

## FROM ABUNDANCE TO ABSENCE: AN ASSESSMENT OF COMMUNITIES PERCEPTIONS ON CLIMATE CHANGE, DESERTIFICATION AND THE DISAPPEARANCE OF WILD FOOD PLANTS IN NORTHERN KATSINA STATE, NIGERIA

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### Abstract

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*Climate change intensifies desertification through extreme events such as increased land surface air temperatures and drought. Variability in rainfall onset, early cessation, and overall decline in rainfall further contribute to these processes. These factors adversely affect the functions and availability of plant biodiversity in the semi-arid ecosystems of northern Nigeria. Wild Food Plants (WFP) are among the most affected components of this biodiversity. WFP serve as essential resources for food and nutritional security in the semi-arid, food-insecure regions of northern Nigeria. Consequently, there is an urgent need to document these changes at both community and species composition levels. Recent evidence demonstrates that climate-driven biodiversity loss is accelerating across West African drylands, with WFP species disappearing more rapidly than they can be documented. This study investigates the perspectives of communities residing along the Nigeria-Niger Republic border regarding the impact of climate change and desertification on WFP availability, comparing current conditions with historical baselines. Data collection involved household questionnaire surveys, key informant interviews, focus group discussions, and field surveys. Findings indicate that reports of WFP species disappearance or decline were more frequent than reports of increases or introductions of new species. Participants aged 70 years and above, both men and women, demonstrated greater awareness of these species changes, with men more frequently perceiving decreases and disappearances. The study recommends the reintroduction of disappeared WFP species, conservation of those in decline, and the adoption of sustainable environmental resource management to promote WFP regeneration in the study area.*

**Keywords:** Wild Food Plants, Desertification, Climate Change, Communities, Semi-arid.

### Introduction

Wild food plants (WFP), also known as wild edible plants, refer to naturally occurring plant species that provide nutritional and medicinal benefits to humans (Pawera et al., 2020; Oluoch et al., 2023, 2024). For centuries, these plants have been a vital part of human diets, supplying sustenance and nutrients to various cultures worldwide (Ahmed et al., 2022). Different parts of WFP are utilized, including fruits, vegetables, nuts, seeds, herbs, and bark (Abdulrashid, 2020). WFP thrive in diverse ecosystems such as farmland, forests, meadows, mountains, and coastlines, often being rich in vitamins, minerals, antioxidants, and other beneficial compounds (Hussain et al., 2023). Many WFP also feature unique flavors and textures that can enhance culinary dishes (Chinomona et al., 2024).

Key benefits of WFP include their nutritional value; they often contain more nutrients than cultivated crops, having adapted to their natural environments and developed strong defenses against pests and diseases (Glew and Vanderjagt, 2006). Furthermore, WFP serve as a vital food safety net for rural households, particularly during periods of food insecurity; their nutritional contributions frequently exceed those of domesticated counterparts in terms of micronutrient density (Bharucha and Pretty, 2010; Dossou et al., 2021). Beyond their nutritional value, WFP are also recognized for their medicinal properties. Many traditional cultures have relied on wild plants for their healing attributes, using them to treat various ailments and promote overall health and well-being (Segnon, 2014; Abera and Belay, 2022). However, climate change and desertification pose significant threats to these plant species, jeopardizing their sustainability and availability (Ibrahim et al., 2022; Tapily et al., 2023).

Numerous studies highlight the role of WFP in providing essential nutrients, diversifying diets, and enhancing food security in rural communities (Oluoch et al., 2023, 2024; Chisengo et al., 2023). Yet, limited research has focused on the impact of climate change and desertification on WFP availability and quality in Nigeria's semi-arid regions. This gap is particularly critical given the accelerating pace of climate change and land degradation in the Sudano-Sahelian belt (Adaawen, 2021; Ogunbode et al., 2022). Climate change leads to shifts in temperature and rainfall patterns, affecting the phenology and distribution of wild food plants. Changes in these essential climatic factors increasingly affect the availability of water and arable land and have a significant impact on biodiversity, including WFP that are essential for the food security and nutrition of local communities (Adaawen, 2021; Oluoch et al., 2023). It is essential to understand how communities perceive the impact of climate change and desertification on wild food plants in order to develop effective strategies for mitigation.

Assessing community perceptions of the impact of climate change and desertification on wild food plants is critical for formulating effective mitigation strategies and ensuring the sustainable utilization of these resources.

Climate change refers to the long-term warming of the planet, driven by multiple factors, including an increase in average global temperatures. This warming is primarily caused by human activities that release greenhouse gases, such as carbon dioxide and methane, into the atmosphere (IPCC, 2020, 2021; NASA, 2020). Other contributing factors include deforestation (WWF, 2020), land use changes (Hansen et al., 2013), and unsustainable agricultural practices (Smith et al., 2014). These factors lead to extreme weather events (Mann et al., 2017), such as rising temperatures and altered precipitation patterns (Trenberth, 2011), as well as a loss of biodiversity (IPBES, 2019; 2022), including wild food plants (WFP). Recent modeling studies indicate that under high-emission scenarios, up to 40% of plant species in the West African Sahel could experience significant range contractions by 2050, with wild food plants being disproportionately affected due to their specific habitat requirements (Oluoch et al., 2024; Norris et al., 2022).

Desertification is a complex process of land degradation caused by a combination of natural and human-induced factors, transforming fertile landscapes into arid, desert-like environments (Hillel and Rosenzweig, 2002; Sterk and Stoorvogel, 2020). In semi-arid regions of Nigeria, desertification poses a significant threat to food crops and wild food plants, both of which are essential for the sustenance of local communities. The increasing frequency and severity of droughts (Abdulrashid, 2020), unsustainable land use practices, overexploitation of natural resources (Sterk and Stoorvogel, 2020), climate change (IPCC, 2021), overgrazing (Hill et al., 2017), deforestation (WWF, 2020), soil erosion (Lal, 2017), and heightened pressure on land resources (UN, 2019) have all intensified the desertification process. This has led to soil degradation, decreased agricultural productivity, and a further loss of biodiversity, including wild food plants.

Nigeria's Sudano-Sahelian belt, which covers 40% of the country's landmass (between 11°N and 14°N), is highly vulnerable to desertification. This vulnerability results from multiple factors, including overgrazing, deforestation, wind erosion, and the depletion of soil fertility due to unsustainable agricultural practices, drought, and bushfires (Adegbehin et al., 1990; Mijindadi and Adegbehin, 1991; Medugu et al., 2011). The effects of desertification in Nigeria appear to have extended south of 11°N due to uncontrolled human activities (Otegbeye, 2004). It is estimated that Nigeria loses 350,000 square meters to desertification annually, while the Sahara Desert is advancing at a rate of approximately 0.6 km per year (Medugu et al., 2011; Ibrahim et al., 2022).

Researches indicate that climate change is significantly impacting northern Nigeria, threatening sustainable resource management and community survival (Abdulrashid, 2012; Ibrahim et al., 2022; Ogunbode et al., 2022). For instance, Odjugo (2010) reported that the mean temperature in Nigeria increased from 26°C between 1901 and 1938 to 27.83°C between 1971 and 2008. This reflects a rise of 1.70°C, which exceeds the global mean temperature increase of 0.74°C observed from 1906 to 2005. If these trends continue unchecked, Nigeria could face a temperature increase of between 2.5°C and 4.5°C by the year 2100. Furthermore, rainfall data collected from 1940 to 2000 at 23 meteorological stations in Nigeria's savanna zones indicated a significant reduction in rainfall, with the mean rainfall decreasing from 1,571 mm during 1901–1938 to 1,480 mm during 1971–2008, a decline of 91 mm (Odjugo, 2010, 2011). Roma (2008) noted a 3–4% decrease in rainfall per decade since the early 19th century, with the number of rainy days in northern Nigeria dropping from 150 to 120 over the past four decades.

In northern Nigeria, an analysis of rainfall data by Tomlinson (2010) from more than 120 stations between 9°N and 13.5°N showed a reduction in rainfall from 700 mm in 1970 to less than 600 mm in 2008. Tomlinson (2010) warned that if this downward trend continues, rainfall in northern Katsina State could decline to less than 400 mm by 2030. He noted that the broader implications of rainfall variability include transforming woodlands into thorn shrubs, savannas into deserts, and making rain-fed agriculture unviable. Recent satellite remote sensing and climate model analyses have confirmed these accelerating drying trends across Nigeria's northern belt (Nkechi et al., 2021; Mukhtar et al., 2022).

The increasing demand for vegetation resources, in conjunction with climate fluctuations, has resulted in decreased vegetation density and diversity (Huang, 2017; Abdulrashid and Ibrahim, 2018). Studies in West Africa's Sudano-Sahelian region have documented widespread declines and extinctions of plant species (Wezel and Haigis, 2002; Lykke, 2000; Wezel and Lykke, 2006; Sop and Oldeland, 2011; Sop et al., 2012; Spiekermann et al., 2015). More recently, community-based monitoring efforts have corroborated these findings, demonstrating that local ecological knowledge (LEK) accurately reflects decadal-scale vegetation changes when compared with remote sensing data (Olaniyan, 2022; Brandt et al., 2021).

Local knowledge is widely regarded as a valuable and reliable source of data on the historical distribution patterns of plants, particularly for rare and endangered species that are difficult to assess using advanced technology (Spiekermann et al., 2015; Olaniyan, 2022). Understanding how environmental changes are perceived at the local level is essential for developing adaptation and mitigation strategies for climate variability and desertification. Affected communities must recognize the problems they face to create effective responses (Abdulrashid, 2012; Tapily et al., 2023).

The objectives of this study are to: (i) collect local perspectives on changes in climatic elements (rainfall and temperature) and the severity of desertification and its effects on the availability of wild food plants (WFP); (ii) examine changes in the availability of WFP; and (iii) document the various uses of WFP within the communities.

## Material and Methods

### The Study Area

The study area is situated between latitudes 12°52'N and 13°19'N and longitudes 7°16'E and 8°43'E. (See table 1) The climate here is influenced primarily by two dominant air masses: the dry, dusty, tropical-continental (cT) air mass from the Sahara Desert and the warm, tropical-maritime (mT) air mass from the Atlantic Ocean. The interaction of these air masses results in two distinct seasons—wet and dry. The region experiences a unimodal rainfall pattern, with the majority of precipitation occurring between May and September, and an annual average rainfall of below 700 mm (Abdulrashid, 2012). Throughout most of the year, temperatures are high, with mean daily maximum temperatures ranging from 27°C to over 40°C, particularly from March to May. The area has four distinct seasons: a cool dry season (December to February), a hot dry season (March to May), a warm wet season (May to September), and a cooling season (September to November) (Tomlinson, 2010).

**Table 1: Sample Sizes and Some Characteristics of the Study Area**

| Local Govt.                                               | Villages       | Location (Coordinate) | Estimated Population | No. of Sample Selected in the Village | No. of Sample Selected in the Local Govt. | Dominant Tribe |
|-----------------------------------------------------------|----------------|-----------------------|----------------------|---------------------------------------|-------------------------------------------|----------------|
| Maiadua                                                   | 1. Bumbum      | 13°16'N, 8°07'E       | 1,700                | 170                                   | 390                                       | Hausa/Fulani   |
|                                                           | 2. Kwangwalam  | 13°10'N, 07°32'E      | 2,200                | 220                                   |                                           | Hausa/Fulani   |
| Mashi                                                     | 1. Birnin Kuka | 13°19'N, 07°59'E      | 3,200                | 320                                   | 570                                       | Hausa/Fulani   |
|                                                           | 2. Majigiri    | 13°15'N, 07°53'E      | 2,500                | 250                                   |                                           | Hausa/Fulani   |
| Zango                                                     | 1. Yakubawa    | 13°04'N, 08°29'E      | 1,800                | 180                                   | 400                                       | Hausa          |
|                                                           | 2. Yardaje     | 13°01'N, 08°34'E      | 2,200                | 220                                   |                                           | Hausa/Fulani   |
| <b>Estimated Population and Sample Sizes respectively</b> |                |                       | <b>11,600</b>        | <b>1360</b>                           | <b>1360</b>                               |                |

*Sources: Fieldwork (2026)*

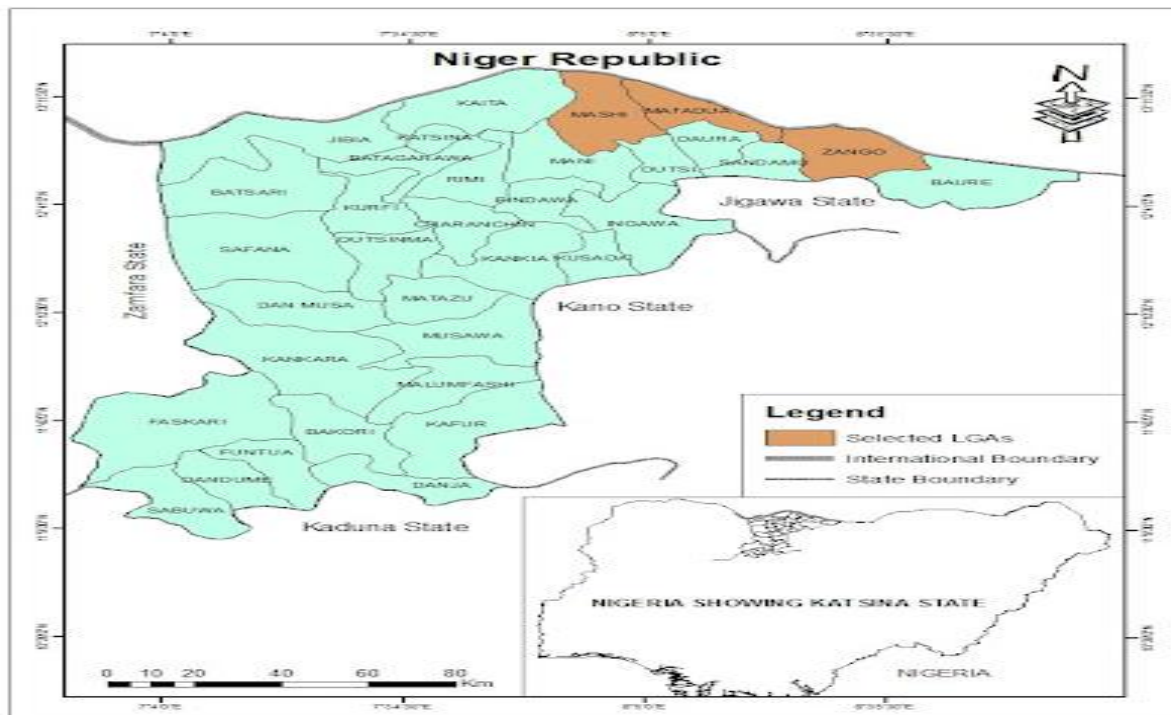


Figure 1: The Study Area

The landscape is predominantly flat, underlain by sedimentary rock, with an average elevation of 300 meters above sea level, and is occasionally interrupted by hills. The soils are sandy ferruginous types belonging to the latosols group, characterized by high weathering, pronounced laterization, slight acidity, low organic matter content, and phosphorus levels. Total nitrogen content rarely exceeds 0.2% (Abubakar, 2006). The vegetation faces several forms of degradation due to fire, wood cutting, cultivation, overgrazing, and bushfires. Subsistence rain-fed farming is the primary economic activity in the area, with fragmented farmland being the most common land use pattern.

### Methods of Data Collection

In a pilot survey, twenty respondents were randomly selected to identify potential issues with the interpretation and administration of the questionnaires. This process allowed for the restructuring and rephrasing of questions to minimize questionnaire-related problems before proceeding with the actual data collection. A sampling technique with proportionate representation was employed to determine the sample size, resulting in a total of 1,360 respondents: 570 from Mashi, 400 from Zango, and 390 from Maiadua local government areas. Priority was given to respondents aged 50 years and above who had lived in the study area and could recall temperature, rainfall patterns, and desertification trends in their communities over several decades (Mkonda and Xinhua, 2017; Tapily et al., 2023).

To gather information on farmers' knowledge of climate change in their immediate environment, community members were asked about their methods for estimating rainfall and temperature, the timing of the rainy season, and the onset and cessation of rainfall. Respondents were also asked to compare current rainy season patterns with those of the past to assess any changes in climate. If changes were noted, they were asked to specify when these changes began by referring to a particular year or significant event they could recall (Mkonda and Xinhua, 2017).

To investigate how climate changes influenced rainfall patterns, temperature, desertification, and the availability of wild food plants, the following activities were undertaken: (i) A transect walk was conducted with selected respondents, prioritizing those aged 50 and above, following the methods outlined by Wezel and Haigis (2000) and Wezel and Lykke (2006); (ii) Questionnaires were administered to respondents and pastoralists, who were asked to indicate the availability of wild food plants (WFP) in comparison to the past using three criteria: Increased, Decreased, and Disappeared; (iii) After the questionnaire administration, Focus Group Discussions were held, featuring dialogues with groups of respondents who participated in the transect walks in their villages, as well as local government officials responsible for forestry.

### **The Identification of Botanical Names of Plants**

The identification of botanical names for the specified Wild Food Plants (WFP) was conducted by comparing local names provided by farmers and pastoralists, along with plant characteristics such as flower, root system, and body morphology, to reference materials from Blench (2004). When names and characteristics corresponded, the botanical names suggested by the author were adopted. Some WFP, particularly those that have disappeared, could not be identified using this approach. In such cases, specimens were sourced from other ecological zones, including the Sudan or Guinea savanna, with assistance from local farmers and pastoralists. These specimens were subsequently taken to the Herbarium in the Faculty of Natural and Applied Sciences, Department of Biological Sciences, Umaru Musa Yar'adua University, Katsina, for thorough identification and naming.

### **Methods of Data Analysis and Presentation**

Quantitative data were analyzed using SPSS software to generate cross-tabulations and frequency tables.

## **Results and Discussion**

### **Occupational Distribution of the Respondents**

Agriculture stands as the primary occupation within the population, forming the backbone of the local economy. A significant majority of respondents as shown in Table 2 (over 70%) across three local government areas are farmers, and livestock rearing is crucially integrated into successful farming practices. Notably, younger men frequently engage in migration to neighboring urban centers or other regions of the country, underlining an important off-farm activity. This observation aligns with recent studies in the Sahel that underscore the increasing relevance of diversified livelihood strategies prompted by climate-induced agricultural stress (Adaawen, 2021; Mukhtar et al., 2022).

### **Land Tenure and Farm Land Sizes**

Table 3 the dominance of farming as the predominant occupation in the study area reflects the essential value placed on land. The land tenure system in this region is characterized by a dual heritage: the traditional idea of communal land ownership combined with Islamic law that recognizes individual tenure. Notably, a substantial majority of respondents as indicated in table 3 acquired their land through inheritance in Zango (70%). This pattern of land ownership, largely dictated by inheritance, highlights widespread land fragmentation and small farm sizes, averaging 1.5 hectares in Mashi and 1.3 hectares in Mai'adua. Despite the limited size of land holdings, most respondents assert that the land tenure system is equitable and that land acquisition is not a barrier. The implications of land fragmentation under customary inheritance systems as a structural constraint on sustainable land management in northern Nigeria have been well-documented (Medugu et al., 2011; Mukhtar et al., 2022).

**Table 2: The Demographic Characteristics of the Respondents**

|                   | Mashi (n=570) |    | Zango (n=400) |    | Maiadua (n=390) |    |
|-------------------|---------------|----|---------------|----|-----------------|----|
|                   | Frq.          | %  | Frq.          | %  | Frq.            | %  |
| <b>Gender</b>     |               |    |               |    |                 |    |
| Male              | 510           | 89 | 380           | 95 | 370             | 95 |
| Female            | 60            | 11 | 20            | 05 | 20              | 05 |
| <b>Age</b>        |               |    |               |    |                 |    |
| 10–20             | 00            | 00 | 00            | 00 | 20              | 05 |
| 21–30             | 70            | 12 | 60            | 15 | 30              | 08 |
| 31–40             | 50            | 09 | 40            | 10 | 110             | 28 |
| 41–50             | 100           | 18 | 150           | 37 | 70              | 18 |
| 51–60             | 170           | 29 | 80            | 20 | 60              | 15 |
| 61–70             | 70            | 13 | 20            | 05 | 50              | 13 |
| 71–80             | 60            | 10 | 30            | 08 | 20              | 05 |
| Above 80 years    | 50            | 09 | 20            | 05 | 30              | 08 |
| <b>Occupation</b> |               |    |               |    |                 |    |
| Farming           | 440           | 77 | 290           | 72 | 270             | 69 |
| Civil Servant     | 20            | 04 | 30            | 08 | 50              | 13 |
| Trading           | 40            | 07 | 20            | 05 | 50              | 13 |
| Other             | 70            | 12 | 60            | 15 | 20              | 05 |

*Source: Fieldwork (2026)***Table 3: Land Tenure and Farm Land Sizes**

|                                     | Mashi (n=570) |     | Zango (n=400) |     | Maiadua (n=390) |     | Average %  |
|-------------------------------------|---------------|-----|---------------|-----|-----------------|-----|------------|
|                                     | Frq.          | %   | Frq.          | %   | Frq.            | %   |            |
| <b>LAND TENURE</b>                  |               |     |               |     |                 |     |            |
| Owner                               | 140           | 25  | 110           | 27  | 100             | 26  | 26         |
| Inherited                           | 370           | 65  | 280           | 70  | 250             | 64  | 66         |
| Purchased                           | 60            | 10  | 10            | 2.5 | 30              | 8.0 | 06         |
| Others                              | 00            | 0.0 | 00            | 00  | 10              | 2.6 | 01         |
| <b>Average Farm Size (Hectares)</b> | <b>1.7</b>    |     | <b>1.4</b>    |     | <b>1.3</b>      |     | <b>1.5</b> |

*Source: Fieldwork (2026)*

### Community's Perception of Climate Variability and Change

The majority of the community farmers recognize that there have been significant changes in the overall climate patterns. There is minimal variation among the six villages regarding the timeframe

in which these changes began to manifest (Table 4). Most farmers believe that these climate changes started over 15 to 30 years ago, while a minority notes a more recent change within the last 10 years. These perceptions align consistently with findings documented in other Sahel locations (Mkonda and Xinhua, 2017; Tapily et al., 2023; Adaawen, 2021).

### Changes in Rainfall Patterns

Farmers have observed that the onset of the first rain in the season now occurs later than it did in the past. Conversely, they reported that the cessation of rainfall happens earlier. These perceptions are consistent with findings from Burkina Faso, as noted by West et al. (2008), which indicated a shorter rainy season. In all sampled villages, more than 80% of farmers reported a late onset of the first rainy season, while 70% to 80% noted an earlier cessation. Additionally, over 80% of respondents perceived a decrease in season duration (see Table 4). The number of rainfall events has consistently declined, while the frequency of dry spells has increased. These observations align with instrumental rainfall records and recent analyses by Nkechi et al. (2021) and Mukhtar et al. (2022), which confirm a statistically significant shortening of the rainy season and an increase in dry-spell frequency across northern Nigeria over the past three decades.

**Table 4: Communities Perceived Changes in the Rainy Season Pattern in Northern Katsina State**

| SPECIES NAME        |           | MASHI LGA<br>(n=570) |    | ZANGO LGA<br>(n=400) |    | MAI'ADUA LGA (n=390) |    |
|---------------------|-----------|----------------------|----|----------------------|----|----------------------|----|
|                     |           | Frequency            | %  | Frequency            | %  | Frequency            | %  |
| Rain onset          | Early     | 70                   | 13 | 40                   | 10 | 10                   | 02 |
|                     | No change | 30                   | 05 | 30                   | 08 | 60                   | 15 |
|                     | Late      | 470                  | 82 | 330                  | 82 | 320                  | 83 |
| Rain cessation      | Early     | 450                  | 80 | 320                  | 80 | 270                  | 72 |
|                     | No change | 40                   | 07 | 50                   | 13 | 60                   | 14 |
|                     | Late      | 80                   | 13 | 30                   | 07 | 60                   | 14 |
| Season duration     | Decreased | 500                  | 88 | 350                  | 88 | 320                  | 83 |
|                     | No Change | 30                   | 05 | 20                   | 05 | 60                   | 15 |
|                     | Increased | 40                   | 07 | 30                   | 07 | 10                   | 02 |
| Rainfall            | Decreased | 400                  | 70 | 300                  | 75 | 300                  | 77 |
|                     | No change | 100                  | 18 | 20                   | 05 | 30                   | 08 |
|                     | Increased | 70                   | 12 | 80                   | 20 | 60                   | 15 |
| Dry spell frequency | Decreased | 30                   | 05 | 50                   | 12 | 40                   | 10 |
|                     | No change | 140                  | 25 | 30                   | 07 | 60                   | 15 |
|                     | Increased | 400                  | 70 | 320                  | 81 | 290                  | 75 |
| Total amount        | Decreased | 500                  | 88 | 350                  | 88 | 350                  | 90 |
|                     | No change | 20                   | 03 | 20                   | 05 | 20                   | 05 |
|                     | Increased | 50                   | 09 | 30                   | 07 | 20                   | 05 |

Source: Fieldwork (2026)

### Changes in Temperature and Sunshine Patterns

Table 5 shows that more than 80% of surveyed farmers in three local governments reported rising temperatures, with only 11% in Mashi local government noticing a decrease. Additionally, 8% of respondents from Zango and Maiadua local governments indicated that temperatures remained unchanged. The results also highlighted a reduction in cold days and an increase in extremely hot days in the area. These perceptions are supported by recent re-analyses of climate station data, which show that mean annual maximum temperatures in the Nigerian Sahel have risen by approximately 1.5°C since the 1980s (Ogunbode et al., 2022; Nkechi et al., 2021). Farmers attribute their perception of rising temperatures primarily to extreme temperature events and a decrease in the number of cold days compared to the past.

**Table 5: Communities Perceived Changes in Temperature in Northern Katsina State**

|                     |           | MASHI LGA<br>(n=570) |    | ZANGO LGA<br>(n=400) |    | MAI'ADUA LGA (n=390) |    |
|---------------------|-----------|----------------------|----|----------------------|----|----------------------|----|
|                     |           | Frequency            | %  | Frequency            | %  | Frequency            | %  |
| Temperature         | Decreased | 60                   | 11 | 40                   | 10 | 20                   | 05 |
|                     | No change | 30                   | 05 | 30                   | 08 | 30                   | 08 |
|                     | Increased | 480                  | 84 | 330                  | 82 | 340                  | 87 |
| Number of hot days  | Decreased | 60                   | 11 | 30                   | 07 | 100                  | 25 |
|                     | No change | 50                   | 09 | 70                   | 18 | 30                   | 08 |
|                     | Increased | 460                  | 80 | 300                  | 75 | 260                  | 67 |
| Number of cool days | Decreased | 450                  | 79 | 320                  | 80 | 200                  | 51 |
|                     | No Change | 80                   | 14 | 20                   | 05 | 70                   | 18 |
|                     | Increased | 40                   | 07 | 60                   | 15 | 120                  | 31 |
| Hottest month       | Change    | 400                  | 70 | 270                  | 68 | 150                  | 38 |
|                     | No change | 170                  | 30 | 130                  | 32 | 240                  | 62 |
| Coolest month       | Change    | 460                  | 80 | 270                  | 68 | 250                  | 64 |
|                     | No change | 110                  | 20 | 130                  | 32 | 140                  | 36 |

Source: Fieldwork (2026)

### Impact of Climate Change and Desertification on Wild Food Plants

According to the Intergovernmental Panel on Climate Change (IPCC, 2021), an increase in global average temperatures above the range of 1.5° to 2.5°C may lead to significant changes in the structure, function, and geographical distribution of ecosystems, negatively impacting species distribution and survival. The sixth assessment report from the IPCC (2021) emphasizes that biodiversity loss under high warming scenarios is becoming irreversible in many dryland ecosystems. In the study area, several species are affected by the combined impacts of climate factors and their interactions with other anthropogenic stressors, such as desert encroachment, land fragmentation, and habitat destruction.

In developing countries like Nigeria, where a large portion of the population relies on natural resources for their livelihoods, these changes can severely impact the socio-economic status of

communities and impede their development (IPCC, 2021; Chinomona et al., 2024). In northern Katsina State, useful WFP species are scattered across crop fields, rangelands, and forest reserves. However, these WFP are undergoing significant changes due to their vulnerability to climate change and desertification, (see Table 6) compounded by both natural and human influences. Recent remote sensing studies confirm substantial reductions in vegetation cover across the northern Katsina landscape, with tree cover losses particularly acute near the Nigeria–Niger Republic border (Ibrahim et al., 2022; Brandt et al., 2021).

**Table 6: Communities Perceptions on the Extent of Severity of Desertification**

| Extent of Severity of Desertification | Mashi (n=570) |    | Zango (n=400) |    | Maiadua (n=390) |    |
|---------------------------------------|---------------|----|---------------|----|-----------------|----|
|                                       | Freq          | %  | Freq          | %  | Freq            | %  |
| Increasing                            | 430           | 76 | 320           | 80 | 300             | 78 |
| Same                                  | 120           | 21 | 70            | 17 | 90              | 22 |
| Decreasing                            | 20            | 03 | 10            | 03 | 0               | 0  |

Source: Fieldwork (2026)

Trees are a prominent feature of farmland in northern Katsina State (Abdulrashid, 2012). This land use system, known as the agroforestry parkland system, was described as farmed parkland by Pullan (1974). Most trees and shrubs in this area have fine leaves, and there are sparse grasses and herbs, some of which have a thorny and short structure. The study area also experiences rapid population growth (Mortimore, 2006, 2008), increasing climatic variability (Wezel and Haigis, 2002; Wezel and Lykke, 2006), and a rising demand for vegetation resources (Boatene, 1998; Odihi, 2003), particularly fuelwood. This demand cannot be met by the existing limited vegetation, leading to further environmental degradation. The situation is further complicated by the lack of viable alternatives to wood energy, which continues to put pressure on the scant remaining vegetation (Nkechi et al., 2021; Mukhtar et al., 2022).

### Changes in Wild Food Plants in Northern Katsina State

The number of wild food plant (WFP) species reported to have decreased or disappeared is greater than those that have increased as shown in Table 7, over 75% of the species listed have either declined or completely vanished in the study area. Local perceptions of this decline align with earlier studies conducted in neighboring Niger Republic (Wezel and Haigis, 2000; Wezel and Lykke, 2006) and with recent findings from semi-arid Kenya and Zimbabwe, which document similar trends of WFP loss driven by climatic and anthropogenic stressors (Oluoch et al., 2023; Chinomona et al., 2024). Local farmers attribute the decrease and disappearance of these species to a decline in rainfall and frequent droughts in recent years.

To illustrate the decrease in rainfall, local farmers compared the amount of rainfall received to the water table levels. They noted that, in the past 20 years, the water table was less than 10 meters below the surface, but now one must dig nearly 30 meters or more to reach it. In Bumbum (Ma'adua LGA), villagers indicated that *Ficus polita* and *Ficus phoningll* (locally known in Hausa as Durumi and Chediya, respectively) were once dominant tree species. However, all have naturally wilted and died, and not a single tree of either species can now be found in the village. The villagers believe this disappearance is due to a significant decline in rainfall and the increasing depth of the water table, which is now too deep for the roots of these trees to access. Farmers' observations are consistent with findings from previous studies (Oluwasemire and Alabi, 2004; Tomlinson, 2010; Ekpho and Nsa, 2011; Ibrahim et al., 2022).

**Table 7: Pattern of WFP Changes in Northern Katsina State****Key: ↓ Decreasing, ↓ Disappeared, ↑ Increasing**

| SPECIES NAMES                  | MASHI L.G.A. |          | ZANGO L.G.A. |          | MAI'ADUA L.G.A. |            |
|--------------------------------|--------------|----------|--------------|----------|-----------------|------------|
|                                | B/Kuka       | Majigiri | Yakubawa     | Yaardaje | Bumbum          | Kwangwalan |
| <i>Acacia Seyal</i>            | ↓            | ↓        | ↓            | ↑        | ↓               | ↑          |
| <i>Bauchinia thonningii</i>    | ↓            | ↓        | ↓            | ↓        | ↑               | ↓          |
| <i>Cucumis prophetarum</i>     | ↑            | ↓        | ↑            | ↓        | ↓               | ↑          |
| <i>Leptadenia hestata</i>      | ↑            | ↑        | ↓            | ↑        | ↑               |            |
| <i>Mitracarpus villosus</i>    | ↑            |          | ↑            | ↑        |                 | ↓          |
| <i>Ceratotheca Sesamoides</i>  | ↑            | ↑        | ↑            | ↓        | ↓               |            |
| <i>Corchorus Olitorius</i>     | ↓            |          | ↑            | ↑        |                 | ↓          |
| <i>Cucumis melon</i>           | ↑            | ↓        |              | ↑        |                 | ↓          |
| <i>Fimbristylis miliacea</i>   |              | ↑        | ↑            | ↑        |                 | ↓          |
| <i>Senna Occidentalis</i>      | ↓            | ↑        | ↓            | ↑        |                 |            |
| <i>Annona Senegalensis</i>     | ↑            |          | ↓            | ↓        | ↓               |            |
| <i>Cammiphora Africana</i>     |              | ↑        | ↓            | ↑        |                 | ↑          |
| <i>Ficus phoningll</i>         | ↓            | ↑        |              | ↑        |                 | ↑          |
| <i>Ficus polita</i>            | ↑            | ↑        | ↓            | ↑        | ↑               | ↑          |
| <i>Hibiscus sabdariffa</i>     | ↓            | ↓        | ↓            |          |                 | ↑          |
| <i>Kyllinfga Erecta</i>        | ↑            | ↓        | ↓            | ↑        | ↓               |            |
| <i>Parkia biglobosa</i>        | ↓            | ↓        |              | ↓        |                 | ↑          |
| <i>Sesamum indicum</i>         | ↓            | ↑        | ↓            | ↑        | ↓               |            |
| <i>Boscia Senegalensis</i>     | ↓            |          | ↓            |          | ↓               | ↓          |
| <i>Leptadenia Pyrotechnica</i> | ↓            |          | ↓            |          | ↓               | ↓          |
| <i>Adansonia digitata</i>      |              | ↓        |              | ↓        | ↓               |            |
| <i>Cenchrus biflorus</i>       | ↓            |          | ↑            | ↑        |                 | ↑          |
| <i>Ziziphus Mountania</i>      | ↑            |          | ↑            |          | ↓               | ↑          |
| <i>Acacia sieberiana</i>       | ↓            |          | ↑            |          | ↑               | ↑          |
| <i>Zizipus Spina Christi</i>   | ↑            | ↑        | ↓            | ↓        |                 |            |
| <i>Hyphaene Thebaica</i>       | ↓            | ↓        | ↓            |          | ↑               |            |
| <i>Tamarindus indica</i>       | ↑            |          | ↓            |          | ↓               | ↑          |
| <i>Guiera Senegalensis</i>     | ↓            | ↑        | ↑            | ↑        |                 | ↓          |
| <i>Spondias Mombin</i>         | ↓            | ↑        |              | ↓        |                 | ↑          |

|                               |   |   |   |   |   |   |
|-------------------------------|---|---|---|---|---|---|
| <i>Dioscorea bulbifera</i>    | ↓ | ↓ | ↓ |   | ↓ | ↓ |
| <i>Lannea microcarpa</i>      | ↓ | ↑ |   | ↑ |   | ↑ |
| <i>Ficus religiosa</i>        |   | ↑ | ↑ | ↑ |   | ↑ |
| <i>Tribulus teriestus</i>     | ↑ | ↓ |   | ↓ |   | ↑ |
| <i>Pennisetum gbucaru</i>     | ↓ | ↓ |   | ↓ | ↓ | ↑ |
| <i>Sorghum bicolor</i>        | ↓ |   | ↓ |   | ↓ | ↓ |
| <i>Sclerocarya birrea</i>     | ↓ | ↑ | ↓ |   | ↓ | ↓ |
| <i>Stylchiton lancirilius</i> | ↓ | ↓ | ↓ | ↑ |   | ↑ |
| <i>Ximerica amaneana</i>      | ↓ | ↓ |   | ↓ | ↓ | ↓ |
| <i>Citrullus lonatus</i>      | ↓ | ↓ |   | ↓ | ↓ | ↓ |
| <i>Sterculia Setigera</i>     | ↓ | ↑ | ↓ | ↑ | ↓ |   |
| <i>Bauhinia rufescens</i>     | ↓ | ↑ |   | ↓ |   | ↑ |
| <i>Dereiniun nucricaroum</i>  | ↓ | ↓ | ↓ | ↑ |   | ↑ |
| <i>Grewia bicolor</i>         | ↓ |   | ↑ |   | ↑ | ↑ |
| <i>Eragrostis tremula</i>     | ↓ | ↑ | ↑ | ↑ |   | ↓ |
| <i>Acacia nilotica</i>        | ↑ | ↓ |   | ↑ |   | ↓ |

Source: Fieldwork (2026)

In addition to climate change, respondents suggested that population growth has significantly increased the demand for WFP vegetation to meet rising needs for fuel wood and the expansion of new farming areas. Because alternative energy sources, such as kerosene and cooking gas, are not readily available or affordable, the destruction of vegetation resources may be necessary (Mukhtar et al., 2022). The lack of job opportunities and reliable income sources outside of farming has also forced many farmers to clear shrubs and trees from their farms and forest reserves.

### Uses of Wild Food Plants

Rural communities in Northern Katsina State use a diverse array of WFP to supplement their diets. The importance of and reliance on WFP increases during times of drought or famine. Households experiencing food deficits, even in periods of normal rainfall, tend to utilize more WFP to compensate for their needs. All respondents reported using WFP and identified nearly 50 plant species. However, villagers acknowledged that certain WFP that were once available have disappeared due to over-exploitation, drought, or desertification. Most respondents (93%) reported increasing their use of WFP during drought periods to augment their diets. Gathering WFP is not limited by gender or age; men, women, children, and the elderly all partake in this activity. This pattern of gender-neutral WFP gathering has been documented in other Sahelian communities and is recognized as a key indicator of household food stress (Oluoch et al., 2023; Dossou et al., 2021).

Some WFPs yield more than one edible product. For example, *Adansonia digitata*, *Ficus polita*, *Momordica balsamina*, and *Ziziphus spina-christi* all have edible leaves and fruits. *Tamarindus indica* produces edible flowers, seeds, and fruits, while *Hibiscus sabdariffa* offers various edible products (see table 8). The leaves of the baobab tree (*Adansonia digitata*) are prepared as a powder used to thicken and flavor sauces. The seeds of *Parkia biglobosa* (dorawa), known as Kalwa, are

ground into a spice for flavoring. The leaves of *Hibiscus sabdariffa* (Yakuwa) are also added to sauces. The multifunctional nature of these species makes their conservation particularly urgent; their disappearance would eliminate multiple food-use pathways simultaneously (Chinomona et al., 2024; Chisengo et al., 2023).

Table 8: Wild Food Plants Uses by Some Communities of Northern Katsina State

| Scientific/Botanical Names        | Hausa Names            | Edible Components     | Preparation and Uses                                          |
|-----------------------------------|------------------------|-----------------------|---------------------------------------------------------------|
| <i>Acacia Seyal</i>               | <i>Dakwara</i>         | Leaves                | Pounded; flour used to prepare soup                           |
| <i>Bauchinia thonningii</i>       | <i>Kalgo</i>           | Leaves                | Leaves cooked                                                 |
| <i>Cucumis prophetarum</i>        | <i>Cicidu</i>          | Leaves/seed           | Leaves cooked and eaten or pounded flour used in soup         |
| <i>Leptadenia hestata</i>         | <i>Yadiya</i>          | Leaves and flower     | Leaves cooked                                                 |
| <i>Mitracarpum verticillation</i> | <i>Gogamasu</i>        | Leaves/root           | Leaves cooked                                                 |
| <i>Ceratotheca Sesamoides</i>     | <i>Yalo</i>            | Leaves                | Pounded; flower used in soup preparation                      |
| <i>Corchorus Olitorius</i>        | <i>Lalo</i>            | Leaves                | Used in soup preparation                                      |
| <i>Cucumis melo</i>               | <i>Gurji</i>           | Fruits, seed          | Fruit eaten                                                   |
| <i>Fimbristyllis hupidula</i>     | <i>Gude gude</i>       | Leaves                | Leaves cooked or pounded and used in soup preparation         |
| <i>Senna Occidentalis</i>         | <i>Rai dore</i>        | Leaves                | Leaves cooked or pounded and used in soup preparation         |
| <i>Annona Senegalensis</i>        | <i>Gwandar daji</i>    | Fruit, leaves, flower | Fruit eaten; leaves used in soup; flower used to flavour food |
| <i>Cammiphora Africana</i>        | <i>Dashi</i>           | Leaves                | Leaves cooked or pounded and used in soup preparation         |
| <i>Ficus Ingens</i> (Mig)         | <i>Shirinya</i>        | Leaves                | Leaves cooked or pounded; used in soup preparation            |
| <i>Ficus Platyphylla</i>          | <i>Gamji</i>           | Leaves, fruit         | Leaves cooked or pounded and used in soup preparation         |
| <i>Hibiscus sabdariffa</i> var    | <i>Yakuwa</i>          | Leaves, fruit, seed   | Leaves, seed and fruits used in soup preparation              |
| <i>Kyllinfga erecta</i>           | <i>Gemun Kwado</i>     | Leaves                | Leaves cooked or pounded and used in soup preparation         |
| <i>Parkia biglobosa</i>           | <i>Dorawa</i>          | Fruit, seed           | Fruit eaten; seed used in condiment preparation               |
| <i>Sesamum Spp</i>                | <i>Ridin Kadangare</i> | Leaves                | Leaves cooked or pounded and used in soup preparation         |
| <i>Boscia Senegalensis</i>        | <i>Tabila</i>          | Fruits, leaves        | Fruits eaten and leaves cooked                                |
| <i>Leptadenia Pyrotechnica</i>    | <i>Kalimbo</i>         | Leaves, flower        | Leaves and flowers used in soup preparation                   |
| <i>Adansonia digitata</i>         | <i>Kuka</i>            | Fruit, leaves, seeds  | Fruit added to milk; seed and leaves used in soup preparation |

|                               |                       |                        |                                                           |
|-------------------------------|-----------------------|------------------------|-----------------------------------------------------------|
| <i>Cenchrus biflorus</i>      | <i>Kwringiya</i>      | Seeds                  | Seed threshed, cooked and eaten                           |
| <i>Ziziphus Mountania</i>     | <i>Magarya</i>        | Fruit, leaves          | Fruit dried and eaten; leaves pounded in soup preparation |
| <i>Acacia sieberiana</i>      | <i>Farar Kaya</i>     | Leaves, Gum            | Leaves pounded and used in soup preparation; gum eaten    |
| <i>Zizipus Spina christi</i>  | <i>Karna</i>          | Fruits                 | Fruit dried and eaten                                     |
| <i>Azadirachta indica</i>     | <i>Bedi</i>           | Seed                   | Oil extracted from the seeds                              |
| <i>Hyphaene Thebaica</i>      | <i>Guruba</i>         | Fruit                  | Fruit dried and eaten                                     |
| <i>Tamarindus indica</i>      | <i>Tsamiya</i>        | Flower, Fruit and seed | Fruit prepared as porridge                                |
| <i>Guiera Senegalensis</i>    | <i>Sabara</i>         | Leaves                 | Leaves pounded and used in soup preparation               |
| <i>Senna Occidentalis</i>     | <i>Tafasa</i>         | Leaves, seeds          | Leaves cooked and pounded in soup; seed: oil extraction   |
| <i>Spondias Mombin</i>        | <i>Tsadar lamnudi</i> | Fruits                 | Fruits eaten                                              |
| <i>Dioscorea bulbifera</i>    | <i>Tuwon biri</i>     | Fruits                 | Fruits eaten                                              |
| <i>Lannea microcarpa</i>      | <i>Faru</i>           | Fruits                 | Fruits eaten                                              |
| <i>Ficus religiosa</i>        | <i>Gudai</i>          | Leaves                 | Leaves cooked                                             |
| <i>Tribulus teriestus</i>     | <i>Hana takama</i>    | Fruits                 | Fruits eaten                                              |
| <i>Pennisetum gbucaru</i>     | <i>Lawur</i>          | Fruits                 | Fruit eaten                                               |
| <i>Sorghum bicolor</i>        | <i>Janjare</i>        | Seed                   | Seed threshed and eaten                                   |
| <i>Sclerocarya birrea</i>     | <i>Daniya</i>         | Fruit                  | Fruits eaten                                              |
| <i>Stylchiton lancirolius</i> | <i>Akwari</i>         | Leaves, fruits         | Leaves and fruit used in soup preparation                 |
| <i>Ximerica amaneana</i>      | <i>Tsada</i>          | Fruits                 | Fruits eaten                                              |
| <i>Citrullus lonatus</i>      | <i>Gunna</i>          | Fruits                 | Fruits used in soup preparation                           |
| <i>Sterculia Setigera</i>     | <i>Shasfa</i>         | Leaves                 | Leaves pounded and used in soup preparation               |
| <i>Bauhinia rufescens</i>     | <i>Sisis</i>          | Leaves                 | Leaves pounded and used in soup preparation               |
| <i>Perosopos Africana</i>     | <i>Kirya</i>          | Fruits                 | Fruits pounded and used in soup                           |
| <i>Dereiniun nucricaroum</i>  | <i>Taura</i>          | Fruits                 | Fruits eaten                                              |
| <i>Grewia bicolor</i>         | <i>Dargaza</i>        | Fruits, leaves         | Leaves cooked and fruits eaten                            |
| <i>Eragrostis tremula</i>     | <i>Komaiyya</i>       | Seed                   | Seed threshed, cooked and eaten                           |
| <i>Acacia nilotica</i>        | <i>Bagaruwa</i>       | Leaves                 | Seed used in various preparations                         |

Source: Fieldwork (2026)



### Seasonal Availability and Locations of Wild Food Plant

Wild food plants (WFP) are available during different periods throughout the year. Four distinct periods have been identified based on informant accounts and studies by Frances and Mohammed (2003):

1. Pre-Raining Season This period is characterized by increasing humidity, during which many trees begin to flower.
2. Rainy Season Spanning from the start of planting with the first rain to the end of the rain (from June or July to September).
3. Harvest Season: This occurs when many plants mature and begin to produce grains and fruits, generally from late August to November.
4. Dry Season (Harmattan Period): This period runs from November to February.

Most wild food plants are found on individual farmlands, while others grow on fallow lands, grazing areas, cattle tracks, and forest reserves (Humphrey et al., 1993). The availability of these plants is increasingly affected by climate variability, with several informants noting that certain species now flower irregularly or do not fruit in years of poor rainfall. These observations align with findings from other communities in the Sahel region (Oluoch et al., 2024; Tapily et al., 2023).

### Implications for Local Resource Management

Many species of wild food plants have been reported to have decreased in number or even disappeared in various parts of the study area. It is important to prioritize the management of these vanished species. A significant portion of these plants has not yet been domesticated, and many are slow to regenerate because their young seedlings are often consumed by livestock or destroyed during annual field clearing. To enhance regeneration, it is essential to identify and protect endangered species from livestock and field clearance. This approach has proven to be the simplest and most cost-effective, as demonstrated by successful projects in the Niger Republic (Wezel, 2006; Brandt et al., 2021).

Community-based conservation models have shown great promise in the West African Sahel, and local and international development agencies should consider the preferences and conservation priorities of local people when designing poverty eradication projects (Norris et al., 2022; Dossou et al., 2021).

Integrating Indigenous and Local Knowledge (ILK) into formal environmental management frameworks is increasingly recognized as a vital strategy for addressing the decline of wild food plants in dryland Africa (Olaniyan, 2022; IPBES, 2022). Policy frameworks, such as Nigeria's National Adaptation Plan (2021), have begun to officially acknowledge the role of traditional knowledge in biodiversity conservation and food system resilience; however, implementation at the community level remains inconsistent (Ogunbode et al., 2022).

### Conclusion and Recommendation

Wild Food Plants (WFP) are widely utilized by rural communities and serve as valuable resources for enhancing food and nutritional security in households living in semi-arid areas. However, climate change and desertification, along with human activities, are increasingly leading to the decline and



extinction of certain WFP species. While some WFP are consumed daily, others are used less frequently; their usage tends to increase significantly during critical periods of drought or famine. Households experiencing poor harvests or food shortages often rely more heavily on WFP to supplement their food supply.

The alarming rate of WFP loss documented in this study highlights the urgent need for community-centered conservation strategies, climate-smart land management practices, and the incorporation of indigenous knowledge systems into national biodiversity and food security frameworks. Future research should focus on mapping WFP hotspots using Participatory Geographic Information Systems (PGIS) and exploring the feasibility of WFP domestication as an adaptation strategy for food systems in semi-arid regions.

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