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Examining the Impact of Agricultural Extension Services on Plant Conservation and Exploring its Implication for Extension Service

[1]Amafade U.G, [1]Eromedoghene E.O, [2]Iloba C.I, [3]Evwierhurhoma F.E

[1]Department of Agricultural Extension, Delta State University, Abraka, Nigeria
[2]Department of Forestry and Wildlife, Delta State University, Abraka, Nigeria
[3]Department of Agricultural Extension and Rural Development, Dennis Osadebay University, Asaba, Nigeria.
Corresponding author: Amafade Ughwe Goodluck
Email: amafade-ughwe@delsu.edu.ng
Orcid: https://orcid.org/0009-0004-2762-9308

Abstract: *The idea of plant conservation is essential for maintaining ecological stability and food security because plants are the basis for all life on Earth. Farmers and communities can benefit greatly from the knowledge and practices of plant conservation that are promoted by agricultural extension services. Agricultural extension services can assist farmers in implementing sustainable farming practices that promote biodiversity and plant protection by offering knowledge on these methods. However, there are challenges in integrating plant conservation into AES policies and programs, including limited funding and conflicting goals. AES can also help conserve and use endangered and underutilized plant species, which has consequences for rural development, livelihoods, and innovative agriculture. Stronger interdisciplinary cooperation and partnerships are required to increase the function and effects of AES on plants.*

Keyword: Agricultural extension service, Plant conservation, Sustainable farming practice, biodiversity, Plant protection, endangered, Underutilized, Interdisciplinary cooperation

Introduction

Agricultural extension services are crucial for enhancing food security and promoting sustainable farming methods. These services aid farmers, agricultural stakeholders, and rural communities in boosting agricultural productivity and revenue through technical assistance, education, and training.AES strives to promote sustainable practices among farmers and increase productivity by offering them modern technologies and relevant research findings. This is achieved through a range of activities such as workshops, field trips, training sessions, presentations, and visits to farms (Amafade, Okogu, Eromedoghene, Nwachukwu, 2024). Research has shown the positive impacts of AES on rural living and agricultural productivity. A study conducted in Ethiopia by Ali and Abdulai in 2010 discovered that agricultural extension services significantly increased crop yields and household income. In another study, AES was found to positively impact better practices and the adoption of rice cultivars in Bangladesh (Sarker et al., 2011).

In Nigeria, the Federal Ministry of Agriculture and Rural Development offers AES through a number of projects, including the National Programme for Food Security and the Agricultural Development Programme. Non-governmental organizations (NGOs) like the Nigerian Extension Society of Nigeria and the Sasakawa Africa Association (SAA) provide agricultural extension services. However, despite the benefits of AES, issues such as inadequate finance, lack of skilled personnel, and poor infrastructure remain key hurdles to its success (Abunyewa et al., 2021).

AES are vital for supporting sustainable agriculture practices, particularly plant conservation. Plant conservation refers to the efforts done to conserve the world's plant species from extinction. This involves preserving the genetic variety and protecting the habitats of diverse plant species (Goodluck & Joseph, 2024). The necessity of safeguarding these endangered vegetation species cannot be underestimated as it has several advantages for food security, the environment, and economics.

Food Security: To ensure food security for the world's rising population, plant protection is vital. Humans generally acquire their food from plants, therefore sustaining the diversity of plant life can contribute to the resilience and stability of agricultural systems. A research published in the Journal of Ethnobiology and Ethnomedicine (Özdemir et al., 2020) reveals that wild edible plants are essential sources of vitamins, minerals, and nutrients in many different countries. Crops' genetic diversity helps them to adapt to fluctuating environmental variables including pests, diseases, and climate change. A report by the Food and Agriculture Organization (FAO, 2010) revealed that agricultural output might grow by 20% as a result of maintaining genetic variation in crops. Conservation of wild plants and their habitats can assist maintain local populations' food security and provide essential sources of nourishment.

Ecosystem Stability: Plants are crucial to keeping our ecosystems' stability. Their roots serve in anchoring the soil and avoiding erosion, and they offer a variety of species food and shelter. Plants play a critical part in managing the Earth's climate by generating oxygen and absorbing carbon dioxide from the atmosphere. According to research that was published in the journal "Science," ecosystems all around the world are being disrupted as a result of the loss of plant species (Dirzo et al., 2014). Because of this, maintaining plants helps to keep ecosystems healthy and able to continue delivering a number of ecosystem services, such clean soil, water, and air.

Economic Benefits: There are substantial financial advantages to plant conservation as well. Numerous plant species, including those used for medicine, decoration, and lumber, are valued economically. Local communities can profit from the conservation of these species and assist preserve their sustainable use. As per a report published by the United Nations Environment Programme (2010), protected locations, such as national parks and wildlife reserves, can produce large revenue from tourism since they usually incorporate essential plant ecosystems.
Nigeria is home to over 4,715 recognized plant species, some of which are endangered. This suggests that the country has a great range of plant life. Numerous plant species, both endangered and underutilized, can be found in Nigeria. These include African mahogany (Khaya senegalensis), African sandalwood (Baphia nitida), African nutmeg (Monodora myristica), African pear (Dacryodes edulis), African nutmeg (Monodora myristica), African yam bean (Sphenostylis stenocarpa), Pigeon pea (Cajanus cajan), African eggplant (Solanum macrocarpon), and many more.

However, a number of issues, including deforestation, habitat degradation, urbanization, and agricultural development, pose a threat to Nigeria's plant diversity. These issues have resulted in habitat fragmentation and plant species loss, which have a significant influence on the nation's biodiversity and food security. To ensure the conservation of plant species in Nigeria, numerous strategies have been implemented. The Federal Government of Nigeria has established many national parks and wildlife reserves to protect biodiversity. The government also issued the Endangered Species Decree no. 11 of 1985, which controls the exploitation and sale of endangered plant species in Nigeria.

In Nigeria, a number of non-governmental organizations (NGOs) have also made a considerable contribution to the cause of plant conservation. Among these groups is the Nigerian Conservation Foundation (NCF), which promotes sustainable development practices and develops public awareness of the value of plant conservation in order to conserve Nigeria's biodiversity. Planting botanical gardens and arboretums is another endeavor to protect plant species in Nigeria. The Jos National Park and the Lekki Conservation Centre are two examples of botanical gardens that are home to various plant species. These centers provide opportunities for study, education, and ecotourism, which encourage plant conservation.

Morever, community-based projects have been formed in Nigeria to protect plant species. The Participatory Forest Management (PFM) initiative is one of such attempt that involves incorporating local inhabitants in forest conservation activities. These programs have demonstrated to be beneficial in encouraging sustainable resource use practices, which in turn has led to the conservation of plant species.

The purpose of AES and its consequences in increasing plant conservation.
AES play a vital role in spreading plant conservation practices and knowledge among farmers and communities in Nigeria. These services give farmers with the required information, tools, and skills to improve their agricultural methods, raise crop yields, and enhance sustainable farming techniques. In Nigeria, AES are offered through government agencies, non-governmental organizations, and private sector firms.

Technology transfer: One of the primary functions of AES in supporting plant conservation practices is through the distribution of information on plant biodiversity and conservation. This involves teaching farmers and communities on the need of maintaining and conserving plant genetic resources, as well as providing knowledge on how to identify, manage, and conserve plant species. Through this information transfer, farmers and communities can learn about the different plant species in their region, their ecological and economic significance, and how to properly manage and conserve them. Farmers can learn about new technologies through extension bulletins, field days, and other extension events.

Technical assistance: AES works with farmers to provide technical help in order to encourage plant conservation measures. Examples of sustainable farming practices that can assist to improve soil fertility, halt soil erosion, and protect plant genetic resources are agroforestry, intercropping, and crop rotation. In order to help farmers boost crop yields and lower crop losses due to pests and diseases, AES offers instruction on the use of contemporary agricultural techniques and technologies, such as improved seed varieties, irrigation systems, and pest management tactics. AES also aids in the creation of seed banks so as to preserve plant genetic resources to be used by future generations.

Technical support: AES in promoting plant conservation practices is through the provision of technical assistance to farmers. Agroforestry, intercropping, and crop rotation are examples of sustainable farming methods that can help to increase soil fertility,

stop soil erosion, and preserve plant genetic resources. AES also provide training on how to use modern techniques and technologies in farming, such as better seed types, irrigation systems, and pest management strategies, which can help farmers increase crop yields and decrease crop losses from pests and diseases. Also, AES assist develop seed banks, which are crucial for protecting plant genetic resources. Farmers can deposit their seeds in the seed banks for future generations to use.

Community participation: AES play a vital role in increasing community participation in plant conservation measures. This involves working closely with local communities to identify their needs and concerns, and to involve them in the creation and execution of plant conservation projects. This participatory method serves to foster trust and collaboration between farmers and extension workers, and can lead to the creation of more effective and sustainable plant conservation techniques.

Training and education: AES train farmers on sustainable farming practices. Farmers can learn about sustainable farming practices through workshops, seminars, and demonstrations. Several studies have indicated that training programs offered by agricultural extension services boosted the adoption of sustainable farming methods (Abebaw et al., 2013; Raza et al., 2015).
Advisory services: AES offers farmers advise on sustainable farming strategies. Extension workers can give farmers with advise on best practices for their unique agricultural systems as well as information on the technologies and resources at their disposal.

Advisory services: AES provide advise services to farmers on sustainable farming practices. Farmers can consult with extension agents on the best practices for their individual agricultural systems and learn about the tools and technologies available to them.

Monitoring and evaluation: AES monitors and assesses the adoption of sustainable agriculture techniques. This makes it possible to make the required adjustments to the extension operations and assists in discovering gaps and impediments in the adoption of sustainable practices.

Challenges of integrating plant conservation within AES plans and policies

Lack of awareness: Farmers may have minimal awareness of the importance of plant conservation, the causes of biodiversity loss, and the benefits of biodiversity to agriculture

Resource constraints: AES providers may be restricted by lack of resources, notably financial and human resources, to give effective support for integrating plant conservation into agriculture policies and initiatives.

Conflicting priorities: AES suppliers are often busy with addressing critical issues including farmers' economic demands, crop yield and protection, leaving little room to consider plant conservation.

Poor coordination: Goodluck, Enoh, Precious, Tega, Okogu, & Endurance, (2024) noted that integrating plant conservation into AES plans and policies requires a coordinated effort across numerous stakeholders. Therefore, lack of coordination across agencies may lead to duplication of efforts or gaps in delivery of help.

Opportunities of integrating plant conservation within AES plans and policies

There are tremendous benefits of integrating plant conservation into AES plans and policies. Biodiversity, for instance, adds to soil fertility, insect management, and water conservation, all of which are crucial for agricultural productivity.

Economic benefits: Integrating plant conservation into AES plans and policies can provide extra cash sources for farmers. For instance, boosting the cultivation and selling of indigenous plant species can lead to an improved diversification of production and enhanced environmental sustainability.

Policy support: Various national and international policies provide frameworks for the integration of conservation into agriculture. For example, the United Nations Sustainable Development Goals (SDGs) have set targets for biodiversity protection, while national governments are supporting this absorption through policies like the National Biodiversity Strategies and Action Plans (NBSAPs).

Partnerships: The integration of plant conservation into AES programmes and policies needs collaboration among different stakeholders such as agricultural extension service providers, farmers, non-governmental organizations, and government agencies.

The function of AES promoting the conservation and utilization of underutilized and endangered plant species
The development of agroforestry techniques is one of the key ways that extension services can contribute in the protection and usage of underutilized and endangered plant species. Crops, trees, and cattle are all included in a single system through the integrated land use method termed agroforestry. By supplying a favorable habitat for the growth and proliferation of endangered plant species, this technique can contribute in their conservation and protection. Through the diversified use of land resources, it also benefits farmers economically (Akinyemi & Adekunle, 2018)

Another method that AES may promote the conservation and usage of underutilized and endangered plant species is through the promotion of value addition and marketing. They can provide training and technical help to farmers on the processing and packaging of underused plant species into high-value goods such as herbal medicines, cosmetics, food supplements, and colors. This can assist to diversify the revenue sources of farmers and generate new economic opportunities for local communities (Olumide et al., 2020).

Implication of plant conservation for rural development, livelihoods, and agricultural innovations

Plant conservation is crucial for the development of rural areas, livelihoods, and agricultural innovation. The protection of plant species plays a key role in the sustainability and well-being of both human and environmental systems. Here are some consequences of plant conservation for rural development, livelihoods, and agricultural innovation.

Livelihoods: Plant conservation protects plant biodiversity that is crucial for the wellness of rural people. Rural residents depend on plants for food, medicine, fuel, and other items. Plant diversity is critical in guaranteeing a stable supply of these products and services. The protection of plant species can also contribute to the generation of cash and the development of rural livelihoods. For example, the cultivation of vulnerable plant species such as the African yam bean (Sphenostylis stenocarpa) has been found to be a useful source of food and revenue for rural farmers in Nigeria (Adebayo et al., 2012).

Agricultural innovation: Plant conservation supports agricultural innovation by offering a diversity of plant species that can be employed in cross-breeding to generate new and better crops. For instance, the conservation of plant genetic resources has enabled the production of better varieties of major crops such as cassava, cowpea, and maize, which have enhanced yields, nutritional quality, and resistance to pests and diseases (Aina et al., 2012). With a range of crops, farmers can establish a sustainable cropping system that diversifies their income and meets the problems of changing weather conditions and other environmental factors (Goodluck, et al, 2024).

Rural development: Plant conservation contributes to rural development by strengthening the sustainability of rural communities. When plants are conserved, their habitats are likewise conserved, which implies that the natural resources essential for rural livelihoods are protected. Conserving flora also means supporting ecotourism and other sustainable economic activities that help rural people.

Ecosystem services: Plant conservation creates important ecosystem services, which are essential for the wellbeing of rural populations. These services include soil formation and conservation, water conservation, pollination, and climate management. The conservation of plant species contributes to the maintenance of healthy ecosystems that supply these services, which are vital for rural development.

Recommendation

Interdisciplinary collaboration and partnerships are important to strengthen the role and impact of AES on plant conservation and sustainable agriculture in Nigeria. Plant conservation and sustainable agriculture require a range of experience and knowledge from many sectors. Therefore, a holistic approach that leverages many disciplines is important to address the complex difficulties facing plant conservation and sustainable agriculture in Nigeria.

Collaborative agreements between AES providers and research institutions can boost the adoption and implementation of evidence-based methods that promote plant conservation and sustainable agriculture. Extension workers can promote the dissemination of research findings and innovations to farmers, while research institutions can provide technical and scientific support to extension workers. This partnership could increase the effectiveness and sustainability of agricultural methods through informed scientific evidence (Adebayo et al., 2020).

Partnerships between AES providers, government agencies, and non-governmental groups can also strengthen the creation and implementation of policies that encourage plant conservation and sustainable agriculture. Extension workers can provide useful insights into local community needs and goals. Government agencies can provide institutional support and enough money for conservation interventions, while non-governmental groups can enhance community engagement and ownership of conservation programs (Otufale & Oghenekaro, 2019).

Moreover, the integration of social sciences, economics, and politics into AES programs could significantly boost the impact of plant conservation initiatives. For example, economists might engage with extension workers to identify the economic benefits of plant conservation and create incentives for farmers to adopt sustainable agricultural methods (Bashir et al., 2018). Social scientists can help to facilitate the involvement of local communities in conservation activities, boosting community ownership and sustainability (Olabisi et al., 2018).

Conclusion

It is crucial to safeguard endangered plant species because of their economic benefits, the function that they play in ecosystem stability and food security. For this to be done, AES need to play a vital role in plant conservation by supporting sustainable agriculture methods and the preservation of local plant species. The role of AES has enormous consequences for sustainable development, biodiversity conservation, and the preservation of cultural property. Despite the challenges such as lack of awareness, resource constraints, conflicting priorities and poor coordination, there are opportunities for improving the effectiveness of AES in plant conservation, which will contribute to sustainable agriculture, biodiversity conservation, and the preservation of cultural heritage.

Interdisciplinary collaboration and partnerships are vital to strengthening the role and impact of AES on plant conservation and sustainable agriculture in Nigeria. Collaboration between extension workers, research institutions, government agencies, non-governmental organizations, and experts in social sciences, economics, and policy can design a training programs to address the needs, priorities, and challenges of different stakeholders more which turn can improve conservation efforts and promote sustainable agriculture more effectively.

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