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## CLIMATE CHANGE-RELATED DISASTERS AND RISK REDUCTION THROUGH INDIGENOUS KNOWLEDGE APPROACHES IN OSUN STATE, NIGERIA

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**Abstract.** This study focuses on people's risk reduction techniques in response to emerging disasters due to the constantly changing climatic conditions. Library and Archival data on disaster episodes in Osun State were sourced from selected libraries in Tertiary Institutions in the State. The study focused on communities with unique indigenous techniques and a history of consistent use for disaster management and risk reduction within the State. The study utilized an interviewing technique to gather and record participants' past experiences, followed by content analysis and an ethnographic summary of the gathered data. The study identified the type of disasters experienced in the study settings within the state. This included those originating from solid earth (geophysical), those caused by the occurrence, movement, and distribution of water on earth (hydrological), climate inclined like droughts and wildfires, weather conditions such as storms (meteorological) as well as those caused by exposure to living organisms and their toxic substances or diseases such as disease epidemics (biological). The study proved that indigenous knowledge systems are effective in helping communities manage and reduce the risk of disasters. This, in turn, explained why it was consistently used to avert calamities and alleviate their effects whenever they did occur.

**Keywords:** *climate change, disaster, risk reduction, indigenous knowledge techniques.*

**Rezumat.** Articolul se concentrează pe tehnicile de reducere a riscurilor pentru oameni ca răspuns la dezastrele emergente din cauza condițiilor climatice în continuă schimbare. Datele de arhivă privind episoadele de dezastre din statul Osun au fost obținute din biblioteci selectate din instituțiile terțiare din stat. Studiul s-a concentrat pe comunitățile cu tehnici indigene unice și cu o istorie de utilizare consecventă pentru managementul dezastrelor și reducerea riscurilor în cadrul statului. Studiul a folosit o tehnică de interviu pentru a aduna și a înregistra experiențele anterioare ale participanților, urmată de o analiză de conținut și un rezumat etnografic al datelor colectate. Studiul a identificat tipul de dezastre

experimentate în mediile luate în studiu. Acestea au inclus cele provenite din pământ solid (geofizice), cele cauzate de apariția, mișcarea și distribuția apei pe pământ (hidrologice), seceta și incendiile de vegetație, condițiile meteorologice (furtunile), precum și dezastrele cauzate de expunerea la organisme vii și la substanțele toxice ale acestora, sau boli precum epidemiile (riscuri biologice). Studiul a demonstrat că sistemele de cunoștințe indigene sunt eficiente în a ajuta comunitățile să gestioneze și să reducă riscul de dezastre. Acest lucru a explicat motivul folosirii în mod constant a acestor tehnici indigene pentru a preveni calamitățile și a atenua efectele lor ori de câte ori au apărut.

**Cuvinte cheie:** *schimbări climatice, dezastre, reducerea riscurilor, tehnici de cunoaștere indigenă.*

## 1. Introduction

Disasters are frequently featured in the news due to an increasing number of individuals falling prey to various types of disasters. Catastrophic events, such as disasters, have led to severe losses in human, animal, and plant life, as well as injuries, disabilities, and property damage, with a negative impact on the environment. The concept of a disaster has undergone a significant shift in interpretation over time [1]. During the early stages of human and societal growth, numerous cultures worldwide tended to perceive disasters as manifestations of divine intervention [2], or mistakenly associated them with supernatural forces such as celestial bodies, bad fortune, and blind faith [3,4]. As scientific progress continued, these long-held disaster perceptions and realities began to be questioned. Consequently, the shift in knowledge led to a change in the thematic focus and the method of identifying disaster locations. The disaster's physical effects and severity assessment, previously measured by magnitude, have undergone a shift in perspective.

In contemporary academic environments, disasters are regarded as consequences of inadequately managed risk. The identified risks stem from a combination of existing hazards and vulnerabilities [5]. Areas that are prone to low vulnerability but are affected by hazards are generally not considered disaster zones, similar to uninhabited regions. Severe impacts are felt by a community when a hazard strikes an area with restricted resources, resulting in considerable damage, financial losses, and considerable disruption to its routine activities. The financial, physical, and ecological expenses are greatly exceeding the community's budgetary capacity.

Over the past few decades, the number of reported disasters has risen significantly worldwide. For instance, from 1975 to 1999, fewer than 300 disasters occurred annually. However, between 2000 and 2010, the average annual disaster count rose to around 400. As populations expand and societies become more interconnected and complex, the severity of both natural and human-caused disasters has increased substantially [6-8]. Numerous disasters strike with little prior notice, such as tornadoes and landslides, while others develop over a period of time, often preceded by warning signs, as seen with tropical cyclones. Natural disasters can stem from severe weather events and human actions such as bombings. Disasters are generally categorised based on their underlying cause, which can be either naturally occurring or caused by human activities [1]. Natural hazards such as droughts, earthquakes, epidemics, floods, and windstorms are distinct from disasters. Two distinct communities can face the same hazard threat yet vary in their ability to adapt [9-11].

Most natural and human-caused disasters share common outcomes, including extensive physical destruction, loss of life, physical impairment, and population displacement, coupled with interruptions to economic and social functions [12, 13]. Disaster specialists concentrate primarily on two types of susceptibility. The initial point of concern is

people's susceptibility to disasters. This is the level of risk to which people are exposed. Residing on a floodplain may involve issues such as a home being incapable of withstanding flooding, and the degree to which individuals can adapt to its effects through measures like healthcare services and property insurance coverage. Vulnerability to disasters also exists in key institutions or systems such as power supplies, water supplies, hospitals, and emergency response networks.

Over the last forty years, catastrophic occurrences including earthquakes, droughts, floods, storms, fires, and volcanic eruptions have resulted in substantial loss of human life and income; devastation of economic and social infrastructure, and considerable environmental harm. Initiatives aimed at sustainable development and poverty alleviation are vulnerable to disasters caused by hydro-meteorological, geological, and environmental hazards that can be exacerbated by human actions or technological advancements [14]. Gu's study [9] found that natural disasters like earthquakes, floods, and hurricanes can cause significant devastation to urban areas, resulting in the destruction of infrastructure and housing, and resulting in thousands of injuries and fatalities. Disasters have a more significant impact on developing countries, with over 95 percent of fatalities resulting from hazards occurring there, while economic losses from natural hazards represent 20 times a larger percentage of Gross Domestic Product in developing countries than in industrialised nations [1,9,15].

Global disaster and risk awareness have been escalating, yet the formulation of well-coordinated plans for disaster risk reduction initiatives frequently encounters undue postponement. A major destructive event is typically the catalyst for an official strategy to be developed to mitigate its impacts. Studies have demonstrated that local initiatives provide a crucial lifeline, typically acting as the main factor in regulating the frequency of disaster occurrences and reducing associated risks until the delay is resolved [16,17]. Despite the appeal of this information, there remains a need to reveal more about the character and functioning of these initiatives. Comprehending the procedures for identifying vulnerabilities to disasters and evaluating the suitability of measures to mitigate associated risks will be equally beneficial to this study. This research aims to gain insight into the community's awareness and susceptibility to disasters and strategies for mitigating risk in Osun State, Nigeria. The initiative also aims to acknowledge and appreciate existing non-traditional methods being utilised to address the situation.

### **1.1 Environmental Disasters and Management Approaches**

The fragility of humans, which is worsened by inadequate planning or ineffective emergency management, results in financial, environmental, or human losses [18, 19]. In the view of Uddin et al. [20], the resulting loss depends on the capacity of the population to support or resist the disaster and its resilience. The implication is that disasters occur when hazards meet vulnerability [21]. Therefore, a natural hazard will hence never result in a natural disaster in areas without vulnerability, e.g., strong earthquakes in uninhabited areas. Many natural hazards are related, for instance, earthquakes can result in tsunamis, and drought can lead directly to famine and diseases. A concrete example of the division between hazard and disaster is the 1906 San Francisco earthquake, which was a disaster [22,23]. Hazards are associated with potential future events, whereas disasters are connected to past or ongoing events. Technological innovations such as aircraft, automobiles, and industrial advancements lead to man-made disasters. Human-made catastrophes often arise from civil unrest such as riots, as well as from unprofessional and reckless actions like fires, burst

pipelines, collapsed buildings, chemical leaks, car accidents, food contamination, industrial epidemics, deforestation, war, pollution, and plane crashes, among other incidents.

Susceptibility to natural disasters is a multifaceted concern influenced by economic infrastructure, the nation's level of development, prevailing social and economic circumstances, existing coping strategies, risk evaluation, disaster recurrence and severity, and other factors. The potential consequences for low-income individuals may include being denied access to essential services, a reversal of gains in physical and human assets, and a rise in child labor and criminal behavior. Research has revealed the importance of identifying the influence and impact factors of natural disasters. [13, 24]. This information is valuable for policymakers as it allows them to understand the necessity for external aid and determine which solutions are most effective; it also enables the identification of specific groups impacted, such as low-income households (etc.), and can be useful for planning disaster relief and anticipating potential outcomes.

One of the key concerns regarding natural disaster effects on communities and residential areas is their potential unpredictability. Yu et al. [25] also explained that when assessing the effects of natural disasters, it is essential to consider other factors, including mitigation strategies, emergency preparedness, and relief efforts. Dutta's [26] study also considered the aftermath of tornadoes in the United States, revealing that the consequences were not entirely unpredictable. This is because various factors, including environmental, organizational, demographic, and technological factors, play a role in determining the impact of such disasters.

## **1.2 Historical Exploration of Disaster Management in Nigeria**

The primary objective of disaster management is to mitigate threats from both existing and impending hazards [24]. These hazards can be categorized into three distinct categories: natural, technological, and complex emergencies. The primary objective of natural and technological hazards planning is risk assessment and mitigation. Initiatives to mitigate and prepare for natural and technological disasters have stemmed from the necessity to safeguard communities from widespread threats that are endemic within a given region of governmental authority [24, 27]. This approach to risk reduction and civil protection was established through legislation, clear definitions of institutional roles and distribution of financial resources from the top down, in conjunction with local responses and community participation.

Establishment of disaster management in Nigeria can be traced back to 1906, when the Police Fire Brigade, now known as the Federal Fire Services, was initially set up to undertake tasks beyond firefighting, including the provision of humanitarian aid and emergency assistance to protect lives and property. The National Emergency Management Agency (NEMA) is a government agency responsible for managing disasters, as well as educating the public to increase their awareness and mitigate the impacts of disasters within the country [28]. The organization is a non-partisan, non-profit organization striving to boost public safety by strengthening the country's capacity to prepare for, respond to and recover from emergencies, disasters and national security risks [29].

In 1990, the United Nations member countries, including Nigeria, established the National Committee for the International Decade for Natural Disaster Reduction (IDNDR). In line with the objectives and goals of the IDNDR, Nigeria's government in 1993 chose to widen the scope of disaster management to encompass all aspects of this field. This includes prevention, mitigation, response, and recovery measures. As a result, Decree 119 of 1993

elevated the agency's status to an independent entity, reporting directly to the Presidency, to develop overarching policies and directives for disaster management in Nigeria and its allied nations. The new agency should encompass various departments, including Search and Rescue, Policy and Strategy, Information, Education and Prevention, Administration, Finance and Logistics, Relief and Rehabilitation and Research and Planning [28,29].

## **2. Materials and Methods**

Files from the National Emergency Management Agency (NEMA) and the Nigeria Security and Civil Defense Corps (NSCDC) were used to identify communities that are at risk of disasters or have a high incidence of disaster. Communities with a history of disaster occurrence were specifically identified. The data show that the disaster nearly affected every Local Government Area in Osun State. This study focused on rural areas within the state that have a history of experiencing disasters.

The recognition of indigenous practices' value for disaster risk assessment and mitigation led to limiting the scope of this study to rural areas. Community Development Association residents and officials within the areas were also used as participants in the study. They were involved in exploring the stories behind disasters, their frequency, and commonly recognized hazards, as well as risk vulnerability and methods used to mitigate such risks. The chosen communities represented four distinct sub-ethnic groups within Osun State: Ife, Ijesha, Oyo, and Igbo. The communities chosen from each of these groups included Gbengbeleku, Orafidiya (Ife), Dagbaja, Fadahunsi-Ogundele (Ijesha), Odeyinka, Omosan-Igbo (Oyo), Abalagemo, and Aworo Ayedaade (Igbomina). Five residents from each selected community participated in in-depth interviews. One participant from each of the selected communities was chosen to participate in the interview sessions of the key informants. Academics from the University of Ibadan, Obafemi Awolowo University in Ile-Ife, and the Federal University of Technology in Akure were chosen based on their expertise in disaster management and indigenous knowledge systems, along with their research experience in Climatology. In this study, the group of participants was categorized as key informants. The study population comprised 53 participants. Data obtained from the participants were documented in accordance with the methods chosen by the participants, reflecting a commitment to ethical principles. The collected data was subjected to content and ethnographic analyses. Some important quotations from participants during IDI and KII sessions were reported verbatim to further illustrate the issues under focus.

## **3. Results and Discussion**

The occupations of the participants comprised trading, civil service, farming, and artisanal work. Among the respondents, the distribution by gender comprised 28 males and 25 females. No participant is younger than 45 years. Almost all participants referred to towns or communities that have faced natural disasters in the past. From the viewpoints of the individuals involved, a disaster is perceived as an unexpected, all-encompassing event, encompassing major health issues, fatalities, significant financial or social setbacks within the household, floods, fires, building collapses, loss of livelihoods, outbreaks, or community displacement resulting from conflict, and any other adverse occurrences that individuals affected are unable to manage without external support.

The forms of disaster ever experienced in their lifetime included epidemics like cholera, road accidents, domestic fire outbreaks, forest fires, floods, explosions, and environmental pollution. Some of the participants in the interview sessions classified disaster

into two categories. In the words of one of them, disaster could be natural and manmade and the relationship between the two is that one is caused due to human error, and the other is caused by God (Female IDI/Farmer/Abalagemo community/72 years old). Another submission classified disaster into unfavourable social situations that manifested in terms of water, land, or epidemic diseases (Male IDI/Farmer/Aworo Ayedaade community/66 years old).

### **3.1 Factors influencing Occurrence of Disasters and their Impacts**

At the time when the disasters occurred last, only a handful of the participants could give first-hand accounts of the latest disasters mentioned. The majority relied on subsequent narrations from their parents and their elderly within the communities. The factors causing disaster according to the participants included mismanagement of environmental resources, poor or absence of coping capacity by those affected, poor or absence of resilience when responding to disasters, poor or absence of knowledge of proper environmental management, absence of political will towards prevention of activities that are inimical to positive environmental outcome (Male IDI/Farmer/Gbengbeleku community/56 years old). Other factors mentioned by the participants included failure to adapt and adopt the home-grown mechanisms used by the forbearers in the past to prevent or checkmate the occurrence of disasters (Female IDI/Farmer/Orafidiya community/61 years old).

The impacts of disaster according to the information collected included displacement of the people from their places of primary residence, dislocation of communities' economic activities, psychological trauma which often leads to health challenges, loss of jobs and forced migration, and loss of human and natural resources. The entire study population affirmed their knowledge of authority that could be contacted in the event of disasters. Those to be contacted in this situation included the (a) head of the community, (b) leaders in the community, (c) Security and Civil Defence Corps, (d) National Emergency Management Agencies through State Emergency Management Agency, (e) Federal Road Safety Commission.

### **3.2 Nature of Disasters Ever Witnessed in the Study Settings**

The nature of disasters that have occurred in the communities according to the participants in this study include epidemics, road accidents, domestic fire outbreaks, forest fires, floods, drought, famine, explosions, environmental pollution, landslides, and infestation. Among these, the participants classified road accidents, domestic fire outbreaks, and environmental pollution as man-made while the remaining ones mentioned above were classified as natural. Out of those classified as natural disasters, epidemics, floods, droughts, famine, and landslides were noted to have been in high occurrence in the past. In the history of each of the communities selected as the study settings, epidemics, drought, and famine were noted to have occurred severally. It was however noted by a participant that epidemics like cholera, dysentery, typhoid, and typical ailments are common during natural disasters such as floods.

Meanwhile, an octogenarian who participated in this study revealed an uncommon scenario referred to as 'earth tremor' as having occurred in the mid-1980s with attendant disaster. According to him, the event happened across southwestern Nigeria and his community experienced it as well. The event was sudden and never reoccurred since then. In another submission, another participant noted extreme heat as one of the disasters she had experienced in her lifetime. In her words, at the time when it happened, extreme heat brought with it a situation where one's body could not maintain a normal temperature (Male

IDI/Farmer/Dagbaja community/74 years old). Another submission that corroborated this equally submitted that extreme heat resulted in a monumental number of deaths. In this situation, both the old and the young became sick while the individuals who were overweight easily became vulnerable to the challenges occasioned by the extreme heat (Female IDI/Farmer/Fadahunsi-Ogundele community/77 years old).

In the case of drought and famine, a female participant noted that virtually everyone in her community was traumatized. Everywhere became dried. Survival became difficult for the human populace as well as the animals and the plants. In her words, when I experienced drought, the usual precipitation was fading away gradually, resulting in a water shortage. Everybody became sick, agricultural produce became scanty so also was the harsh nature of the physical environment. The effects of an absence of adequate water further led to improvising to get potable water. It equally led to sourcing for water that is of questionable quality. In the process, all sorts of health challenges emerged leading to pandemonium (Female IDI/Farmer/Gbengbeleku community/77 years old).

Recounting their experience of drought further, the participants traced the aftermath to the emergence of famine. According to one of them, the absence or shortage of water made the survival of plants and crops impossible. The implication of this was inadequate or absence of harvest for human survival. This subsequently led to an extreme lack of food and other basic needs hence starvation, death, and destitution. As people were losing their loved ones, quiet migration was witnessed. Many did not wait for succor from the government before they moved out of the community to distant settlements where life was more bearable (Male IDI/Farmer/Orafidiya community/68 years old).

### **3.3 Indigenous Approach to Disaster Vulnerability Prediction**

Most of the participants averted that constant deliberation among the elders and other stakeholders within the communities were common steps first taken to find lasting solutions to the problem. In the words of one of them, the palace of the traditional rulers became the melting pot where the solutions were perfected (Male IDI/Farmer/Omosan-Igbo community/70 years old). According to another participant, consultations with an oracle for divine guidance were further affirmed as part of the steps (Female IDI/Farmer/Abalagemo community/72 years old). Further phase according to another participant included the monitoring of the progression of hazards with possible advice to govern the behavior of the communities (Male IDI/Farmer/Odeyinka community/72 years old). Manifestation of positive results from the homegrown ideas on the way forward has assisted in assuaging the suffering passed through by the people (Female IDI/Farmer/Abalagemo Community/72 years old). This in the words of another participant has placed the indigenous practices as indispensable assets in the minds of the people. The practices equally allowed many communities to live with the disaster through the ability to identify and prepare for its occurrence (Male IDI/Farmer/Abalagemo Community/55 years old). Recalling what her grandfather told her about the past events of disaster, a participant revealed that the oracle consulted in their community mandated the elders and the King to go back to traditional ways of managing the situation. This included cross-fertilization of indigenous ideas that are cost-effective. Along with this, such deliberations have enabled our people to appreciate that everybody is susceptible to disasters hence the need for protection and safety of the people living in the community (Female IDI/Farmer/Omosan-Igbo Community/57 years old).

Experiences about the devastating effects of disasters have taught people about the reality of individuals being vulnerable to disasters. This equally motivated the people to fully

embrace prevention and mitigation approaches (Male IDI/Farmer/Orafidiya Community/68 years old). From experience, people in vulnerable circumstances were found to be significantly less able to represent their interests, and more likely to suffer harm than the average others (Female IDI/Farmer/Abalagemo Community/72 years old). Given this, virtually everyone in the communities is knowledgeable about what breeds poor resistance or response when a disaster occurs. In the words of an opinion leader in one of the communities, it was established that people who live on plains are more vulnerable to floods than people who do not. Preventive measures against disasters thus assumed high priority due to the establishment that people who are aged, the young, individuals with poor health, the nature of the physical environment and sanitary conditions, as well as the quality and state of local buildings and their location concerning any hazards (Female IDI/Farmer/Omosan-Igbo Community/57 years old). A clear case presented by the participants was that of deforestation. People were noted as engaging in unsustainable usage of forest resources without minding the likely implications. In the words of one of the participants, a high level of poverty, which brought about the inability to make ends meet and the idea that forest resources are gifts of nature informed ravenous exploitation of the resources (Female IDI/Farmer/Fadahunsi-Ogunde Community/71 years old). Further comments pointed out that, as people cut down too many trees at a faster pace than nature can replace them, the situation led to an increase in the vulnerability of many communities to rain. The rain falls on unprotected soil, causing mudslides, landslides, floods, and the like. Thus, the reality of obvious vulnerability in the population helps to build community members' bravery and resilience while also promoting stronger bonds and interactions with others (Female IDI/Farmer/Aworo Ayedaade Community/78 years old).

### **3.4 Disaster Risk Reduction Processes in Communities**

The growing prevalence of disaster risk is a result of people's carefree attitude towards environmental management, according to interactions with study participants. According to one participant, after acknowledging that human factors make disasters inevitable, communities employ prediction and/or potential early warning indicators as a means of improving disaster risk reduction (Female IDI/Farmer/Aworo Ayedaade Community/78 years old). For example, every community that has gone through a crisis has become more knowledgeable and well-organized. Similar to what is happening in our community, we get together to discuss what to do in the event of an emergency and to gauge our degree of readiness. The community is now less susceptible to calamities as a result (Male IDI/Farmer/Dagbaja Community/74 years old). Further disclosure came from another submission, which demonstrated that constructing homes in high-risk areas increases people's vulnerability. This is why it's generally agreed that people shouldn't live too close to a river. Human settlements become more susceptible to flooding when trash is dumped into waterways. Therefore, this technique was completely disapproved of for disaster-free, sustainable living (Female IDI/Farmer/Odeyinka Community/65 years old). According to the participants, the communities often use traditional songs and legends to influence how people respond to the looming tragedies. People's behavior has improved as a result of learning from these legends and songs. Disasters rarely happen when people have this knowledge, confirming the role that traditional belief systems and associated tales play in lowering the likelihood of disasters (Male IDI/Farmer/Orafidiya Community/68 years old).

The way a community responds to a calamity is impacted by its culture and beliefs. Disasters only occurred when people were not at peace with God and the spirits, according



to the traditional religious beliefs of the majority of the sampled research locations' residents. Our stance, according to one of the participants in this study, is that disasters cannot be prevented once they are caused by specific factors, but their impacts can be lessened. According to traditional healers, we think that every incident, whether it be spiritual or bodily, has a reason and that there may be a means to overcome it. Another traditionalist agrees that certain gods and deities create hydrological threats in reaction to the unsanitary use of water resources. Such use could include disposing of trash in rivers, among other things (Male KII/Community Leader, Abalagemo Community/75 years old). To alert the locals to this negligent environmental behavior, numerous persons have perished in the village rivers. The 'deities may pay a warning visit' to the traditional heads of the villages when such incidents become common. In other cases, oracles are consulted regarding how to validate the cause and how to lessen the risks or calamities. To lower the risk, mitigation frequently involves corrective or preventive actions (Female KII/Community Leader, Odeyinka Community/69 years old). In certain cases, determining the number of people afflicted and the prevalence rate of the condition provides early warning and a signal to take action. The majority of communities in this state use traditional knowledge. In this situation, the majority of communities use traditional medical expertise to treat the affected persons by quarantining or curing them (Female KII/Community Leader, Omosan-Igbo Community/65 years old).

### **3.5 Labyrinths of Early Warning Process and Prediction of Disasters**

People get ready for the impending calamity by making reasonable predictions about its coming. According to the study's participants, this is based on their combined experiences with the severity and aftereffects of previous disasters. To foretell upcoming disasters, unusual behavior and restlessness among the 'lower' creatures are typically observed and tested over time. The behaviors of the communities' 'lower animals' typically functioned as warning signs of impending calamities and the necessity of proper planning to prevent their probably disastrous results (Male KII/Academic, University of Ibadan, Nigeria/56 years old). According to another contribution, the disaster scenario will be evaluated to determine ways to limit its devastating impacts in cases when the event could not be completely predicted (Female KII/Academic, Federal University of Technology, Akure, Nigeria/45 years old).

It was discovered that every community has a range of early warning signs and established procedures that allow it to swiftly and effectively use its collective knowledge for disaster response. According to one of the contributing scholars, this innovation in anticipating impending catastrophes required a thorough analysis of the behavior of animals, birds, insects, plants, trees, winds, air and water temperatures, clouds, earth motions, and celestial bodies (Male KII/Academic, Obafemi Awolowo University, Ile-Ife, Nigeria/51 years old). This also acts as an early warning system for impending disasters, much as the ability to forecast disasters was made possible by the meticulous study and interpretation of the actions of living things. This is part of the indigenous knowledge system of nearly every community in this region of the state (Female KII/Academic, University of Ibadan, Nigeria/47 years old).

In the event of an epidemic, early warning usually takes place before the disease is contracted by community members. Any weird events that are observed are interpreted by the community members based on their personal experiences (Male KII/Academic, Federal University of Technology, Akure, Nigeria/50 years old). This thus serves as warning signs to get them prepared for whatever threats might happen. The existence of snakes and other reptiles, along with wild animals, near homesteads in pursuit of food and water, was

emphasized as another evidence of the prevalence and persistence of drought in almost all of the examined communities (Female KII/Academic, Obafemi Awolowo University, Ile-Ife, Nigeria/49 years old). It is believed that the arrival of swallow birds, or '*alápàándèdè*' in huge numbers circling the sky is a sign that the rains are coming and that it is time to avoid vulnerable situations.

The screams and shifting melodies of the '*olongo*' (robin) birds are signs that rain is expected that very day. Poor seasonal rainfall was suggested if the birds postponed their journey. When flock '*àsá*' (hawk) birds hover and make strange cries around the community, it means people should get prepared for famine. Farmers usually study Akintola plants. The botanical name of this plant is '*siam weed*' or '*chromolaena odorata*'. The plant is used to know when to stop planting seasonal crops like maize, rice, beans, soybeans, etc. Their position is that anytime these plants bring about colored flowers, it is an indication that rain will stop falling within a few weeks. The farmers usually resort to planting crops like cassava rather than engaging in the planting of seasonal ones (Male IDI/Farmer/Abalagemo Community/55 years old).

Bird activity in the neighborhoods is frequently a sign of unfavorable weather conditions. One sign of a protracted drought is the swarming of *ègà* bird (sparrow) in the sky as the dry season draws near. In certain cases, the dogs are observed constantly urinating in the neighborhoods. Such a circumstance is an indication that hunger is imminent. It also indicates impending hunger when *òbòònbòòn* (bettle) are observed to be humming around in numbers within the settlements (Male KII/Community Leader, Abalagemo Community/75 years old). Another participant supported this by stating that the Yoruba tree species known as *òpòtó* (*Ficus sur* Forrsk) is not anticipated to bloom during the dry season. This tree's blooming during the dry season is a hint that the communities will experience drought (Female KII/Community Leader, Odeyinka Community/69 years old).

Extreme tranquility within the environment across the communities indicates that 'measles disease' will be experienced at that material time (Male KII/Academic, Obafemi Awolowo University, Ile-Ife, Nigeria/51 years old). People identify impending 'famine' within the communities where sheep are seen crying about unnecessarily in the communities without anybody disturbing them (Female KII/Academic, Federal University of Technology, Akure, Nigeria/49 years old). A very severe harmattan is an indication of the fruitfulness of palm fruits and plentiful harvest for bountiful palm oil. Where such was not witnessed this portends poor harvest and scarcity of palm for domestic and commercial purposes (Male KII/Academic, University of Ibadan, Nigeria/47 years old).

### 3.6 Structural and Non-Structural Management Approaches for Disaster Risk Reduction

Many different strategies are being used in communities to reduce the risk of disasters. For landscape protection, some people plant trees as windbreaks. It is typical, according to this group, to plant trees in places designated as shelters for ecological preservation. Our purpose in doing this is to act as a buffer for the maintenance of fertility throughout a wider area of land. This allows the protected land to maintain its fertility and structure. The outcome of this is not just an instant increase in crop yields but also the long-term and ongoing maintenance of the productivity of their land holdings (Male IDI/Farmer/Aworo Ayedaade Community/66 years old). In another instance, sourcing for fuelwood was equally mentioned. In this situation, it was revealed that the existence of shelterbelts across the

communities makes this possible. The shelterbelts were created across the neighborhood within the community. In a situation of this nature, everybody knows where to go at a particular point in time for the harvesting of fuelwood. This has provided an avenue for preventing the haphazard harvest of fuelwood (Male IDI/Farmer/Odeyinka Community/72 years old).

Another strategy that has been used to help reduce the risk of disasters is the planting of crop varieties that mature early. According to one of the study's participants, early-maturing crop varieties with significant resistance to moisture, heat, and severe illnesses were found. These crops are cultivated throughout the rainy season under the proper growth cycles. They are suitable for controlling ecological conditions and disaster mitigation due to their ability to resist brief and sporadic periods of irregular rain (Male IDI/Farmer/Omosan-Igbo Community/70 years old).

Another strategy is the planting of drought-resistant tree species, such as neem trees, as a crop and soil management technique. Helping to increase soil moisture storage and decrease runoff is the main goal of this (Female IDI/Farmer/Dagbaja Community/67 years old). Another participant stated that excavation of drains around buildings to lower the height of flood water, clearing drainage channels, and sand-filling erosion-prone regions were other communal techniques that have been used over the years. To prevent flood water from entering the building, barriers are sometimes built in the front of the structure (Male IDI/Farmer/Orafidiya Community/68 years old). The use of neem cake as a fertilizer for agricultural products is also common. This stems from its recognition as an excellent organic nitrogenous fertilizer. In this region, its application is a standard procedure due to its efficacy in enhancing the soil's physical state and its capacity to restore and maintain the soil's humus status. This will consequently supply the nutrients that the plants need to increase their resistance to hardship. Additionally, neem cake was found to be effective in controlling locusts and other insect pests. Spraying soaked neem cake over crops to deter insect infestations is one of the tactics within this area (Female IDI/Farmer/Fadahunsi-Ogundele Community/71 years old).

#### 4. Conclusion

Integrating indigenous knowledge systems into climate change-induced disaster risk reduction is crucial for building resilient communities. From this study, IKS has offered valuable insights into climate variability and adaptation strategies. The ingenuity of the local communities in terms of unique knowledge and coping mechanisms in the face of disasters. The study emphasized the interconnectedness of traditional lifestyles with the preservation of regional ecological systems, biodiversity conservation, and even enhancement. The foregoing is therefore an indication of the relevance of indigenous knowledge system in every development agenda.

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