Bioresources Development Conference (BDC26)
NABDA
Journal of Biotechnology Research
ISSN: 1119-0531
Special Issue Vol. 5(3): (2026)

Underutilized Weed Flora as Bioresources for Sustainable Biotechnology and Food Security in Federal university Otuoke, Ogbia Local Government Area, Bayelsa State.

[1]Sam, N., [1]Eneni, R. I., and [2]Eduok, I. N.

[1]Deptartment of Biology, Faculty of Science, Federal University Otuoke, Bayelsa State

[2]Oxbow Lake Yenagoa, Bayelsa State

Corresponding Author: nel4real2003@yahoo.com, +2348064043245

Article ID: NJBR-BDC26-B009 | Received: 30 April, 2026 | Accepted: 2 May, 2026

ABSTRACT

The growing demand for sustainable biotechnology, food security, and environmental conservation has increased interest in identifying underutilized plant resources with potential socioeconomic and ecological value. This study evaluated selected weed species occurring within the West Campus of Federal University Otuoke, Bayelsa State, Nigeria, as potential bioresources for sustainable biotechnology and environmental management. Field surveys were conducted using a stratified quadrat sampling approach across different habitat conditions, and species were identified using standard taxonomic procedures. Selected species were assessed based on documented medicinal, nutritional, and ecological attributes. The study identified several weed species with significant bioresource potential. Medicinally important species included Euphorbia hirta, Senna alata, and Ageratum conyzoides, while Peperomia pellucida, Physalis angulata, and Ipomoea batatas were recognized for their nutritional value. Ecologically important species such as Panicum maximum, Axonopus compressus, and Eleusine indica contributed to soil stabilization, biomass production, and ecosystem support. In addition, Commelina benghalensis exhibited multiple functional attributes, including medicinal, nutritional, antioxidant, and ecological importance. The findings demonstrate that weed flora can serve as valuable sources of food, medicine, and ecosystem services while contributing to sustainable biotechnology and environmental management. The study supports a shift from indiscriminate weed eradication toward selective utilization and integrated management approaches that recognize beneficial weed species as important biological resources for biodiversity conservation, food security, and sustainable development. However, the assessment was based primarily on field observations and published literature; therefore, further studies involving phytochemical, nutritional, molecular, and bioactivity analyses are required to further more validate the bioresource potential of these species and support their utilization in biotechnology and sustainable resource management.

Key words:

INTRODUCTION

The increasing demand for sustainable food systems, renewable biological resources, and environmentally friendly technologies has stimulated interest in the circular bioeconomy, which promotes the efficient use of biological resources to produce food, energy, materials, and other value-added products while reducing environmental impacts (Stegmann *et al.*, 2020). Within this framework, underutilized plant species are increasingly recognized as valuable resources for sustainable biotechnology, food security, and biodiversity conservation.

Underutilized and neglected plant species have attracted significant scientific attention because of their potential to improve dietary diversity, nutritional security, and ecosystem resilience (Knez *et al*., 2024; Ojuederie *et al*., 2024). Despite their ecological and socioeconomic importance, many of these species remain poorly studied and underexploited, particularly in tropical regions where plant diversity is high.

Among such plants, weeds are often overlooked because they are traditionally regarded as undesirable competitors of cultivated crops. However, recent studies have shown that many weed species possess medicinal, nutritional, and ecological value and can contribute to ecosystem functioning through nutrient cycling, biomass production, soil stabilization, and habitat provision for beneficial organisms (Chauhan, 2020). In addition, weed communities can support biodiversity and enhance ecosystem resilience when appropriately managed (Chauhan, 2020; Marshall *et al*., 2003).
The Niger Delta region of Nigeria supports a rich diversity of weed flora due to its favourable climatic conditions and varied habitats. Many weed species occur abundantly in disturbed environments such as roadsides, agricultural lands, fallow fields, and institutional landscapes (Aigbokhan, 2014). Despite their widespread occurrence, the potential contributions of these species to biotechnology, food security, and environmental management remain inadequately documented (Knez *et al*., 2024; Ojuederie *et al*., 2024).

University campuses provide suitable environments for studying weed diversity because they contain heterogeneous habitats exposed to different levels of human disturbance. Such environments often support diverse ruderal and semi-natural plant communities with potential medicinal, nutritional, and ecological importance (Marshall et al., 2003). Assessing these species can provide valuable information for sustainable biotechnology, biodiversity conservation, and food security initiatives (Chauhan, 2020; Ojuederie *et al*., 2024).

This study, therefore, evaluates selected weed species occurring within the West Campus of Federal University Otuoke, Bayelsa State, Nigeria, intending to identify species of medicinal, nutritional, and ecological importance and assess their potential as underutilized bioresources for sustainable biotechnology and food security.

MATERIALS AND METHODS

Study Area

The study was conducted within selected vegetation habitats of the West Campus of Federal University Otuoke, Ogbia Local Government Area, Bayelsa State, Nigeria. The area lies within the humid tropical rainforest zone of the Niger Delta and is characterized by high rainfall, high relative humidity, and mean temperatures of 25–32°C, conditions that favour the growth of diverse weed species (Aigbokhan, 2014; Nigerian Meteorological Agency, 2024). The campus consists of both disturbed and semi-natural habitats influenced by human activities such as construction and vegetation clearing. These varied habitat conditions provide a suitable environment for assessing the occurrence and bioresource potential of selected weed species.

Research Design

A stratified ecological survey design was adopted to assess selected weed species with potential bioresource value within the study area. The study site was divided into high- and low-disturbance zones based on the intensity of human activities, including construction, trampling, and vegetation clearing. The stratified approach facilitated the sampling of weed species across different habitat conditions and ensured adequate representation of species within the study area. Weed species encountered during field surveys were identified, documented, and evaluated for their medicinal, nutritional, ecological, and ethnobotanical importance, with an emphasis on species of potential relevance to sustainable

biotechnology, food security, and environmental management (Kent, 2012).

Sampling Procedure

A stratified quadrat sampling technique was employed within the designated disturbance zones to document the occurrence and distribution of weed species. Quadrats were established at representative sampling locations, and all weed species encountered within each quadrat were identified and recorded.

Data obtained from field observations were used to identify selected species with medicinal, nutritional, ecological, and ethnobotanical importance. The quadrat method provided a standardized approach for vegetation assessment and ensured adequate representation of weed species across the different habitat conditions present within the study area (Kent, 2012).

Identification and Selection of Bioresource Species:

Weed species encountered during field surveys were identified using morphological characteristics such as growth habit, leaf arrangement, stem features, and reproductive structures. Species identification was verified using standard taxonomic literature and regional floras to ensure accuracy and consistency (Simpson, 2010; Aigbokhan, 2014). Following identification, species were screened for their potential as bioresources based on documented medicinal, nutritional, ecological, and ethnobotanical importance. Priority was given to species with recognized applications in traditional medicine, food systems, soil improvement, and environmental management.

Data Analysis

Data obtained from field surveys were analyzed using descriptive statistics to summarize the occurrence and distribution of selected weed species within the study area. Species were grouped according to their documented medicinal, nutritional, ecological, and multipurpose attributes to assess their potential contributions to sustainable biotechnology, food security, and environmental management.

The ecological and biotechnological significance of the selected species was further assessed qualitatively based on their reported roles in traditional medicine, nutritional supplementation, soil stabilization, erosion control, and other ecosystem-support functions.

RESULT

Selected Weed Flora with Bioresource Potential

Field observations identified weed species with notable medicinal, nutritional, and ecological importance within the study area. Medicinally important species included *Euphorbia hirta*, *Senna alata*, and *Ageratum conyzoides*, while *Peperomia pellucida* and *Physalis angulata* were recognized for their nutritional value.

Ecologically important species such as *Panicum maximum* and *Axonopus compressus* contributed to biomass production, soil stabilization, and erosion control. The occurrence of these species highlights the potential of selected weed flora as valuable bioresources that can support sustainable biotechnology, food security, and environmental management.

Functional Classification of Selected Bioresource Species

The selected weed species were classified according to their documented medicinal, nutritional, ecological, and multipurpose functions. Their potential relevance to sustainable biotechnology, food security, and environmental management is summarized in Table 1.

NABDA
Journal of Biotechnology Research
ISSN: 1119-0531
Special Issue Vol. 5(3): (2026)

Table 1: Functional Classification of Selected Weed Species as Bioresources

Functional Category	Representative Species	Biotechnological Relevance
Medicinal plants	*Euphorbia hirta* (antimicrobial and anti-inflammatory properties; Khursheed *et al.*, 2022), *Senna alata* (antifungal activity and treatment of dermatological infections; Oladeji *et al.*, 2020), *Ageratum conyzoides* (wound-healing, antibacterial, and anti-inflammatory properties; Xu *et al.*, 2023)	Phytomedicine and antimicrobial drug development
Nutritional plants	*Peperomia pellucida* (edible herb rich in nutrients, antioxidants, and bioactive compounds; Tuan *et al.*, 2024), *Physalis angulata* (nutrient-rich edible plant containing essential macro- and micronutrients; Pillai *et al.*, 2022) *Ipomoea batatas* (nutrient-rich food crop containing carbohydrates, dietary fibre, vitamins, minerals, and antioxidants; Islam, 2024)	Food security and nutraceutical development
Soil stabilizers	*Axonopus compressus* (dense ground-cover grass that protects soil surfaces), *Panicum maximum* (high biomass production and extensive root system that supports soil conservation; González Marcillo *et al.*, 2021), *Eleusine indica* (fibrous-rooted grass that contributes to soil stabilization in disturbed habitats)	Erosion control, soil stabilization, and ecosystem restoration
Multipurpose species	*Commelina benghalensis* (medicinal, nutritional, antioxidant, and ecological importance; Dagne *et al.*, 2024)	Phytomedicine, food supplementation, and ecosystem support

DISCUSSION

The findings of this study demonstrate that several weed species occurring within the Federal University Otuoke environment possess important medicinal, nutritional, and ecological attributes that support their potential as bioresources. Although weeds are commonly regarded as undesirable plants, increasing evidence suggests that many species contribute to human well-being, ecosystem functioning, and sustainable resource utilization (Chauhan, 2020; Knez *et al.*, 2024). The occurrence of such species in the study area highlights the need to reassess their value beyond their traditional classification as agricultural nuisances.

Several of the species identified have well-documented ethnomedicinal importance. *Euphorbia hirta*, *Senna alata*, and *Ageratum conyzoides* are widely recognized for their antimicrobial, anti-inflammatory, antifungal, and wound-healing properties, supporting their continued use in traditional healthcare systems and their potential relevance in pharmaceutical research (Khursheed *et al.*, 2022; Oladeji *et al.*, 2020; Xu *et al.*, 2023). The presence of these species in the study area emphasizes the importance of conserving useful weed flora and exploring their bioactive compounds for potential therapeutic applications.

Some of the selected species also possess considerable nutritional value. *Peperomia*

pellucida, *Physalis angulata*, and *Ipomoea batatas* contain valuable nutrients, antioxidants, vitamins, and other bioactive compounds that may contribute to dietary diversification and food security (Pillai *et al*., 2022; Tuan *et al*., 2024; Islam, 2024). The utilization of such underexploited plant resources could support local food systems and reduce dependence on a limited number of conventional crops.

The study further identified species with multiple functional roles. *Commelina benghalensis*, for example, has been reported to possess medicinal, nutritional, antioxidant, and ecological importance, highlighting the multifunctional nature of some weed species and their potential contributions to sustainable livelihoods, biodiversity conservation, and environmental management (Dagne *et al*., 2024).

The ecological importance of selected species was also evident. *Panicum maximum*, *Axonopus compressus*, and *Eleusine indica* contribute to soil protection, erosion control, biomass production, and ecosystem stability. These functions are particularly important in tropical environments where intense rainfall and land-use disturbances can accelerate soil degradation. The presence of these species within the study area highlights their potential role in sustainable land management and environmental conservation.

Overall, the findings support growing calls for selective and integrated weed management rather than indiscriminate weed eradication. Recognizing beneficial weed species as sources of medicine, food, biomass, and ecosystem services can contribute to biodiversity conservation while supporting sustainable biotechnology and resource utilization (Stegmann *et al*., 2020; Ojuederie *et al*., 2024). Consequently, underutilized weed flora should be viewed not only as agricultural constraints but also as valuable components of tropical ecosystems with significant ecological and socioeconomic benefits.

Although this study highlights the bioresource potential of selected weed species occurring within the study area, the assessment was based primarily on field observations and evidence from published literature. Laboratory investigations, including phytochemical screening, nutritional analysis, molecular characterization, and bioactivity evaluation, were beyond the scope of the study. Future research should focus on these areas to provide empirical validation and support the development of weed-based biotechnological products and sustainable resource utilization strategies.

CONCLUSION

This study demonstrates that selected weed species in the Federal University Otuoke environment have significant potential as underutilized bioresources for sustainable biotechnology, food security, and environmental management. Several species were identified as having medicinal, nutritional, and ecological importance, highlighting the diverse benefits that weed flora can provide beyond their conventional perception as undesirable plants. The findings emphasize the value of beneficial weed species as sources of traditional medicine, food, biomass, and ecosystem services. Species such as *Euphorbia hirta*, *Senna alata*, *Ageratum conyzoides*, *Peperomia pellucida*, and *Physalis angulata* demonstrate considerable potential for supporting human well-being, while grasses such as *Panicum maximum*, *Axonopus compressus*, and *Eleusine indica* contribute to soil protection and environmental sustainability.

Overall, the study supports a shift from indiscriminate weed eradication to selective use and integrated management approaches that recognize beneficial weed species as valuable biological resources. Promoting the sustainable use and conservation of these underutilized species can contribute to biodiversity conservation, sustainable biotechnology

development, improved food security, and enhanced ecosystem resilience within tropical environments.

RECOMMENDATIONS

1. Selective weed management practices should be adopted to conserve species with medicinal, nutritional, and ecological value.
2. Further phytochemical, nutritional, and molecular studies should be conducted to validate the bioresource potential of identified weed species.
3. Beneficial weed species should be incorporated into sustainable land management and agroecological practices where appropriate.
4. Bioprospecting initiatives should be encouraged to explore the pharmaceutical, nutraceutical, and biotechnological applications of underutilized weed flora.

REFERENCES

1. Aigbokhan, E. I. (2014). *Annotated checklist of vascular plants of Southern Nigeria* (2nd ed.). Uniben Press.
2. Chauhan, B. S. (2020). Grand challenges in weed management. *Frontiers in Agronomy, 1*, 3. https://doi.org/10.3389/fagro.2019.00003
3. Dagne, A., Hailu, W., & Teka, T. (2024). The genus *Commelina*: Focus on distribution, morphology, traditional medicinal uses, phytochemistry and ethnopharmacological activities–An updated literature review. *Heliyon, 10*(10), e30945. https://doi.org/10.1016/j.heliyon.2024.e30945
4. González Marcillo, R. L., Castro Guamán, W. E., Guerrero Pincay, A. E., Vera Zambrano, P. A., Ortiz Naveda, N. R., &Guamán Rivera, S. A. (2021). Assessment of Guinea grass (*Panicum maximum*) under silvopastoral systems in combination with two management systems in Orellana Province, Ecuador. *Agriculture, 11*(2), 117. https://doi.org/10.3390/agriculture11020117
5. Islam, S. (2024). Sweetpotatoes [*Ipomoea batatas* (L.) Lam]: The super food of the next century? An intensive review on their potential as a sustainable and versatile food source for future generations. *Cogent Food & Agriculture, 10*(1), 2397553. https://doi.org/10.1080/23311932.2024.2397553
6. Kent, M. (2012). *Vegetation description and data analysis: A practical approach* (2nd ed.). Wiley-Blackwell.
7. Khursheed, A., Mujeeb, M., Alqahtani, A. S., et al. (2022). *Euphorbia hirta* as a gold mine of high-value phytochemicals: A comprehensive review of its pharmacological activities and possible role against SARS-CoV-2. *Biomedical Research and Therapy, 9*(2), 4880-4898.
8. Knez, M., Ranić, M., &Gurinović, M. (2024). Underutilized plants increase biodiversity, improve food and nutrition security, reduce malnutrition, and enhance human health and well-being: Let's put them back on the plate! *Nutrition Reviews, 82*(8), 1111-1124. https://doi.org/10.1093/nutrit/nuad103
9. Marshall, E. J. P., Brown, V. K., Boatman, N. D., Lutman, P. J. W., Squire, G. R., & Ward, L. K. (2003). The role of weeds in supporting biological diversity within crop fields. *Weed Research, 43*(2), 77-89. https://doi.org/10.1046/j.1365-3180.2003.00326.x
10. Nigerian Meteorological Agency. (2024). *Annual climate review and seasonal climate prediction bulletin*. Nigerian Meteorological Agency.
11. Ojuederie, O. B., Igwe, D. O., Ludidi, N. N., &Ikhajiagbe, B. (2024). Editorial: Neglected and underutilized crop species for sustainable food and nutritional security: Prospects and hidden potential. *Frontiers in Plant Science, 14*, 1358220. https://doi.org/10.3389/fpls.2023.1358220
12. Oladeji, O. S., Adelowo, F. E., Ayodele, D. T., & Odelade, K. A. (2020). Ethnobotanical description and biological activities of *Senna alata*. *Evidence-Based Complementary*

and Alternative Medicine, 2020, 2580259. https://doi.org/10.1155/2020/2580259
13. Pillai, J. R., Wali, A. F., Menezes, G. A., Rehman, M. U., Wani, T. A., Arafah, A., Zargar, S., & Mir, T. M. (2022). Chemical composition analysis, cytotoxic, antimicrobial and antioxidant activities of *Physalis angulata* L.: A comparative study of leaves and fruit. *Molecules, 27*(5), 1480. https://doi.org/10.3390/molecules27051480
14. Simpson, M. G. (2010). *Plant systematics* (2nd ed.). Academic Press.
15. Stegmann, P., Londo, M., &Junginger, M. (2020). The circular bioeconomy: Its elements and role in European bioeconomy clusters. *Resources, Conservation and Recycling: X, 6*, 100029. https://doi.org/10.1016/j.rcrx.2019.100029
16. Tuan, C. T., Nguyen, T. H., Tran, T. N., & Nguyen, H. T. (2024). *Peperomia pellucida*: Ingredients, antioxidant properties, and health benefits–A review. *Foods, 13*(23), 3868. https://doi.org/10.3390/foods13233868
17. Xu, X., Wang, Y., Li, Z., Zhang, Y., & Chen, H. (2023). Recent advances in phytochemistry, pharmacology, and therapeutic potential of *Ageratum conyzoides* L. *Frontiers in Pharmacology, 14*, 1154876. https://doi.org/10.3389/fphar.2023.1154876.

How to Cite This Article
Sam, N., Eneni, R. I., and Eduok, I. N. (2026). Underutilized Weed Flora as Bioresources for Sustainable Biotechnology and Food Security in Federal university Otuoke, Ogbia Local Government Area, Bayelsa State. NABDA Journal of Biotechnology Research, 5(3), 70-76.