





COMMENTARY

At the tipping point: Can biodiversity and rural livelihoods endure uncontrolled cashew expansion in West Africa?

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Abstract

Our commentary explores the increase in cashew cultivation across West Africa, drawing attention to its impacts on biodiversity and livelihoods. We summarize the issue regionally, then showcase Guinea-Bissau, where we unravel the dynamics between cashew expansion, habitat and biodiversity loss, and livelihoods. Finally, we propose concrete policy measures encompassing strengthened conservation, sustainable land-use planning, enhanced farming practices, community engagement, and international market reforms. Our recommendations extend beyond both a recent review (Rege et al. 2023) and a concise policy commentary on EU deforestation law (Powell et al. 2023) in offering a roadmap for sustainable cashew cultivation.

Abstract in Portuguese is available with online material.

KEYWORDS

biodiversity, cashew expansion, Guinea-Bissau, land conversion, rural livelihoods

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1 | CASHEW EXPANSION IN WEST AFRICA

The conversion of native habitat to agriculture is a main driver of the current biodiversity crisis (Dirzo & Raven, 2003). In the tropics, cashew is the latest cash crop to draw the attention of conservation scientists due to its rapid expansion (Powell et al., 2023).

Cashew (*Anacardium occidentale* L.), native to northeast South America, was introduced to Africa and Asia in the 16th century (Morton & Dowling, 1987). Global demand has driven sharp increases in cashew plantations in Africa: in 1988, cashew covered around 300Kha; this rose to 922Kha in 1998, 2.3Mha in 2008, and reached 4.7Mha by 2018 (FAOSTAT, 2022). As of 2021, nine of the top 20 cashew-producing countries are African (FAOSTAT, 2023) and 45% of the world's cashew is produced in West Africa (African Cashew Alliance, 2022).

In the world's largest cashew producer, the Ivory Coast, orchards in the north have increased between 20% and 700% in the last 35 years, replacing native forest, savannah, and food crops and raising concerns of food insecurity for small farmers (Bamba et al., 2019; Cisse et al., 2021). Likewise, in Benin, the second largest producer in West Africa, orchard area almost doubled between 2015 and 2021, leading to a 55% increase of its encroachment into protected areas (Yin et al., 2023). In Burkina Faso, orchards expanded to occupy 40% of the cultivated area in the southwest in just 25 years (Augusseu et al., 2006). In Nigeria, land covered by cashew has increased by 632% over 30 years (Adeigbe et al., 2015). As orchards enter their fourth decade, the declining quality and quantity of the cashew after 25 years may lead to reduced production (Pereira et al., 2022), threatening small farmer incomes and food security.

There are few published studies on cashew orchards in West Africa and little data on how resulting land-use changes affect biodiversity (Rege & Lee, 2023); much of our understanding originates from India. For instance, medium-sized mammals rarely use cashew plantations adjacent to forests (Rege et al., 2020). However, invertebrates such as ants, butterflies and spiders exhibit high diversity in these plantations (Bhat et al., 2013; Mahata et al., 2019; Vanitha et al., 2017). Reptile diversity is higher in cashew than in other agroecosystems, home gardens, and botanical gardens (Jayakumar & Nameer, 2018). Although both birds and anurans exhibit comparable species richness between cashew orchards and forest, the cashew-associated communities are skewed to generalists (Komanduri et al., 2023; Munje & Kumar, 2022; Ranganathan et al., 2008).

2 | GUINEA-BISSAU: WHERE CASHEW COLLIDES WITH BIODIVERSITY AND LIVELIHOODS

Among West African producers, Guinea-Bissau emerges as a cautionary tale of the impacts that cashew expansion has on

biodiversity and livelihoods. Despite its small size, Guinea-Bissau is the fourth largest cashew producer in West Africa and the eleventh globally (FAOSTAT, 2023). Cashew has become the main income source for small farmers, making them vulnerable to market changes and often forcing them to sell cashew for low prices. This prevents both financial and food security, leading to international food aid requests (BBC News, 2021; France24, 2023; Thomson Reuters Foundation, 2013). These factors plus the biodiversity impacts make Guinea-Bissau a compelling story around which to showcase how cashew plantations impacts both livelihoods and biodiversity in Africa.

Between 1975 and 2013, Guinea-Bissau lost 77% of its dense forests and 35% of its woodlands (United Nations Framework Convention on Climate Change (UN-FCC), 2019). The country is home to 28 critically endangered species, including African forest elephants (*Loxodonta cyclotis*; Palma et al., 2023) and White-headed vultures (*Trigonoceps occipitalis*; Henriques et al., 2017; Figure 1), 40 endangered species, and 77 vulnerable species (IUCN, 2023). Amidst this land use transformation, ca. 26% of the territory are protected areas (Pereira et al., 2022), including several Key Biodiversity Areas (BirdLife International, 2022; Figure 1). Nevertheless, effective protected area management is often lacking due to limited resources and to difficulties managing the balance between nature conservation and local communities' needs. As a result, orchards often encroach within national parks (Pereira et al., 2022). Converting forests and woodlands to cashew adversely affects the critically endangered western chimpanzee (*Pan troglodytes verus*) and excludes specialist butterfly species (Carvalho et al., 2013; Vasconcelos et al., 2015). Curiously, Dos Reis Silva (2023) found that reptile richness, amphibian richness, and amphibian abundance and composition were similar in cashew orchards and forest remnants. Fernández (2023) found that cashew orchards might alter the functional structure of mammal communities, with carnivores being negatively impacted by cashew orchards.

Despite the impacts on biodiversity, cashew is essential for Guinea-Bissau's economy, accounting for 90% of the country's exports (United Nations Development Programme (UNDP), 2020). Eighty percent of cashew orchards are owned by small family farms, rendering cashew the primary income source for local communities (Hanusch, 2016). Overreliance on cashew monoculture brings risk, including the fluctuations of international markets' price, decreasing harvests, and growing food insecurity as farmers shift from rice, the main staple, to cash-based monocultures (Catarino et al., 2015; Lundy, 2012; Sierra-Baquero et al., 2024; Temudo & Abrantes, 2014).

Recent studies on the characterization of Guinea-Bissau's orchards highlight that they are mostly old and outside cashew productive age, with high tree density (286 trees/ha) (Figure 2), low yield (<05. tons/ha) monospecific plantations with no varietal selection and passive management (Sierra-Baquero et al., 2024). This creates the perfect conditions for the emergence and dissemination of pests (Vasconcelos et al., 2014) and diseases (Monteiro et al., 2017,

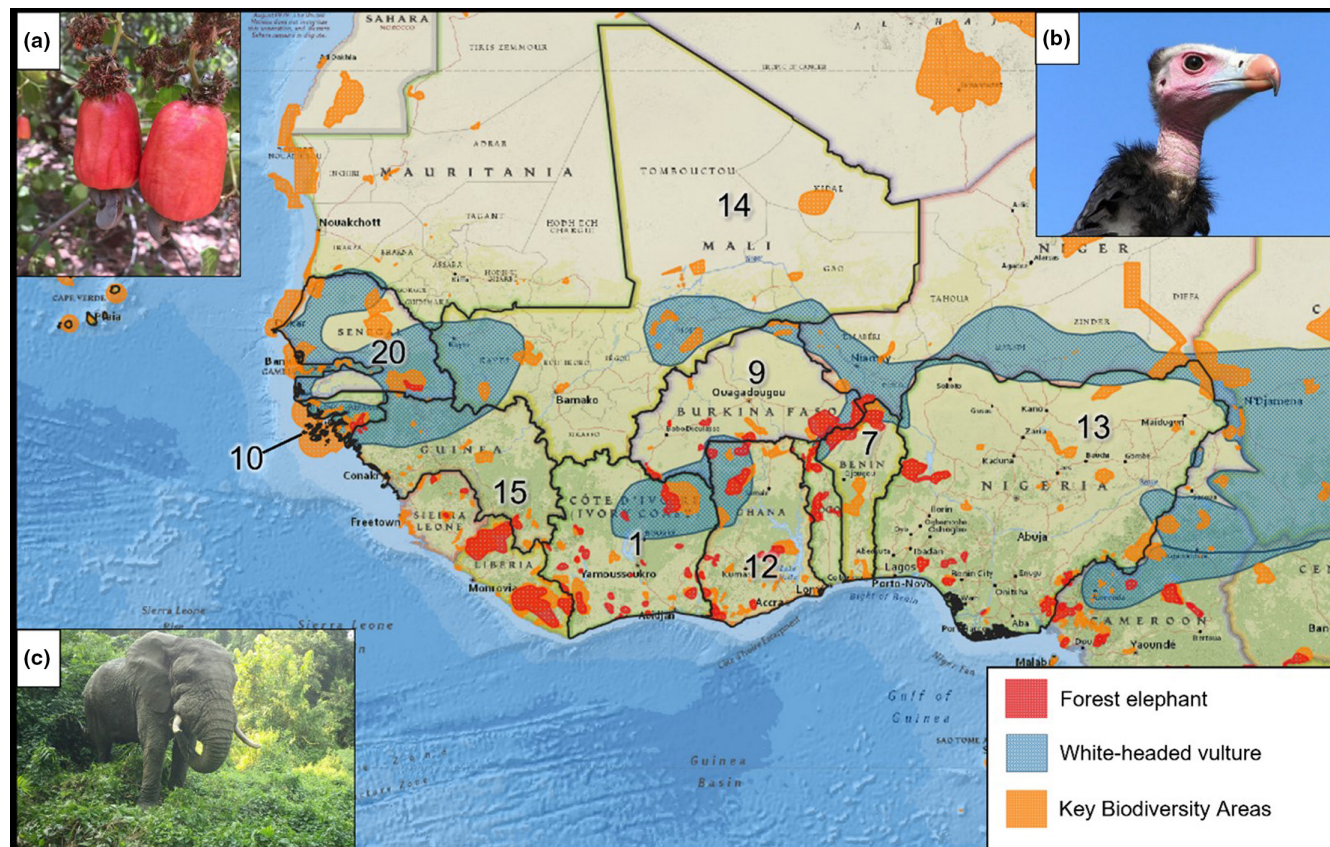


FIGURE 1 Top cashew producing countries in West Africa overlapped with White-headed vulture (*Trigonoceps occipitalis*) and African forest elephant (*Loxodonta cyclotis*) distributions and Key Biodiversity Areas. Numbers in the map indicate position at the world ranking of the nine West African cashew producing countries within the global top 20 in 2021 (FAOSTAT, 2023). White-headed vulture distribution is depicted in blue (BirdLife International, 2021), African forest elephant distribution in red (IUCN and SSC African Elephant Specialist Group, 2021) and Key Biodiversity Areas (BirdLife International, 2022) in orange; both species were historically widespread in the region. The figure illustrates the overlap of cashew production and areas crucial for biodiversity conservation. (a) Cashew fruit and nut; photo credit: Filipa Monteiro; (b) White-headed vulture; photo credit: Frank Wouters (CC BY 2.0) <http://creativecommons.org/licenses/by/2.0/>; (c) African forest elephant; photo credit: Luís Palma.



FIGURE 2 Example of a cashew orchard in Guinea-Bissau (photo credit: Patrícia Guedes). Trees are planted closely together in a monoculture regime with very little understory vegetation during harvest season.

2022). Two of the most harmful fungi for cashew productivity have recently been detected in the country and spread widely: gummosis and dieback (Diniz et al., 2021; Monteiro et al., 2020; Sierra-Baquero et al., 2024).

Guinea-Bissau's narrative shows the intricate interplay between cashew expansion, biodiversity, and livelihoods in West Africa. It stands as a blunt reminder that in the pursuit of economic prosperity, the delicate balance between biodiversity and natural resources and the welfare of human communities can falter. Guinea-Bissau's example underscores the need for a balanced approach, one that harmonizes economic growth with environmental stewardship and community resilience.

3 | RECOMMENDATIONS FOR A SUSTAINABLE FUTURE IN WEST AFRICA

With global demand for cashew more than doubling between 2000 and 2018, it is unlikely that demand will slow down (United Nations

Conference on Trade and Development (UNCTAD), 2021). If these trends continue, weak governance, ineffective management and lack of data will aggravate this major crisis. Moving forward, we must understand how cashew expansion and biodiversity interact to inform evidence-based management and policy that will optimize livelihoods with conservation. As a road map towards this outcome, we suggest the following recommendations:

3.1 | Investing in ecological research

Many knowledge gaps remain on the expansion and consequences of cashew production in West Africa (but see Yin et al., 2023). Data on biodiversity within cashew orchards are scarce (Monteiro et al., 2017), with only 15 studies worldwide focusing on cashew and biodiversity (Rege & Lee, 2023). Priorities should be mapping different types of cashew orchards, monitoring their evolution, and studying changes in biodiversity patterns (Pereira et al., 2022).

3.2 | Support solid agroecological principles and transformation

Agroforestry practices, some of them embedded in local traditional practices in West Africa, may represent the solution to restore lost natural areas while promoting food security (Wynberg, 2024). Whereas some improvements in production per unit could be achieved by integrating better management of crops and land fertility (Mungai et al., 2016), these would not help solve landscape-scale degradation (Jeanneret et al., 2021). Through the integration of regenerative agricultural principals, current cashew crops can be reintegrated within surrounding natural habitats, agroecological mosaics, boosted by collaborations between agricultural agroecologists, biodiversity experts, and traditional farmers (Tittonell, 2023).

3.3 | Improve the integration of local socioeconomic issues for sustainable livelihoods

It is essential to understand the local socioeconomic constraints that can hinder cashew sustainability, such as institutional capacity, power imbalances, lack of infrastructure, and financial barriers (Mungai et al., 2016; Sierra-Baquero et al., 2024). Due to farmers' heavy reliance on cashew income and existing debts outside the season, they often accept cashew prices lower than the government set price (e.g., Sierra-Baquero et al., 2024), which limits reinvestment to improve yields. Empowering farmers in collective finance, marketing, and cultivation management not only enhances livelihoods but also contributes to overall agricultural development and economic growth.

3.4 | Reinforcing management capacity of existing protected areas

Strengthening the management and enforcement capacity of existing protected areas is crucial for protecting native forests from cashew expansion. Buffer zones must be clearly demarcated and managed to encourage sustainable land use practices while minimizing encroachment. Additionally, the borders of protected areas should be revised where necessary to mitigate the effects of cashew expansion and reflect new information about wildlife and its needs (e.g., Palma, 2024). Areas that are not protected but have been proved to be important for wildlife should be given some sound form of protection, namely as community manages areas. It is also important to integrate specific cashew regulations within the management plans of these protected areas and support communities in finding alternative revenues that value ecosystem services. In Guinea-Bissau, communities extract non-timber forest products for city markets, demonstrating the viability of earning livelihoods from the forest (Palmeirim et al., 2023).

3.5 | Improving land-use planning and zoning to facilitate sustainable cashew

Land planning legislation must provide a robust framework for resolving conflicts over land tenure, resource use, and encroachment (Angelsen & Kaimowitz, 2001; Ceddia et al., 2014; Moutinho et al., 2016; Nolte et al., 2017). In countries where traditional land tenure is frequently governed by customary laws and practices (e.g., Guinea-Bissau), cashew plantations play a crucial role in the land tenure system. Therefore, promoting a fair regulatory framework for land tenure would help resolve disputes over land ownership and usage.

3.6 | Boost community involvement and knowledge exchange

Improving the sustainability and mitigating environmental impacts of current cashew production can only be achieved by valuing local knowledge and fostering community ownership. Actively involving communities in decision-making related to sustainable cashew production is essential (Tittonell, 2023). Encouraging the exchange of knowledge, such as learning and testing traditional and improved farming methods can reveal more sustainable alternatives to monocultures (e.g., Mungai et al., 2016). Additionally, training farmers on sustainable practices and high-yield varietal selection and encouraging crop diversification are crucial for sustainability (Olubode et al., 2018).

3.7 | Modifying international supply and demand chains, and prospects for certification

Despite producing almost half of the world's cashew (African Cashew Alliance, 2022), almost 90% of the raw cashew nuts produced in West Africa are exported to Vietnam and India, where they are processed, packaged, and distributed mainly to the USA and Europe (Ton et al., 2018). Therefore, developing projects that support in-country processing would greatly improve prices for producers. Investing in fair trade, organic, or “wildlife friendly” certifications (e.g., African Cashew Alliance) can increase farmer incomes and reduce pressure on ecosystems (Kuenkel & Aitken, 2015).

4 | CONCLUDING REMARKS

As the demand for cashew continues to grow globally, we stand at a critical juncture. West African nations and high-income countries must collectively implement strategies that embrace both traditional knowledge and sustainable practices. This entails improving the current knowledge on the impacts of cashew crops on habitats and biodiversity, promoting sustainable and agroecological methods for cashew crops, strengthening protected areas, comprehensive land-use planning, community engagement, and reshaping international demand.

It is past time to prevent West African countries from losing large areas of natural habitat to monoculture expansions (Myers et al., 2000), but there is still time to preserve the biodiversity that remains and find ways for local people and nature to thrive together.

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CONFLICT OF INTEREST STATEMENT

The corresponding author confirms on behalf of all authors that there have been no involvements that might raise the questions of bias in the work reported or in the conclusions, implications, or opinions stated.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no data were created or analyzed in this study.

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