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Review

Conservation and Promotion of Neglected and Underutilized Crop Species in West Africa: Policy and Governance

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Abstract: Neglected and underutilized crop species (NUCS/NUS) are claimed to contribute to sustainable development. However, many scholars argue that enabling policies and appropriate governance are needed to operationalize such a potential contribution. Therefore, this systematic review analyzes the literature dealing with the relationships between policy and governance aspects and the promotion of NUS in West Africa. It draws upon 45 eligible articles identified through a search conducted on the Web of Science in December 2023. The existing literature focuses on Nigeria and a few NUS, especially cassava. The addressed policy domains include biodiversity conservation; subsidies; seed systems; food security, self-sufficiency and sovereignty; trade and import substitution; food safety and health; climate change and energy; land use; research, innovation and development; and support and assistance systems. Meanwhile, the main governance domains are (1) inclusiveness and participation and (2) institutional capacity. The analysis suggests that NUS development is also affected by sectoral policy coherence and consistency as well as the policy–governance interplay. Future studies should widen the scope in terms of geographical coverage in West Africa and NUS addressed to allow for more comparisons. Furthermore, there is a need for further research to understand the synergies and trade-offs between sectoral policies affecting NUS promotion and development.

Keywords: neglected and underutilized species; NUS; orphan crop; sustainable food system; politics; policy coherence; biodiversity; climate change; Sahel; SUSTLIVES

1. Introduction

Agriculture plays an important socioeconomic role in West Africa [1,2]. Indeed, the contribution of the primary sector (viz. agriculture, forestry, and fishing) to the gross

domestic product (GDP) in West African countries ranges from 4.8% in Cape Verde to 60.4% in Sierra Leone. The share of employment in agriculture in the region ranges from 11% in Cape Verde to 71% in Niger and 73% in Burkina Faso (Table 1). Meanwhile, food insecurity and malnutrition present significant challenges across West Africa [3]. The overall prevalence of undernourishment in the population remained high in the period 2020–2022 with figures ranging from 4.9% in Ghana to 37.9% in Guinea-Bissau and 38.4% in Liberia. The situation is even more concerning when the prevalence of moderate or severe food insecurity is considered with figures ranging from 37.0% in Cape Verde and 39.4% in Ghana to 81.2% in Liberia and, even, 89.2% in Sierra Leone during the same period (Table 1). Moreover, evidence suggests that Sub-Saharan Africa [4–7] in general, and West Africa and Sahel [4,7,8] in particular, experience the most significant impacts of climate change. Indeed, agriculture, which relies primarily on rainfall, is highly susceptible to climate variability [9–11] and the region has inadequate economic and institutional resources to address changes in climate and its variability [9]. The above-mentioned challenges highlight the urgent need to transition to sustainable and resilient agri-food systems in the region [12].

Table 1. Relevance of agriculture and prevalence of food insecurity in West African countries.

Country	Agriculture, Forestry, and Fishing, Value Added (% of GDP)—Value (Year)	Employment in Agriculture (% of Total Employment)—2021	Prevalence of Undernourishment (% of the Population)—2020–2022	Prevalence of Moderate or Severe Food Insecurity (% of the Population)—2020–2022
Benin	26.9 (2022)	28	9.9	73.6
Burkina Faso	18.5 (2022)	73	16.2	56.9
Cabo Verde/Cape Verde	4.8 (2022)	11	18.2	37.0
Côte d'Ivoire/Ivory Coast	16.7 (2022)	45	7.7	44.2
Ghana	19.6 (2022)	39	4.9	39.4
Guinea	27.3 (2022)	59	12.9	73.1
Guinea-Bissau	30.9 (2020)	50	37.9	77.8
Liberia	36.2 (2022)	41	38.4	81.2
Mali	36.4 (2022)	68	12.8	n.r.
Mauritania	22.2 (2022)	29	8.7	53.7
Niger	42.0 (2022)	71	16.1	71.4
Nigeria	23.7 (2022)	35	15.9	69.7
Senegal	15.5 (2022)	22	5.7	49.8
Sierra Leone	60.4 (2022)	43	27.8	89.2
The Gambia	22.6 (2022)	49	19.6	60.7
Togo	18.3 (2022)	31	17.4	62.9
Source	*World Bank [1]*	*World Bank [2]*	*FAO et al. [3]*	*FAO et al. [3]*

GDP: gross domestic product. n.r. not reported.

Neglected and underutilized crop species (NUCS/NUS)—also known as orphan, minor, abandoned or lost crops [13]—are a vast array of plant species that have been largely overlooked [14], despite their potential contributions to sustainable food systems. The increased production of NUS has been reported to contribute to climate change adaptation and mitigation [15], agrobiodiversity conservation [16], food and nutrition security [16,17], environmental integrity and health [15], and the sustainability and resilience of food

systems [16,18]. El Bilali et al. [19] claim that "*there is a wider recognition of the role and potential of NUS in climate resilience and adaptation, biodiversity conservation, food and nutrition security and rural livelihoods*" (p. 47). In this context, Mabhaudhi et al. [20] argue that the promotion of NUS could contribute to the achievement of the Sustainable Development Goals (SDGs), especially SDG 1 (No poverty), SDG 2 (Zero hunger), SDG 3 (Good health and well-being) and SDG 15 (Life on land). However, despite their potential benefits, NUS face several challenges that hinder their mainstreaming in agri-food systems [15]. These challenges include genetic erosion, loss of local knowledge regarding their growing, collection and preparation, difficulty in marketing, and climate change [16]. Moreover, the lack of interest by food chain actors, limited seed availability, and lack of technology and tailored national policies hinder the development of NUS value chains [21]. To overcome these barriers and constraints, research, innovation, and development as well as appropriate policies are needed [22], especially in developing countries [14].

Enabling policies play an essential role in promoting and enhancing the use of NUS. Many countries have adopted sustainable development policies to conserve and promote biodiversity, protect natural resources, and adapt to climate change. International policies and legal frameworks on biodiversity and plant genetic resources also contribute to this momentum [19,23]. However, despite the crucial role of NUS in diversifying agriculture, increasing farmers' resilience, particularly in marginal lands, supporting traditional farming systems, and improving food and nutrition security, few national policies and institutions have recognized their importance and included them as part of the solution to diversify farming systems and diets [24]. According to Notaro et al. [25], this significant gap needs attention. Galluzzi and Noriega [26] also highlight that the current international policies and legal instruments have not provided sufficient funding for the conservation and sustainable use of the genetic resources of these crops.

El Bilali et al. [27] found that agrobiodiversity is not yet a central topic in the national food system transformation pathways in West Africa; it is overlooked in some documents, while it is only marginally addressed in others, and only a few measures and actions deal with the valorization of NUS and traditional crop varieties [27]. An analysis of current strategies and policies that are supposed to support the promotion of NUS in West Africa (cf. Burkina Faso and Niger) [28] was carried out as part of the SUSTLIVES project (SUSTaining and improving local crop patrimony in Burkina Faso and Niger for better LIVes and EcoSystems) [29]. It was found that very few national policies and strategies mention NUS as such. However, strategies and policies generally recognize the importance of agroecological practices and biodiversity issues as essential elements of climate change adaptation and mitigation and thus support the promotion of NUS. The analysis provided an understanding of how policies influence the use of crop diversity by farmers, value chain actors and organizations, markets, and consumers. It also explored policy options to improve the effectiveness of incentives to promote the use of crop diversity for climate change adaptation strategies and nutritional benefits. The study recommended, inter alia, including NUS in sectoral policies and taking into account good practices from other countries in NUS-related policies [28]. Referring to NUS, Idowu [30] argues that "*All these crops receive little research attention, poor commercialization and marketing, and lack effective policy frameworks for harnessing their potentials in Nigeria*" (p. 49).

Some previous reviews dealt with policies on NUS in West Africa [31–38], but they are not recent and/or address only partially or marginally the topic in the whole region. Earlier reviews dealt with the agribusiness innovation in Africa [37], the nutritional importance of cassava in Senegal [31], impacts of climate change on food chains in the Economic Community of West African States (ECOWAS) [38], the potential economic benefits of the biotechnology (cf. genetically modified organisms—GMOs) for the promotion of orphan crops in Sub-Saharan African countries—including Nigeria and Ghana from West Africa [32], the biofuel policy in Nigeria [33], the bioenergy sector in Nigeria [34], relationships between food security/safety and GMOs in Africa [35], and the biosafety regulatory

framework regarding GMOs in Sub-Saharan Africa—including Ghana and Nigeria from West Africa [36].

In this context, the present paper specifically analyzes the scholarly literature dealing with the relationships between policy and governance aspects and the promotion of NUS in West Africa. The main research question addressed in the paper is whether the current policy framework and governance arrangements are favorable enough and enabling for NUS in the region. While the paper deals generally with NUS, it focuses on eight species representing the groups of roots and tubers (viz. sweet potato [39], Hausa potato [40] and cassava [41]), vegetables (viz. amaranth [42], moringa [43], okra [44] and roselle [45]) and legumes (viz. Bambara groundnut [46]).

2. Methods

This systematic literature review follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [47,48]. It draws upon a search performed in the Web of Science (WoS) on 30 December 2023. The used search string—developed based on several previous systematic reviews dealing with NUS [23,49,50] and/or West Africa [12,51,52]—was as follows: *(polic* OR politic OR governance) AND ("West* Africa" OR Sahel OR Benin OR Burkina OR "Cape Verde" OR "Cabo Verde" OR Gambia OR Ghana OR Guinea OR "Guinea-Bissau" OR "Ivory Coast" OR "Côte d'Ivoire" OR Liberia OR Mali OR Mauritania OR Niger OR Nigeria OR Senegal OR "Sierra Leone" OR Togo) AND ("neglected and underutilised species" OR NUS OR "sweet potato" OR "Hausa potato" OR fabirama OR cassava OR manioc OR moringa OR roselle OR sorrel OR bissap OR okra OR amaranth OR "Bambara groundnut" OR voandzou OR "neglected species" OR "neglected and underutilized crop" OR "neglected crop" OR "abandoned crop" OR "abandoned species" OR "alternative crop" OR "alternative species" OR "local crop" OR "local species" OR "lost crop" OR "lost species" OR "minor crop" OR "minor species" OR "niche crop" OR "niche species" OR "orphan crop" OR "orphan species" OR "traditional crop" OR "traditional species" OR "underdeveloped crop" OR "underdeveloped species")*. Only original research articles that deal with NUS, policy and/or governance, and West Africa were considered eligible.

The search on all databases of the Web of Science returned 260 documents. A total of 215 documents were excluded after reviewing their titles, abstracts, and full texts, as they did not meet the eligibility criteria (Table 2). Out of these, 19 documents were excluded based on their titles alone. These documents included those related to animals/livestock, which were not relevant to the study. Similarly, 186 documents were also discarded based on their abstracts; for instance, as the study focuses on crop NUS (cf. NUCS), documents related to forest and forestry were not considered as relevant. Additionally, documents dealing with major commercial crops were also considered ineligible. Likewise, documents that refer to policy or governance only in their concluding parts, to underline the need for some policy/governance interventions, were discarded. Lastly, some 10 documents were excluded based on the scrutiny of full articles, as they failed to meet at least one of the eligibility criteria; the latter included 8 reviews [31–38].

Therefore, 45 articles (Table 3) were determined to be eligible and thus were considered in the systematic review and underwent analyses.

Table 2. Articles selection process.

Steps	Number of Selected Records	Step Description
Initial search on WoS	260	
Screening of records based on titles	260	19 records excluded because they address countries outside West Africa e.g., Brazil, Cameroon, Democratic Republic of Congo (DRC), Indonesia, Kenya, Papua New Guinea, Sudan, Surinam, and Uganda

Table 2. *Cont.*

Steps	Number of Selected Records	Step Description
Screening of records based on abstracts	241	186 records excluded: • 18 documents because they do not deal with crop NUS • 9 documents because they do not address West Africa • 100 documents because they do not deal with policy • 59 records without abstracts
Scrutiny of full-texts to check eligibility	55	10 records excluded: • 1 document because it does not deal with crop NUS • 1 document because it does not deal with policy • 8 reviews
Inclusion of articles in the systematic review	45	--

Table 3. Selected articles.

Year	Articles Number	References
2023	6	Ahmad et al. [53]; Asare-Nuamah et al. [54]; Belcher et al. [55]; Birol et al. [56]; Liverpool-Tasie et al. [57]; Missiame et al. [58]
2022	3	Assima et al. [59]; Dey et al. [60]; Donkor et al. [61]
2021	6	Dogba et al. [62]; Ezeh et al. [63]; Mobio et al. [64]; Sanusi et al. [65]; Sanusi et al. [66]; Torvikey [67]
2020	8	Adewuyi [68]; Agbaeze et al. [69]; Darko-Koomson et al. [70]; Donkor et al. [71]; Inegbedion et al. [72]; Mbosso et al. [73]; Ojediran et al. [74]; Okoruwa et al. [75]
2019	1	Agwu et al. [76]
2018	3	Dick and Wilson [77]; Donkor et al. [78]; Poku et al. [79]
2017	2	Garcia-Casal et al. [80]; Haggblade et al. [81]
2016	3	Bricas et al. [82]; Felicia et al. [83]; Sanyang et al. [84]
2015	3	Etongo et al. [85]; Nnamani [86]; Saravia-Matus and Gomez Y Paloma [87]
2014	2	Adenle [88]; Olajide-Taiwo et al. [89]
2013	4	Adegbola et al. [90]; Phalan et al. [91]; Rudebjer et al. [92]; Tittonell and Giller [93]
2012	1	Ogundari et al. [94]
2010	1	Ohimain [95]
2009	1	Dada et al. [96]
1994	1	Prudencio and Al-Hassan [97]

The selected documents underwent a topical/content analysis. The topical analysis of the eligible documents was informed by the SAFA (Sustainability Assessment of Food and Agriculture systems) approach of the Food and Agriculture Organization of the United Nations [98,99]. The SAFA framework considers four sustainability dimensions viz. environmental integrity, economic resilience, social well-being, and good governance. As suggested by El Bilali et al. [100], political aspects were included in the governance dimension (cf. policy and governance). Then, different themes related to policy and governance were considered in the analysis (Table 4). Deductive coding [101,102] was used to identify and cluster the main policy domains addressed in the selected, eligible documents.

Table 4. Themes related to policy and/or governance considered in the selected documents.

Sustainability Dimension	Themes Addressed
Policy and governance	Agenda, accountability, coalition, collaboration, cooperation, governance, inclusion, inclusiveness, legitimacy, multi-actor, multi-stakeholder, participation, participatory, plan, policy, politics, roadmap, strategy, transparency, vision

Source: Adapted from El Bilali et al. [100].

Some limitations of this systematic review must be acknowledged. Firstly, by selecting the Web of Science (WoS) database for the search process, only high-quality scholarly literature was considered; this means that gray literature (e.g., reports) and research on NUS published in journals not indexed in WoS were not included. Secondly, the choice of search terms used may have impacted the results despite employing various terms to broaden the initial screening dealing with NUS and policies in West Africa. Nonetheless, despite these limitations, this research is significant as it is the first of its kind and offers a starting point for future studies and research projects exploring the relationship between NUS, on the one side, and policy and governance, on the other side, in West Africa and other regions.

3. Results and Discussion

The analysis suggests that policy and governance are still marginal topics in the scholarly literature on NUS in West Africa. The studies analyzed cover different geographical areas, ranging from global to local levels, including regional and national ones. The West African countries addressed in the studies include Benin, Burkina Faso, the Ivory Coast, Ghana, Liberia, Mali, Niger, Nigeria and Sierra Leone. However, the lion's share of articles deals with Nigeria. The analyzed literature addresses both NUS and main, staple crops. While some studies deal with NUS in general, others focus on specific families or groups of plants, such as vegetables and tubers. Furthermore, some studies focus on particular NUS/crops, like amaranth, Bambara groundnut, cassava, celosia, corchorus, cowpea, fonio, moringa, okra, plantain, sweet potato and yam. However, cassava is by far the most addressed crop (Table 5).

Table 5. Synthesis of documents considered in the systematic review.

Source	Country/Region	NUS/Crops Considered	Thematic Focus
Haggblade et al. [81]	Sahelian West Africa	Different crops (e.g., cassava, yams, maize, sorghum)	Implications of staple food substitution in terms of food security
Rudebjer et al. [92]	Sub-Saharan Africa	NUS	Research capacity on underutilized species
Prudencio and Al-Hassan [97]	Africa	Cassava	Roles of cassava in food security
Adenle [88]	West Africa (Ghana and Nigeria)	No specific crop	Perceptions of genetic modification (GM) technology
Assima et al. [59]	Mali	Different crops (e.g., cowpea)	Effects of input subsidies on crop diversity
Agbaeze et al. [69]	Nigeria	Cassava	Processing of cassava
Ojediran et al. [74]	Nigeria	No specific crop	Growth Enhancement Support Scheme
Etongo et al. [85]	Burkina Faso	Trees (e.g., moringa)	Impacts of tree planting on livelihoods

Table 5. *Cont.*

Source	Country/Region	NUS/Crops Considered	Thematic Focus
Dogba et al. [62]	Liberia	Cassava	Efficiency and technology gap of small-scale producers
Saravia-Matus and Gomez Y Paloma [87]	Sierra Leone	Different staples (e.g., rice and cassava) and export crops (e.g., cocoa and coffee)	National Sustainable Agriculture Development Plan (NSADP)
Sanyang et al. [84]	Africa	Maize and cassava	Innovation platforms in agricultural research for development
Ahmad et al. [53]	Burkina Faso	Different crops (e.g., rice, maize, cotton, cowpea)	Effects of input subsidies on crop diversity in family farms
Dey et al. [60]	Vietnam, Uganda, Zambia, Niger and Guatemala	Different crops (rice, maize, sorghum, pearl millet, bean, cowpea, soybean, groundnut, potato and sweet potato)	Seed production by small-scale farmers
Torvikey [67]	Ghana	Cassava	Impacts of industrial cassava production in rural areas
Adegbola et al. [90]	Benin	Cassava	Market performance and constraints
Liverpool-Tasie et al. [57]	Nigeria	Different crops (e.g., wheat, millets, rice, cassava and tubers)	Wheat self-sufficiency programs
Felicia et al. [83]	Nigeria	Yam	Yam production and consumption
Nnamani [86]	Nigeria	NUS	Nutritional benefits of NUS and their contribution to food and nutrition security
Sanusi et al. [65]	Nigeria	Cassava	Productivity of cassava farmers
Birol et al. [56]	Nigeria	Cassava and maize	Staple crop biofortification program
Bricas et al. [82]	West and Central Africa	Different crops (e.g., maize, cassava, sorghum, yam, plantain)	Dependence of cities on food imports
Agwu et al. [76]	Nigeria	Different crops (e.g., maize, cassava, rice)	Growth Enhancement Support Scheme
Donkor et al. [78]	Nigeria	Cassava	Direct marketing channels
Tittonell and Giller [93]	Africa	No specific crop	Ecological intensification in smallholder agriculture
Donkor et al. [71]	Ghana	Sweet potato	Sweet potato yoghurt
Ohimain [95]	Nigeria	Different crops (e.g., cassava)	Bio-ethanol projects
Olajide-Taiwo et al. [89]	Nigeria	Vegetables (e.g., amaranth, corchorus, celosia, okra and pepper)	Vegetable value chains
Donkor et al. [61]	Nigeria	Cassava	Added value distribution in the cassava value chain
Sanusi et al. [66]	Nigeria	Cassava	Adoption of technologies among cassava farmers
Poku et al. [79]	Ghana	Cassava	Cassava-based bioeconomy

Table 5. *Cont.*

Source	Country/Region	NUS/Crops Considered	Thematic Focus
Inegbedion et al. [72]	Nigeria	Cassava	Effects of policy on cassava development
Phalan et al. [91]	Tropical countries (e.g., Nigeria, Indonesia, Ethiopia, Sudan and Brazil)	Different crops (e.g., rice, sorghum, sugar cane, oil palm, beans, cowpeas, wheat, cassava)	Trade-offs between crop expansion and conservation priorities
Dick and Wilson [77]	Nigeria	Different crops (e.g., cassava)	Biofuels policy
Darko-Koomson et al. [70]	Ghana	Cassava	Cassava value chain
Mbosso et al. [73]	Mali	Bambara groundnut and fonio	Bambara groundnut and fonio value chains
Mobio et al. [64]	Cote d'Ivoire	Cassava	Decline of cassava production
Dada et al. [96]	Nigeria	Cassava	Science and technology for cassava
Ogundari et al. [94]	Nigeria	Cassava	Biofuel production
Okoruwa et al. [75]	Nigeria	Cassava	Finance for cassava actors
Asare-Nuamah et al. [54]	Ghana	Cassava	Role of cassava in women's economic empowerment
Adewuyi [68]	Nigeria	Different crops (e.g., sugarcane, cassava)	Bioethanol and biodiesel production
Missiame et al. [58]	Ghana	Cassava	Collective action and farm efficiency
Belcher et al. [55]	Nigeria	Different crops (e.g., maize, cassava)	Implications of carbon tax and carbon credit policies
Ezeh et al. [63]	Nigeria	Different crops (e.g., rice, cassava, maize, vegetables)	Agricultural extension service
Garcia-Casal et al. [80]	Global	Staple crops	Crop biofortification

3.1. Policy and Governance in the Scholarly Literature on NUS in West Africa

The selected articles addressed different domains of policy and/or governance. The domains of policy that affect the promotion of NUS and the development of their value chains are related to biodiversity conservation; subsidies; seed systems; food security, self-sufficiency and sovereignty; trade and import substitution; food safety and health; climate change and energy; land use; research, innovation and development; and support and assistance systems in rural areas. Meanwhile, the main governance domains are linked to inclusiveness and participation as well as institutional capacity (Table 6).

Table 6. Key policy and governance domains addressed in the analyzed scholarly literature dealing with NUS in West Africa.

Policy/Governance Domain	References *
Biodiversity conservation	Ahmad et al. [53]; Assima et al. [59]; Phalan et al. [91]
Subsidies	Ahmad et al. [53]; Assima et al. [59]; Ogundari et al. [94]
Seed systems	Adenle [88]; Ahmad et al. [53]; Dey et al. [60]; Tittonell and Giller [93]
Food security, self-sufficiency and sovereignty	Bricas et al. [82]; Dada et al. [96]; Dick and Wilson [77]; Donkor et al. [71]; Felicia et al. [83]; Garcia-Casal et al. [80]; Haggblade et al. [81]; Liverpool-Tasie et al. [57]; Mobio et al. [64]; Nnamani [86]; Ogundari et al. [94]; Phalan et al. [91]; Prudencio and Al-Hassan [97]

Table 6. *Cont.*

Policy/Governance Domain	References *
Trade and import substitution	Adegbola et al. [90]; Bricas et al. [82]; Haggblade et al. [81]; Inegbedion et al. [72]; Liverpool-Tasie et al. [57]
Food safety and health	Donkor et al. [71]; Garcia-Casal et al. [80]
Climate change and energy	Adewuyi [68]; Belcher et al. [55]; Dick and Wilson [77]; Ogundari et al. [94]; Ohimain [95]; Poku et al. [79]; Saravia-Matus and Gomez Y Paloma [87]
Inclusiveness and participation	Adegbola et al. [90]; Asare-Nuamah et al. [54]; Darko-Koomson et al. [70]; Dey et al. [60]; Dogba et al. [62]; Donkor et al. [78]; Donkor et al. [61]; Missiame et al. [58]; Ojediran et al. [74]; Okoruwa et al. [75]; Olajide-Taiwo et al. [89]; Poku et al. [79]; Sanusi et al. [65]; Sanusi et al. [66]; Sanyang et al. [84]; Tittonell and Giller [93]; Torvikey [67]
Land use	Ahmad et al. [53]; Assima et al. [59]; Dick and Wilson [77]; Etongo et al. [85]; Phalan et al. [91]; Saravia-Matus and Gomez Y Paloma [87]; Torvikey [67]
Research, innovation and development	Dada et al. [96]; Donkor et al. [71]; Rudebjer et al. [92]; Sanyang et al. [84]
Support and assistance systems	Agbaeze et al. [69]; Dogba et al. [62]; Donkor et al. [78]; Etongo et al. [85]; Ezeh et al. [63]; Mbosso et al. [73]; Okoruwa et al. [75]; Olajide-Taiwo et al. [89]; Sanusi et al. [65]; Sanusi et al. [66]
Institutional capacity	Agwu et al. [76]; Okoruwa et al. [75]; Rudebjer et al. [92]; Sanyang et al. [84]

* Some articles deal with different domains.

3.1.1. Policy

Many articles discuss *policies* related to NUS. They either analyze the current state of the system or propose policies that can encourage the production of NUS. These studies cover policies at various geographical levels (global, continental/African, regional, national, local), including urban food systems. The considered policies can be in the form of strategies, plans or programs. They relate to various domains, which were addressed separately or together. Examples of policies discussed in the articles reviewed in this paper include the Growth Enhancement Support Scheme in Oyo State [74] and Kogi State [76] in Nigeria, the National Sustainable Agriculture Development Plan (NSADP) in Sierra Leone [87], the Nigerian Biofuel Policy [95], and the Ebonyi State Agricultural Development Programme, Nigeria [63].

The promotion of NUS can contribute to *biodiversity conservation*, but agricultural subsidy policies can interfere with this objective. *Subsidies* concern mainly inputs like fertilizers or seeds. Assima et al. [59] show that fertilizer subsidies are strongly and negatively associated with agricultural biodiversity (viz. crop species diversity) in Mali. Ahmad et al. [53] point out that the fertilizer subsidy (targeting specific staple and cash crops such as rice, maize and cotton) negatively affects crop diversity in Burkinabé farms. Therefore, input subsidies, which are supposed to increase crop production and productivity, thus contributing to food security, might negatively affect crop diversity and lead to the exclusion of NUS (e.g., cowpea). However, Ahmad et al. [53] found that the seed subsidy to cowpea offsets the bias of fertilizer subsidy toward targeted crops (viz. rice, maize and cotton) and enhances crop diversity. Prudencio and Al-Hassan [97] argue that the stabilization role of cassava in African food security is negatively affected by access to and use of modern inputs such as fertilizers. In other words, input subsidies may push farmers to move toward the cultivation of other cash crops to the detriment of staples such as cassava.

Subsidies might regard also specific typologies of seeds. *Seed systems* in West Africa have been mainly impacted by the introduction of genetically modified organisms (GMOs) in some countries of the region and the challenges and opportunities that such an introduction brings about. In this regard, Adenle [88] found that policymakers and scientists in Ghana and Nigeria have a positive perception of genetic modification (GM) technologies, and they believe that GM has great potential to solve many of the problems faced by agriculture in both countries. While smallholder seed systems can help overcome the difficulty in access to seeds that most small-scale producers face, they also encompass some challenges like difficulties in timely access to good-quality early-generation seeds, the suboptimal packaging and labeling of the seed produced and marketed, and the poor understanding of seed policy and legislation. These challenges hinder the commercialization of seeds by producer groups. In this context, some authors call for changing the current model of crop breeding and, consequently, the paradigm of crop intensification in Africa. For instance, referring to the case of Africa, Tittonell and Giller [93] point out that "*smallholder farmers are unable to benefit from the current yield gains offered by plant genetic improvement*" (p. 76).

Many scholars underscore the contribution of NUS to *food security, self-sufficiency and sovereignty* [64,86,96]. Many NUS have interesting nutritional profiles; they thus can represent an important ally in the struggle against food insecurity and malnutrition, provided that policy support and attention are ensured [86]. Prudencio and Al-Hassan [97] underline the important role of cassava in stabilizing food security in Africa due to its ability to bridge the food availability gap during the lean, hungry season. However, this role is affected by developments in many policy domains such as land use, crop risk management (cf. insurance), input subsidies and market inclusiveness and accessibility. The importance of some NUS, such as cassava, is also demonstrated by the negative effects of the supply shortages on the food security of the population; this was the case for cassava in the Ivory Coast during 2015–2016 [64]. The biofortification of staple crops (e.g., cassava, maize, pearl millet, rice, sorghum) seems a promising strategy to address food insecurity and malnutrition, especially micronutrient deficiencies [56,80]. This is particularly true when biofortified crops are included in social protection and humanitarian aid programs [56]. Changes in policies may negatively affect the production and consumption of some NUS. Referring to the example of yam in Nigeria, Felicia et al. [83] suggest that "*policy changes on yam substitutes, particularly rice, sometimes have negative effects on yam production, prices, land share and real income among yam farming households in Nigeria depending on the nature of the policy.*" (p. 363).

The domains of food security, self-sufficiency and sovereignty, and *trade and import substitution* are often addressed conjointly. Haggblade et al. [81] point out that policy responses to address food insecurity challenges in the Sahel region include consumer substitution and trade. Consumer substitution can be implemented among staple foods (e.g., cassava, yams), while trade is mainly utilized with the coastal countries in West Africa, which have more favorable environmental and climatic conditions. This suggests that food substitution strategies can not only improve food security but also strengthen the food sovereignty of West African countries. Referring to the example of wheat in Nigeria, Liverpool-Tasie et al. [57] question the efficacy and adequacy of import substitution strategies. Indeed, consumption patterns in Nigeria suggest that coarse grains (e.g., millets, rice) and tubers (e.g., cassava) are more important for food security than imported wheat. Therefore, policy support for the local production of wheat to reach self-sufficiency might not be judicious. Instead, the Nigerian government should support the production of local grains and tubers. Similarly, Bricas et al. [82] argue that local starchy products (e.g., maize, cassava, sorghum, yam, plantain) are still heavily consumed in the cities of West and Central Africa and call for decreasing policy support for imported cereals (e.g., wheat and rice); they add that "*food policies must take into account all food products (instead of cereals only), and in particular those which contribute to diet diversification*".

Concerning *food safety and health*, the example of *potagurt* (sweet potato yogurt) in Ghana shows that innovative NUS-based products are appreciated by consumers for their

nutritional, health, food safety, and quality attributes [71], so their promotion can contribute to the nutrition security of populations in West Africa. It is also important to underline that seed systems and food (bio)safety and health are strongly linked. In a review focusing on Sub-Saharan Africa, Zambrano et al. [32] stress "*the importance of having an enabling policy environment and regulatory system—covering, among other elements, biosafety and food/feed safety assessment, and varietal release registration—that is efficient, predictable, and transparent to ensure that the projected economic benefits are delivered and realized in a timely manner*".

As for the *climate change and energy* domain, some NUS, especially cassava, have been increasingly used as a feedstock to produce biofuel/biodiesel [68,77,79,94]. While such a development shows the potential of NUS to contribute to the efforts for climate change adaptation/mitigation, it also raises concerns about negative effects on food security. Some scholars underline that the current policy environment is not favorable for the development of biofuels in West Africa. Referring to the case of cassava in the bioeconomy sector in Ghana, Poku et al. [79] argue that "*Unsuccessful government initiatives and the absence of legislation such as a composite flour policy or a biofuel blend policy have also been major contributing factors to the unrealized industrial potential of cassava in Ghana*" (p. 134). Referring to the biofuel policy in Nigeria, Ohimain [33] warns that "*The policy did not address the potential food versus fuel conflicts that could arise from the use of food crops as biofuel feedstock*" (p. 246). Mitigating climate change and reducing greenhouse gas emissions also implies phasing out some unsustainable practices such as shifting cultivation. In this respect, the NSADP 2010–2030 in Sierra Leone aims to eradicate shifting cultivation practices and promote integrated value chains of selected staples (e.g., cassava) and export crops (e.g., cocoa). This change, promoted by policy, means variations in land use with implications to, inter alia, livelihoods, biodiversity conservation and food security. Also, intercropping and agroforestry, for instance with moringa, can be a further strategy to mitigate emissions from agriculture [55].

Concerning *land use*, Assima et al. [59] suggest that fertilizer subsidies affect land allocation and use in Mali. Ahmad et al. [53] found that fertilizer subsidies led to a decrease in land allocated to cowpea, although legumes, such as cowpea, assure nitrogen fixation, thus reducing the need for fertilizers. Phalan et al. [91] show that there was an expansion of cropland in tropical countries (including land allocated to cassava and cowpea), which might negatively affect biodiversity; therefore, they call for adopting more effective sustainability standards and policies that address both the production and consumption of tropical commodities. Also, the use of some NUS as feedstocks for the production of biofuels can affect land allocation and use. Dick and Wilson [77] suggest that future expansion of the bioethanol program (cf. cassava) would result in significant land use changes in Nigeria and underline that "*future biofuels' policy requires a carefully-articulated land-use policy to ensure that land allocation to bioethanol feedstock production is tempered by the need to allocate arable land to food production, in order to avoid consequential adverse impacts on its food security*". Land tenure issues sometimes represent barriers to the cultivation of NUS. In the context of Ziro province (Burkina Faso), while referring to forestry and agroforestry (e.g., moringa), Etongo et al. [85] found that "*tenure insecurity and lack of sufficient land were the main reasons cited for not planting trees*" (p. 2655).

Research and innovation are fundamental for the development of NUS and their value chains. However, achieving this requires strengthening the capacity of all actors involved, including young researchers [92]. This also implies that the national research systems go beyond commodity crops to encompass NUS [92]. Considering the case of cassava in Nigeria, Dada et al. [96] highlight the need to harness science and technology to increase productivity and achieve food security. Meanwhile, Sanyang et al. [84] call for a paradigm shift in agricultural research for development to address organizational and institutional barriers to innovation and change in African agriculture. For that, they suggest fostering multi-stakeholder innovation platforms.

Access by value chain actors to quality and appropriate *support and assistance* services is crucial for the promotion of NUS. Unfortunately, often there is a lack of those services,

and/or actors, especially producers, have difficulty accessing them. Agbaeze et al. [69] enumerate the lack of agricultural technical experts and difficult access to extension and financial services among the factors that hamper the development of cassava processing in Nigeria. Similarly, Darko-Koomson et al. [70] identify limited access to credit as one of the main constraints to cassava value chain upgrading in Ghana. Okoruwa et al. [75] underline credit access as a major problem hindering the expansion of the cassava value chain in Nigeria and suggest, inter alia, improving the capacity of financial institutions to make access to finance easier for value chain actors (e.g., producers, processors, marketers). Meanwhile, referring to Bambara groundnut and fonio value chains in Mali, Mbosso et al. [73] list the lack of access to inputs and equipment for fonio and poor processing and lack of market promotion for Bambara groundnut among the main bottlenecks inhibiting their development. Inadequate finance and weak institutional linkages are among the main constraints hampering the development of the value chain of vegetables (e.g., amaranth, corchorus, celosia, okra, pepper) in Ibadan City (Nigeria) [89]. Meanwhile, many factors hinder the participation of farmers in markets. Donkor et al. [78] suggest that poor road networks in rural areas, difficult access to market information, and low involvement in farmer associations negatively affect the participation of cassava producers in direct marketing channels in the Oyo State (Nigeria). Support and assistance can also foster the adoption of sustainable practices. For instance, Etongo et al. [85] found that access to markets and local support were among the main reasons for planting trees in Ziro province (Burkina Faso).

Beyond the single policy domains, many scholars underline the need to improve *policy coherence and consistency* [53,59,69]. Indeed, some articles also discuss the interplay between policies and their instruments, highlighting potential synergies and, especially, trade-offs. Examples of trade-offs include climate change vs. food security in the case of biofuel [68,77,95], food security vs. food safety and biodiversity conservation in the case of GMOs [88], food security vs. biodiversity conservation in the case of input subsidies [53,59], import substitution vs. food security in the case of wheat [57], and food security vs. biodiversity conservation in the case of crop expansion [91]. In this regard, Agbaeze et al. [69] found that policy inconsistency is one of the factors that hinder the development of cassava processing in Nigeria. In the context of the biofuel policy and use of transgenic varieties of cassava, sugarcane, sweet potato, and maize in Nigeria, Ohimain [33] points out potential trade-offs between climate change mitigation and biodiversity conservation and environmental protection, especially agronomic impacts of transgenic crops to native species.

3.1.2. Governance

Some studies have focused on *governance* at different levels. They dealt with inclusiveness and participation and/or institutional capacity.

Inclusiveness and participation regard mainly smallholders and women. Ojediran et al. [74] show that the participation of farmers in the Growth Enhancement Support Scheme (GESS) in Oyo State (Nigeria) allowed them to obtain benefits such as access to inputs (e.g., seeds and fertilizers) and advisory services through the agro-input dealers. Sanusi et al. [65] suggest that access to advisory services sponsored by GIZ (*Deutsche Gesellschaft fur Internationale Zusammenarbeit)* increased the productivity of cassava farmers in Ogun State (Nigeria). Therefore, participation is not only a mere formality but also allows farmers to obtain tangible benefits and advantages. Interestingly, Missiame et al. [58] found that female smallholder cassava farmers in eastern Ghana benefit more than male farmers from farmer-based organizations with their membership, resulting in a 12% increase in their technical efficiency.

The *organization of value chain actors* in groups or cooperatives/associations can improve their efficiency and facilitate their access to services. In this respect, referring to cassava and *gari* (a cassava-based product) in Benin, Adegbola et al. [90] stress the need to gather especially female traders and retailers in commercialization groups or co-

operatives to facilitate access to production or processing points. Poku et al. [79] and Darko-Koomson et al. [70] suggest that weak governance system and coordination problems among the value chain actors (e.g., farmers, processors, industrial end-users) hinder the increase of production and processing of cassava in Ghana. Dogba et al. [62] stress the importance of access to finance services and products (e.g., microfinance, agriculture insurance, grouped loan scheme) by cassava producers in Liberia and underline the need to develop multi-stakeholder partnerships to achieve that. Participation in farmers' groups can be also instrumental in the adoption of sustainable production practices and systems [66,85]. For instance, Etongo et al. [85] found that people participating in farmers' groups have favorable attitudes toward the planting of trees, including moringa, in Ziro Province (Burkina Faso). Similarly, Sanyang et al. [84] argue that participation in innovation platforms enhanced behavioral change and inter-actor relationships.

Gender issues are a prominent aspect of the debate on participation and inclusion. Women play a central role in the value chains of NUS [54,61,90], but this role is not always adequately recognized and valued. Adegbola et al. [90] underscore that the markets of cassava and *gari* in Benin are run mainly by women. Furthermore, NUS have contributed to the empowerment of women in the case of cassava in Ghana [54]. However, Donkor et al. [61] pinpoint inequal income distribution patterns in the value chain of cassava in the Oyo State (Nigeria) and recommend that "*agricultural policies that promote agrifood value chains should aim at minimizing income inequality by targeting vulnerable groups, particularly female farmers to achieve sustainable development in rural communities*" (p. 254). Torvikey [67] points out that the intensification of production (including large-scale industrial production of staples such as cassava) and the commodification of land resources might change land access rules and rights to the detriment of women and other vulnerable groups such as migrants. These developments might imply trade-offs between food security, which requires increasing production and productivity, and social inclusion and justice. Also, women are often underrepresented in public policies and programs. Agwu et al. [76] point out that the low participation of women in the GESS in Kogi State (Nigeria) reduces the effectiveness and impacts of the program.

Institutional capacity is needed for the promotion of NUS. Rudebjer et al. [92] underline that the development of the NUS value chains is crucial for their promotion and commercialization; they suggest that, in turn, institutional capacity building is needed to develop NUS value chains and argue "*This requires investments in human and institutional capacity for research, marketing and knowledge sharing, including policy dialogue*" (p. 577). The examples of Ghana and Nigeria show that with the "*lack of appropriate regulatory framework, lack of trained personnel, weak institutions and poor equipped laboratory*" (p. 241), the introduction of GMO crops represents not only a significant challenge but also high risk in terms, inter alia, of biosafety [88]. Improving the access of farmers to extension services also implies transforming and strengthening these services, including digitalization. In this context, Ezeh et al. [63] make proposals to enhance the digitalization of extension services in Ebonyi State (Nigeria) through mobile apps, supporting and strengthening organizations engaged in extension delivery, and organizing training programs on e-extension for extension agents. The need to strengthen institutions and build institutional capacity in West Africa is a recurring theme in the literature. In a review of the impacts of climate change on food chains in ECOWAS, Rhodes and Atewamba [38] recommend that "*Policies should be revisited, institutions strengthened and financial investments made for ECOWAS to realize its potential to significantly contribute to food security and carbon storage*" (p. 35).

3.1.3. Policy and Governance

Some articles explore the interplay between *policy* and *governance* and highlight how governance mechanisms and arrangements affect the impacts and success of policies. Examples include the need to strengthen the capacity of institutions involved in the design and implementation of policies as well as the delivery of services. Referring to the GESS in Kogi State (Nigeria), Agwu et al. [76] highlight the untimely provision of inputs and

inability to pay for the subsidized inputs among the major constraints to the effective implementation of the scheme. According to Prudencio and Al-Hassan [97], there might be trade-offs even between policy and governance objectives, e.g., food security vs. market inclusiveness. In the case of cassava, the access to markets by producers, which might increase their inclusion and participation in markets, might negatively affect the stabilizing role of cassava in food security across Africa [97].

3.2. Promotion of NUS in West Africa: Some Recommendations

Scholars have recommended different measures and actions to promote the development of NUS in West Africa (Table 7).

Table 7. Recommendations for the promotion of NUS in West Africa.

Recommendation	Reference
Increasing substitutability across starchy staples, through the expansion of processed, convenience foods	Haggblade et al. [81]
Fostering research and innovation on NUS-based processed foods, including convenience foods and superfoods	Donkor et al. [71]
Strengthening the capacity and skills of young scientists on NUS	Rudebjer et al. [92]
Enabling better access of producers, especially smallholders, to markets	Darko-Koomson et al. [70]; Donkor et al. [78]; Etongo et al. [85]; Mbosso et al. [73]
Organizing traders and retailers in commercialization groups or cooperatives	Adegbola et al. [90]
Enhancing coherence and consistency among sectoral policies to promote NUS	Agbaeze et al. [69]; Ahmad et al. [53]; Assima et al. [59]
Focusing policy support on local crops that are highly consumed by the population (e.g., cassava/tubers) rather than on only imported ones (e.g., wheat)	Bricas et al. [82]; Liverpool-Tasie et al. [57]
Paying more attention to NUS in agricultural and other sectoral policies	Felicia et al. [83]; Nnamani [86]
Improving land tenure security among producers	Etongo et al. [85]
Promoting multi-stakeholder partnerships to develop innovative finance on NUS (e.g., cassava)	Darko-Koomson et al. [70]; Dogba et al. [62]; Okoruwa et al. [75]
Improving the coordination among the actors in NUS value chains	Poku et al. [79]
Empowering women and vulnerable groups in the value chains of NUS	Asare-Nuamah et al. [54]; Donkor et al. [61]; Missiame et al. [58]; Torvikey [67]
Increasing the participation and inclusion of farmers, especially smallholders, and value chain actors in agricultural development programs and projects	Ojediran et al. [74]
Improving access of NUS producers to extension and advisory services	Ezeh et al. [63]; Sanusi et al. [65]; Sanusi et al. [66]
Fostering research and development on NUS, including through multi-stakeholder innovation platforms	Dada et al. [96]; Sanyang et al. [84]
Strengthening and upgrading smallholder seed systems and seed producer groups of NUS	Dey et al. [60]
Introducing or updating the regulatory frameworks and strengthening institutional capacity on genetically modified crops	Adenle [88]

Table 7. *Cont.*

Recommendation	Reference
Promoting biofortification of staple crops to address food insecurity and malnutrition	Birol et al. [56]
Rethinking the agricultural development policy aimed at improving crop productivity to address food insecurity	Tittonell and Giller [93]
Developing integrated policies on the use of NUS for biofuel production that mitigate impacts on food security and biodiversity conservation	Adewuyi [68]; Dick and Wilson [77]

Given the high potential contribution of NUS to food and nutrition security, food self-sufficiency and food sovereignty as well as biodiversity conservation and climate change mitigation/adaptation, it comes as no surprise that many scholars call for their promotion, and policy and governance are central in this endeavor. Locally produced NUS can be valuable allies in food security, but this requires extending their shelf-life and investing in product development and processing to provide NUS-based convenience foods that are more adapted to modern consumers [71]. This, in turn, requires investments in the development of value chains as well as in research, innovation and development of products [81]. Indeed, increasing substitutability across starchy staples (e.g., cassava) can be achieved through the expansion of processed, convenience foods [81]. The food processing sector can play an important role in putting innovations of tasty plant-based food products into practice. Particular attention should be paid to strengthening the capacity and skills of young scientists on NUS [92]. Multi-stakeholder innovation platforms [84,96] can be instrumental not only in boosting research and innovation on NUS but also in improving the inclusiveness and participation of different actors, including women and smallholders. Indeed, promoting sustainable and fair value chains of NUS requires, inter alia, increasing the participation and inclusion of farmers, especially smallholders [74] and empowering women and vulnerable groups in the value chains [54,58,61,67]. In this context, the organization of value chains [90] makes them more efficient and can provide producers, especially smallholders, with better access to markets [70,73,78,85]. It is also crucial to improve the access of value chain actors, especially smallholder producers, to quality services such as finance [62,70,75] and extension and advisory services [63,65,66]. Also, securing land tenure is crucial to ensure the sustainable development of NUS production in West Africa [85]. The evidence shows that there can be no development of NUS without performing seed systems; in this case, strengthening and upgrading smallholder seed systems and seed producer groups of NUS [60] can be instrumental in developing seed production and distribution without undermining the role of producers or jeopardizing their seed sovereignty. However, the development of NUS value chains goes beyond production, and, for that, there is also a need to improve the coordination among all the actors of NUS value chains [79].

In general, it is necessary to revisit policies in West Africa. In particular, more attention to NUS should be paid in agricultural and other sectoral policies [83,86]. In this context, it is crucial to rethink the agricultural development policy paradigm focusing on improving crop productivity to address food insecurity [93], which has often been detrimental to NUS. Revisiting the national policies also implies focusing policy support on highly consumed local crops (e.g., cassava/tubers) rather than on only imported ones (e.g., wheat) [57,82]. However, the main way to promote NUS is to enhance coherence and consistency among sectoral policies [53,59,69]. This is important to seize all opportunities offered by NUS while avoiding pitfalls and managing trade-offs. For instance, the use of NUS as biofuels represents advantages in terms of climate change mitigation, but it is important to develop integrated policies on the use of NUS for biofuel production that mitigate potential negative impacts on food security and biodiversity conservation [68,77]. Similarly, promoting the biofortification of staple crops (e.g., cassava) is useful to address food insecurity and

malnutrition [56], but particular attention should be paid to the techniques used in order not to affect biodiversity conservation and, especially, food safety and health. On the same line, it is crucial to introduce or update the regulatory frameworks and strengthen institutional capacity on GM crops [88] to avoid and/or manage potential effects in terms of biodiversity loss (cf. land use) and biosafety.

4. Conclusions

There is a widespread agreement among scholars that West African food systems need to be transformed, and NUS can play a vital role in making these systems more sustainable and resilient. Policies are an essential component in the enhancement and mainstreaming of NUS in West African food systems.

The analysis of the scholarly literature dealing with policies and governance on NUS in West Africa shows that most existing studies focus on Nigeria and a few NUS, especially cassava. The domains of policy affecting NUS promotion and development related to climate change and energy; biodiversity conservation; seed systems; subsidies; food security, self-sufficiency and sovereignty; trade and import substitution; land use; food safety and health; research, innovation and development; and support and assistance systems. Meanwhile, the main governance domains are connected to institutional capacity as well as inclusiveness and participation. Beyond the effects of single policies and policy domains, the analysis suggests that sectoral policy coherence and consistency also affect the development of NUS. Furthermore, the interplay between policy and governance seems crucial in determining the real impacts of policies on intended results and expected outcomes.

In general, the existing literature suggests that the current policy and governance frameworks are not supportive or can, even, hinder the development of NUS in West Africa. In particular, current policies on input subsidies, biofuels, seeds and, even, import substitution seem unfavorable to the production and use of NUS. Indeed, these policies often support the productivity and intensification of agriculture at the expense of diversity, which is detrimental to minor, local crops, especially non-cereal ones. Similarly, the low power and lack of organization of smallholders, who are mainly engaged in NUS cultivation, suggest that also the current governance of agriculture and food systems in West Africa does not support NUS. Therefore, the region is called to create an enabling policy and governance environment to valorize its patrimony of local, traditional crops to adequately address the numerous challenges it faces. The promotion of NUS can also contribute to food sovereignty and food import substitution, which are two policy priorities in the region.

Further research is needed to understand the role of policy and governance in the mainstreaming of NUS and their integration into food systems and diets. Future studies should widen the scope in terms of geographical coverage in West Africa and NUS addressed to allow for more comparisons. Furthermore, there is a need for further research to understand the synergies and trade-offs between sectoral policies affecting NUS promotion and enhancement. Finally, it is important to better understand the interplay between governance and policy along the whole policy cycle (cf. design, implementation, monitoring and evaluation). Indeed, it seems that the major inclusiveness and participation of end-users, especially women and smallholders, can improve the efficiency, efficacy and sustainability of policies related to NUS and food systems.

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