

The Impact of Climate Change on Francolins (*Francolin Bicalcaratus*) Habitat Adaptation in the Farming Areas of Bangem City, Southwest Region Cameroon

Blandine Lenyonga Tutuwan*

Department of Environmental Science, University of Buea, Cameroon

Abstract

Climate change is one of the greatest threats facing the natural world today, with far-reaching consequences for ecosystems, wildlife, and human communities alike. Rising global temperatures, shifting precipitation patterns, and more extreme weather events are dramatically altering the environmental conditions that species have adapted to over centuries and millennia. For many vulnerable animal and plant populations, the pace of these changes far exceeds their ability to adapt, putting their long-term survival at risk. This study investigated the impact of climate change on the habitat adaptation of Francolins (*Francolin bicalcaratus*), a species of francolin bird found in the farming areas of Bangem. Additionally, Bangem region was selected for this study due to its important Francolin populations as well as the rapidly changing environmental conditions being experienced in this agricultural landscape. The study was conducted over a 5-month period, and research data collection through field observations, and interviews with local farmers and community members. Key parameters measured included changes in temperature, precipitation patterns, vegetation cover, and Francolin population dynamics. This study revealed a significant association of climatic conditions on birds' aggregation behavior $X^2=60.861$ $df=6$ $P=0.000$, the social behavior of francolin birds $X^2=28.861$ $df=9$ $P=0.001$, and human activities in francolin ecosystem $r=0.462$ $P=0.000$ respectively. The role of climatic changes on the aggregation behavior of Francolins (*Francolin bicalcaratus*) has been a subject of increasing research interest, as climate change continues to impact ecosystems worldwide. Also, the study showed an association between climatic conditions and various food consumed by francolin birds $X^2=161.819$ $df=12$ $P=0.000$. Additionally, climatic conditions significantly linked with francolins' vocalization pitch intensity $X^2=58.697$ $df=6$ $P=0.000$.

Keywords: Climate change; Human communities; Francolin population

Introduction

Climate change is one of the greatest threats facing the natural world today, with far-reaching consequences for ecosystems, wildlife, and human communities alike. Rising global temperatures, shifting precipitation patterns, and more extreme weather events are dramatically altering the environmental conditions that species have adapted to over centuries and millennia. For many vulnerable animal and plant populations, the pace of these changes far exceeds their ability to adapt, putting their long-term survival at risk. One such species facing significant challenges are the Francolin (*Francolin bicalcaratus*), a type of francolin bird found in the farming regions of Cameroon. Francolins are ground-dwelling gamebirds that play an important role in local ecosystems, serving as both predators and prey. They are also an important cultural and subsistence resource for many rural communities in Cameroon. However, recent studies have indicated that Francolin populations in the country are in decline, with habitat loss and fragmentation emerging as key threats [1-3].

The African continent is particularly vulnerable to the impacts of climate change, which are already having significant effects on the region's ecosystems and biodiversity. Rising temperatures, shifting precipitation patterns, and more frequent extreme weather events are disrupting the delicate balance of many natural habitats. These changes are driving habitat loss and fragmentation, species range shifts, and population declines across a wide range of flora and fauna. Several studies have documented the impacts of climate change on bird species in Africa. For example, Huntley projected that up to 30% of African bird species could face a high risk of extinction by 2050 due to climate-driven habitat changes. Sekercioglu found that many Afrotropical bird species, including some game birds, are highly vulnerable to the effects

of climate change on their preferred habitats [4,5].

Methodology

The Francolin is a ground-dwelling gamebird found across West and Central Africa, including in the farming regions of Cameroon. Francolins play an important role in local ecosystems, serving as both predators and prey, and are also a valuable cultural and subsistence resource for rural communities. However, Francolin populations in Africa have been declining in recent decades, with habitat loss and fragmentation emerging as key threats. The species' ground-dwelling nature and reliance on specific vegetation structures make Francolins particularly vulnerable to changes in land use and climate. Few studies have specifically examined the impacts of climate change on Francolin populations in African farming regions. However, research on related gamebird species and their habitats can provide insights into the potential challenges facing Francolins. Studies have shown that climate-driven changes in temperature, precipitation, and other environmental factors can significantly alter the vegetation composition and structure of agricultural landscapes, affecting the

*Corresponding author: Blandine Lenyonga Tutuwan, Department of Environmental Science, University of Buea, Cameroon, E-mail: blandine56@yahoo.com

Received: 01-July-2024; Manuscript No: jee-24- 140666; **Editor Assigned:** 03-July-2024; pre QC No: jee-24- 140666 (PQ); **Reviewed:** 17-July-2024; QC No: jee-24- 140666; **Revised:** 19-July-2024; Manuscript No: jee-24- 140666 (R); **Published:** 26-July-2024, DOI: 10.4172/2157-7625.1000535

Citation: Blandine LT (2024) The Impact of Climate Change on Francolins (*Francolin Bicalcaratus*) Habitat Adaptation in the Farming Areas of Bangem City, Southwest Region Cameroon. J Ecosys Ecograph, 14: 535.

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availability and quality of Francolin habitat. For example, increasing drought and extreme weather events can lead to the loss of important grass and shrub cover, reducing nesting and foraging opportunities for Francolins. Additionally, climate change may indirectly impact Francolins through its effects on human land use and agricultural practices. As farmers adapt to changing climatic conditions, they may adopt new crop varieties, alter their grazing regimes, or expand their fields, further fragmenting and degrading Francolin habitat.

Given the close relationship between Francolin populations and the farming landscapes they inhabit, any successful conservation strategy will need to meaningfully involve local communities. By drawing on the traditional ecological knowledge and resource management practices of rural communities, conservation efforts can be better tailored to the specific needs and priorities of the region. One promising approach is to empower local communities to take the lead in managing and protecting Francolin habitats within their agricultural lands. Community-based natural resource management (CBNRM) programs have been implemented successfully for other wildlife species in Africa, giving communities greater control over the use and conservation of natural resources. In the context of Francolin conservation, CBNRM could involve establishing community-managed wildlife corridors, grassland preserves, or agroforestry systems that maintain the vegetation structures and connectivity required by Francolins. Communities could also develop and enforce their own sustainable land use practices, such as regulated grazing regimes, to ensure the long-term viability of Francolin habitat [6-8].

To encourage community participation in Francolin conservation, incentive-based programs could be developed that provide tangible benefits to local stakeholders. This might include establishing Payments for Ecosystem Services (PES) schemes, where communities are compensated for protecting and restoring Francolin habitat on their lands. Alternatively, ecotourism initiatives focused on Francolin viewing and hunting could generate revenue for communities while providing an economic incentive to maintain healthy Francolin populations and their habitats. Such initiatives would need to be carefully designed to ensure equitable distribution of benefits and sustainable use of the resource. Beyond community-based initiatives, local authorities and conservation organizations could work with farming communities to integrate Francolin habitat requirements into broader land use planning and agricultural development strategies. This might involve designating priority conservation areas, promoting agroforestry and other biodiversity-friendly farming practices, and ensuring that infrastructure projects and land use changes do not further fragment or degrade Francolin habitats. By empowering local communities, providing economic incentives, and integrating Francolin conservation into broader land use planning, a multi-faceted approach can help ensure the long-term survival of this important gamebird species in the face of climate change and other threats within African farming landscapes [9,10].

Results

Furthermore, photo-period showed a significant link on climatic conditions $X^2=37.062$, $df=3$, $P=0.000$ (Figure 8). The day-period changes, including morning and evening hours, in the ecosystem of Francolins (*Francolin bicalcaratus*) are also influenced by various climatic factors, such as sunlight, rainfall, cloud cover, and wind patterns. Several studies have explored the impact of these diurnal climatic changes on the Francolins' behavior, activity patterns, and resource utilization. A study by Borghesio and Laiolo in the Biosphere Reserve of Mount Kilimanjaro, Tanzania, found that Francolins

exhibited distinct diurnal activity patterns that were closely linked to the changes in sunlight and temperature throughout the day. The birds were observed to be most active during the early morning and late afternoon hours, when the temperatures were relatively cooler and the light levels were suitable for foraging and other daily activities. The researchers noted that the Francolins tended to reduce their activity levels and seek shelter during the midday hours, when the sunlight was more intense, and the temperatures were higher. This behavioral adaptation helped the birds to conserve energy and avoid heat stress during the hottest parts of the day. Similar findings were reported by Njoroge in the Bamenda Highlands of Cameroon, where the researchers observed that the Francolins' daily movements and foraging patterns were influenced by the changes in cloud cover and wind speeds throughout the day.

The birds were found to be more active and vocal during the morning and evening hours, when the cloud cover was higher and the wind speeds were lower, as these conditions provided better protection and visibility for their foraging and social activities. Awa in the Sahelian region of Cameroon found that the Francolins' selection of foraging and roosting sites within their habitat was also affected by the diurnal changes in climatic factors, such as temperature and precipitation. During the morning and evening hours, when the temperatures were relatively cooler, the birds were observed to utilize more exposed and open areas for foraging and basking, as these sites provided better access to their preferred food sources and thermal regulation. In contrast, during the midday hours, when the temperatures were higher, the Francolins were more likely to seek refuge in denser vegetation or shaded areas to avoid heat stress and predation. These diurnal patterns of resource utilization and habitat selection were found to be particularly important for the Francolins' survival and reproduction, as they allowed the birds to optimize their energy expenditure and minimize the risks associated with environmental stressors, such as heat and predation, throughout the day. This study, highlights the significant role of climatic factors, including sunlight, rainfall, cloud cover, and wind patterns, in shaping the day-period changes, morning, and evening activities of Francolins (*Francolin bicalcaratus*) within their ecosystem. Understanding these diurnal patterns and their underlying drivers is crucial for developing effective conservation strategies and management plans for this species in the Bangem City region and the Southwest Region of Cameroon.

Discussion

The Bangem region of Cameroon has experienced notable climate change trends in recent decades, including increases in average temperatures, shifts in precipitation patterns, and a higher frequency of extreme weather events. These changes are expected to continue, with projections indicating further warming and more variable rainfall in the coming decades. The Francolin (*Francolin bicalcaratus*), a widespread gamebird species in sub-Saharan Africa, is facing significant challenges due to the impacts of climate change within the farming landscapes it inhabits, including the region around Bangem, Cameroon. This comprehensive research discussion explores the specific implications of climate change for Francolin habitat adaptation in the farming areas of Bangem. The climate change-driven shifts in temperature and precipitation observed in the Bangem region are likely to significantly alter the suitability of existing Francolin habitats. Studies have shown that the Francolin's preferred grassland and savanna ecosystems are highly sensitive to changes in these climatic variables. For example, a modeling study by Fandohan projected that areas of high habitat suitability for the Helmeted Francolin (*Francolinus hildebrandti*) in West Africa, including parts of Cameroon, may contract by as much as 50% by the end of the 21st century under certain climate change

scenarios. This could lead to the fragmentation and isolation of Francolin populations in the Bangem region.

Conclusion

The findings of this comprehensive study on the impact of climate change on Francolin (*Francolin bicalcaratus*) habitat adaptation in the farming areas of Bangem City, Cameroon, paint a concerning picture for the future of this species in the region. The key factors behind the loss and degradation of Francolin habitats are directly linked to the impacts of climate change, including changes in temperature, precipitation patterns, and land-use practices. Increased deforestation, overgrazing, and shifts in crop cultivation have all contributed to the reduction of suitable nesting sites, foraging grounds, and protective cover for Francolins. Importantly, the study also highlighted the direct experiences and perceptions of the local communities in Bangem, who have observed and felt the effects of a changing climate on their agricultural activities and natural resources. These community-level insights provide invaluable context and underscore the urgent need for collaborative, locally-driven conservation efforts. To address the threats posed by climate change and secure the long-term survival of Francolins in Bangem farming areas, a multi-faceted approach is required. This should include strengthening community engagement and participatory land-use planning, implementing climate-smart agricultural practices, enhancing environmental education and awareness. Promoting the integration of trees, shrubs, and other perennial vegetation within farming landscapes. This can help maintain habitat connectivity, provide valuable nesting and foraging resources for Francolins, and enhance overall biodiversity. Implementing managed grazing systems that allow for periods of rest and recovery for pasturelands. This can prevent overgrazing and degradation of Francolin habitats. Adopting practices such as minimal soil disturbance, permanent soil cover, and diverse crop rotations. This can help maintain soil health, reduce erosion, and provide suitable ground cover for Francolins. Using a combination of biological, cultural, mechanical, and selective chemical controls to manage agricultural pests. This can reduce the need for broad-spectrum pesticides that may harm Francolin populations. Implementing techniques to capture and

store rainwater, as well as using drip irrigation and other water-efficient methods. This can help maintain suitable moisture levels in Francolin habitats during periods of drought. Encouraging the cultivation of a variety of crops, including those that provide food and shelter resources for Francolins, such as grains, legumes, and native vegetation. By adopting these measures, Bangem community can work to safeguard the future of Francolin population and maintain the ecological balance of the region in the face of a rapidly changing climate. The findings of this study serve as a critical call to action, underscoring the need for proactive and collaborative conservation efforts to protect this iconic species and the habitats upon which it depends.

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