (Agarwal, 1994; Kabeer, 1994; Meinzen-Dick & Mwangi, 2009) by demonstrating, rather than asserting, that cultural norms carry greater statistical weight than financial or tenure-related barriers in this context, a distinction with direct implications for how limited intervention resources should be prioritised. The findings also corroborate Kehinde *et al.*, (2021), who found land tenure and property rights security to be a significant, though not singular, determinant of positive livelihood outcomes for Nigerian women farmers; the present study's disaggregated approach clarifies that tenure insecurity, while significant, ranks behind cultural norms and financial exclusion in relative influence.

Taken together, the two regression models offer a coherent, theory-consistent account: women farmers' sustainable farming practices in Biliri LGA are most directly advanced by improving access to land and water (the natural capital pathway) and by addressing restrictive cultural norms and financial exclusion (the transforming structures pathway), the two pathways the SLF identifies as jointly determining livelihood outcomes. This dual finding, more precise than a generalised assertion that "access matters" and "barriers matter," is the central empirical contribution of this study.

## **CONCLUSION**

This study examined women farmers' access to natural livelihood assets in Biliri LGA, Gombe State, how that access shapes sustainable farming practices, and the social and institutional challenges constraining access. The evidence shows that access is uneven across asset types, strongest for land and weakest for forest resources and dry-season water; that sustainable farming practice correspondingly tracks this pattern of access; and that, among the challenges women face, restrictive cultural and gender norms exert the greatest constraining influence, ahead of financial exclusion and land tenure insecurity. Grounded in the Sustainable Livelihoods Framework, these findings demonstrate that the sustainability of women farmers' livelihoods in Biliri LGA is jointly determined by the specific natural assets they can access and by the specific social structures that mediate that access, a more precise account than earlier, less disaggregated treatments of this relationship allow. Addressing the sustainability gap identified in this study requires interventions that target land and water access specifically, and that confront cultural and gender norms as the primary, rather than incidental, barriers to women's effective resource use.

## **RECOMMENDATIONS**

Based on the findings of this study, the following recommendations are made:

### **i. Prioritise Land and Water Access Interventions**

Given that land and well water access were the strongest predictors of sustainable farming practices, interventions in Biliri LGA should prioritise expanding women farmers' access to farmland and to reliable water infrastructure, particularly for the dry season, where access was most constrained and where sustainability outcomes were correspondingly weakest.

### **ii. Address Restrictive Cultural and Gender Norms Directly**

Because cultural and gender norms emerged as the single strongest barrier to women's access, community-level engagement with traditional leaders, household heads, and community structures in Biliri LGA should be designed to directly confront the specific norms restricting women's land and resource use, rather than treating this as a secondary concern to financial or infrastructural interventions.

### **iii. Strengthen Women's Access to Agricultural Finance**

Financial constraints ranked as the second strongest barrier to sustainable farming practices. Local financial institutions and cooperative structures in Biliri LGA should design credit and savings

products specifically accessible to women farmers, addressing the collateral and documentation barriers that typically exclude them from mainstream agricultural finance.

iv. Improve Land Tenure Security for Women Farmers

Given that land tenure insecurity significantly predicted lower sustainability, local land administration processes in Biliri LGA should be reviewed to identify practical, community-acceptable pathways for strengthening women's tenure security over farmland they cultivate, without requiring wholesale reform of customary tenure systems.

v. Strengthen Extension Service Delivery

Extension services should be extended and strengthened in the study area, with content specifically tailored to the natural asset access patterns identified in this study, particularly land productivity maintenance and dry-season farming continuity, to translate improved access into sustained farming outcomes.

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