



# Blueprint for Sustainable Management and Utilization of Nigeria's Bioresources

Edited by

**Christie Oby Onyia, B. O. Solomon,  
A. M. A. Imevbore & O. T. Ogundipe**



Federal Ministry of Science & Technology



## Blueprint for Sustainable Management and Utilization of Nigeria's Bioresources

**T**he mono-cultural nature of the Nigerian economy which is about ninety-five per cent dependent on crude oil; has blinded our planners to the richness of the country in bioresources. This is in spite of the fact that over seventy per cent of the Nigerian populace derive their livelihood from subsistence farming while most of the rural poor depend on wild species of biodiversity.

This blueprint therefore seeks to define a roadmap for the conservation, management and utilization of Nigeria's bioresources such that it can combine her profile's current developmental needs and aspirations, even as it upholds the country's biodiversity and her ecological environment.

It will no doubt provide a useful guide to conservationists, manufacturers, researchers, bio-pharmacists, the academia and students of environmental sciences and related disciplines.

### Project Co-ordinator

Christie Oby Onyia, Ph.D.  
Director, Environmental Biotechnology  
and Bioconservation Department  
National Biotechnology Development Agency  
Abuja, Nigeria.



Concept Publications

BIORESOURCES AND  
ENVIRONMENTAL STUDIES



## Chapter 6

# Action Plan: Policy Implementation / Programmes for Sustainable Management of Nigeria's Bioresources

by

Okafor, J. C.<sup>1</sup>, Solomon, B. O.<sup>2</sup>, Onyia, O. C.<sup>2</sup>,  
Imevbore, A. M. A.<sup>3</sup> and R. C. Ughasoro<sup>4</sup>

### 6.1 Introduction

**T**HIS blueprint has documented several important aspects of the process, status, goals and policy for sustainable management of Nigerian bioresources. As can be seen from the different chapters of this document, the path to sustainable development and management of Nigerian bioresources involves a multidisciplinary and participatory approach.

Thus, for achievement of effective, sustainable development and management, government, communities, industries, private firms, and non-governmental organizations must work together to plan, monitor and manage Nigerian bioresources. An action plan embodying policy implementation of identified programmes must be put in place, to ensure that all hands are on deck to achieve sustainable development. This therefore means that government, the community and household, for example, must work together. The result of the work carried out from the Okwangwo Division of Cross River National Park has proved that a participatory approach

<sup>1</sup> No. 7, Dona Drive, off Ihiala Street, Independence Layout, Box 3856, Enugu.

<sup>2</sup> National Biotechnology Development Agency, Abuja.

<sup>3</sup> Environmental Resources Management Ltd. (ERML)

<sup>4</sup> Federal Ministry of Science and Technology

involving all stakeholders can yield substantial revenue from non-timber products far in excess of revenue from timber.

It is imperative; therefore, that greater attention should be given to the bioresources endowment of the nation in order to maximize their contribution to the national economy.

## **6.2 Objectives**

The single most important objective of the blueprint is to combine the development needs and aspirations of the present generation without compromising the ability of the future generation, while also maintaining ecological integrity of the Nigerian biodiversity and supporting environment.

Specifically, these objectives include:

- (i) Promotion of sustainable utilization of biological resources;
- (ii) Conservation of plants, animals, and microbial genetic resources;
- (iii) Documentation of indigenous knowledge of our bioresources.
- (iv) Taking inventory of bioresources leading to development of database for our bioresources as well as information management and dissemination;
- (v) Research on and development of our bioresources so as to discover and develop novel products as well as improve the production of our indigenous plants and animals;
- (vi) Training and continuous education of experts in the field of bioresources;
- (vii) Promotion of and collaboration in bioresources development with private and public sectors, researchers, industry and the academia;
- (viii) Development of bioresources entrepreneurship, especially for natural medicine, agriculture and industry.

## **6.3 Programmes/Projects**

The National Action Plan of Bioresources management and development will cover a wide range of activities involving food and agriculture, bioresources conservation, environmental management, industrial/medical programmes with each sector



involving biotechnology approaches and methodologies as indicated in the table below:

**Table 6.1:** List of Bio-Resources Programmes under Biotechnology Sectors

S/N	Biotechnology Sector	Suggested Programmes
1.	Food and Agriculture	<p>(a) Priority areas of R&amp;D to be pursued include:</p> <ul style="list-style-type: none"> <li>- Radical improvement of crop yields, including forages,</li> <li>- Integrated pest management,</li> <li>- Increased efficiency of food and animal production,</li> <li>- Improved technologies for animal vaccine production,</li> <li>- Increased agro-processing and storage standardization of starter cultures and bio-purification of indigenous fermented foods.</li> </ul>
2.	Bioresources Conservation	<p>(a) Developing community-based conservation measures</p> <p>(b) Expanding the present network of protected ecosystems to provide greater coverage for the broadest biodiversity hotspots in the country,</p> <p>(c) Undertaking bioresources inventory, monitoring and documentation;</p> <p>(d) Supporting germplasm exploration, collection characterization, improvement as well as the development of indigenous plants and animals in the ecological zones of the country;</p> <p>(e) Supporting programmes for the domestication of flora and fauna based on local preference rating and other socio-economic criteria;</p> <p>(f) Establishing zonal co-ordination of bioresources activities in the country;</p>



		<p>(g) Training on taxonomy and systematic; using DNA Barcoding technique</p> <p>(h) Ethnobotany of leafy vegetables, spices and condiments;</p> <p>(i) Tree domestication with local partnership;</p> <p>(j) Novel product formulation;</p> <p>(k) Proximate analysis for industrialization with gender specification;</p> <p>(l) Inventory and bioprospecting of bioresources and database establishment; and management</p> <p>(m) Compilation of Nigerian fauna and flora;</p> <p>(n) Tissue culture technique for difficult-to-germinate species.</p>
3.	Environmental Programmes	<p>(a) Identifying priority areas, especially with regard to:</p> <ul style="list-style-type: none"> <li>- Waste management, bioremediation of contaminated soils and waste water treatment,</li> <li>- Processing and managing industrial wastes,</li> <li>- Desertification, deforestation and erosion control and afforestation,</li> <li>- Organic farming through composting and Biofertilizer utilization,</li> <li>- Development of biofertilizers using micro-organisms</li> </ul> <p>(b) Mushroom production from wastes, e.g., from <i>Nypa</i> palm and water hyacinth harvesting as a substrate for mushroom production;</p> <p>(c) Generating wealth from waste bioresources;</p> <p>(d) Development of biofertilizers using micro-organisms;</p>



		<p>(e) Ecological engineering strategies for climate change, e.g. use of agro-forestry for rehabilitation of fragile or degraded ecosystem;</p> <p>(f) Medicinal plant research with local participation;</p> <p>(g) Novel product formulation based on bioresources;</p> <p>(h) Establishment of bioremediation and biomonitoring policies and programmes.</p>
4.	Industrial/Medical Programmes	<p>(a) Investigating systematically the presence of active chemical substances and developing those that would provide leads for medicals, pharmaceuticals and flavours from indigenous plants;</p> <p>(b) Bioprospecting of natural molecules:</p> <ul style="list-style-type: none"> <li>- Isolation and characterization of marker compounds for the standardization of herbal drugs,</li> <li>- Plant-based drug bioavailability enhancers, including rapid screening methods methods for bioenhancers,</li> <li>- In vitro screening of plants for anti-cancer agents and neoplastic agents,</li> <li>- Nigerian herbal pharmacopoeia, Development of hypoglyceramic agents of plant origin (anti-diabetic effects),.</li> <li>- Search for traditional herbal drugs for immunomodulators,</li> <li>- Development of traditional herbal drugs as adaptogen (survival under reduced pressure and hypoxia, protection against insulin-induced hypoglycemia and stress-induced ulcer,</li> </ul>



		<ul style="list-style-type: none"> <li>- Co-ordinated programme on development and commercialization of bioactive substances from plant sources;</li> </ul> <p>(c) Natural products: cultivation, improvement and processing:</p> <ul style="list-style-type: none"> <li>- Development and field evaluation of drought-tolerant strains</li> <li>- Development and tissue culture protocols for the above,</li> <li>- Development of hops,</li> <li>- Establishment of genebanks in various ecological zones: seed bank, field genebank and greenhouse facility</li> </ul> <p>(d) Microbial biotechnology:</p> <ul style="list-style-type: none"> <li>- Screening of enzymes,</li> <li>- Enzymatic resolution of specific drugs,</li> <li>- Mass production of bioinoculants by fermentation process,</li> <li>- Commercialization of technology on bioinoculants,</li> <li>- Evaluation of total microbial load and pathogen load on specific materials, e.g. stored products,</li> <li>- Screening and development of new and indigenous enzymes,</li> <li>- Molecular and chemical marker studies of identified plants,</li> <li>- Production of Baker's yeast, mushroom and single-cell protein,</li> <li>- Processing and preservation of foods,</li> <li>- Production of ethanol and other industrial chemicals from industrial wastes,             <ul style="list-style-type: none"> <li>- Production of industrial enzymes, particularly the amylolytic, proteolytic and lipolytic for use in the food, chemical and allied industries,</li> </ul> </li> </ul>
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		<ul style="list-style-type: none"> <li>- Locally designing, fabricating and constructing bioreactors for SMEs,</li> <li>- Production of microbial polysaccharides</li> <li>- Production of food additives, e.g. vitamins, amino acid, sweeteners and flavours,</li> <li>- Developing human antibiotic production capability,</li> <li>- Attaining self-sufficiency in vaccine production,</li> <li>- Developing monoclonal antibodies' production capability</li> <li>- Capacity building on industrial biotechnology, including curricular development in tertiary institutions.</li> </ul>
5.	Other Support Programmes	<ul style="list-style-type: none"> <li>(a) Formulating and enforcing standards and guidelines on bioresources utilization, bio-prospecting and biosafety;</li> <li>(b) Strengthening capacity of technicians, technologists and university research groups;</li> <li>(c) Promoting networking of scientists nationally and internationally;</li> <li>(d) Adopting interdisciplinary approach to R&amp;D proposals on biotechnology in bioresources management;</li> <li>(e) Forging linkages with other centres of excellence;</li> <li>(f) Strengthening institutional groups and linkages;</li> <li>(g) Establishing regional network on under-utilized tropical and sub-tropical fruit crops;</li> <li>(h) Research and capacity building potentials.</li> </ul>

#### **6.4 Strategies**

The strategies for attaining the above will include:

- (i) Development of a regulated bioprospecting capacity through well- coordinated programmes;
- (ii) Research and development of our indigenous plants and animals so as to characterize them and evaluate their economic potentials;
- (iii) Development of well-equipped laboratories for sustainable exploration and exploitation of bioresources of the ecological zones;
- (iv) Discovery and development of novel biologically active chemical substances from indigenous natural resources, typically providing leads for new pharmaceutical and nutraceutical agents, flavours, fragrances and crop protection agents;
- (v) Establishment of entrepreneurial activities from associated life sciences research and development;
- (vi) Application of information technology to bioresources development, including the setting up of databases;
- (vii) Development and co-ordination of clearing house mechanism and access to genetic resources, including genetically modified organisms (GMOs) and products;
- (viii) Establishment of type culture or reference strain collection;
- (ix) Establishment of networks in the field of bioresources development;
- (x) Establishment of appropriate legislation to protect this national patrimony in the areas of conservation, exploration and capacity building.

#### **6.5 Tools**

These strategies will be implemented by the following tools:  
Pursuing a developmental focus.

The overall objective is to see that biotechnology will bring benefits to all; therefore, an effective bottom-up approach which allows for local participation and enables one to capture their local



knowledge will be adopted. For instance, to succeed, community forestry project should be considered an integral part of forestry planning and management aimed at contributing to the livelihoods and income to local communities on a sustainable basis. It is not just a forestry project sited in a rural area. There is need therefore for a planned strategy for integrating scientific and technical information with social requirements of the communities where the project is implemented. It requires a bottom-up instead of a top-bottom approach where decisions are merely passed down to communities on what should be done and how and when.

TAUNGYA approach (where the local people, farmers and forestry staff have a relationship in crop development is a typical example. Other tools include:

- (i) *People's Participation*: This is essential both at the planning and implementation stages. Participants can plough in local knowledge and improve the efficiency of the choice and siting of the project as well as optimize its local benefits, profit and sustainability. Local participation will also facilitate the allocation of the land, labour and security and other local resources, required for the project.
- (ii) *Political Commitment*: The government should have a long-term commitment towards bioresources development and programmes. The trend of abandoning projects midway should be discouraged.
- (iii) *Relevance to Host Community*: Assessment of site suitability and project relevance to local community must justify the decision to establish the project. Other important criteria include market prospects, demand and supply projections in relation to the envisaged production.
- (iv) *Incentives*: Community projects often require motivation and encouragement to ensure community participation; where such incentives are lacking, projects fail. Examples of useful incentives include, inputs such as grants, free or subsidized seedlings, training, fertilizers, pesticides, payment of bonuses and assistance with sales of produce and processing facilities.

- (v) *Promotion of Indigenous Knowledge and Technology:* Harnessing indigenous knowledge of the local community is an asset to the successful implementation of bioresources projects. The knowledge of the people in conservation and development is a cost-saving device and a source of inspiration to other stakeholders.
- (vi) *Effectiveness of Local Organization:* Successful bioresources development programmes must recognize and respect local organizations in the communities in which they are located. It is also necessary for grass roots mobilization and extension on the purpose and implementation strategy of the project. In this regard, the role of non-governmental organizations (NGOs) is also recognized.
- (vii) *Research and Extension Outfits:* Provision of channels of information dissemination is essential for the technical know-how on all aspects of programme implementation, including research, development and utilization potentials. Protocols for bioresources developed should be developed and extended through clearly identified channels.

#### **6.5.1 Community Sustainability Science**

This deals with local participation in conservation and sustainable development of bioresources in any particular area, especially in a rural setting (Okafor, 2003). The community sustainability science which relates to community bioresources embraces most of the ways by which such resources directly affect the lives of people, particularly rural people. It covers a range of activities which provide labour and income.

Benefits from such community projects can be broadly categorized into three groups (FORMECU, 1989):

- (i) Production of goods for household consumption, e.g. fuel wood, fruits and medicine;
- (ii) Employment and cash income, e.g. forest-seedling raising, sale of fuel wood, fruits, honey, medicines;
- (iii) Environmental effects like improving soil fertility, flood and soil erosion control, ecotourism recreation, research and education, etc.



## 6.6 Devolution

In a country such as ours, where we have a federal system of government in which responsibilities are shared among various tiers for natural resources management, devolution of power to the community level has been found to be vital. According to Sheona *et al.*, (2002), the last two decades have witnessed a paradigm shift in conservation and natural resources management (NRM) away from costly state-centred control towards approaches in which local people play a much more active role. Such reforms aim at increasing resource user participation in NRM decisions and benefits by restructuring the power relations between the central state and communities through the transfer of management authority to local-level organizations. Therefore, the devolution of authority will be of immense benefit important to some of the strategies outlined in this Plan. In such cases, the benefit to the local people should consider both direct and indirect benefits.

## 6.7 Monitoring and Evaluation (M & E):

### Past and On-Going Activities

Monitoring and evaluation of past and on-going activities, e.g. short-term and long-term projects should form an important component of the action plan. They will play major roles in focusing attention on research, development and utilization (RDU) of Nigerian bioresources for the preservation of traditional knowledge of the use of bioresources by various Nigerian communities for medicine, food, culture, ecological services, miscellaneous products, subsistence and cash income.

Several non-governmental organizations (NGOs), government ministries, parastatals, communities and individuals have played significant roles in the past and are still doing so at present in the development, management and conservation of Nigerian bioresources. Their activities have produced good results towards identification, documentation and capacity-building and training on the country's bioresources. Notable examples of such institutions are:

Nigerian Conservation Foundation (NCF); Nigerian Environment Study Team (NEST), MAN and Biosphere (MAB),

World-wide Fund for Nature (WWF) for its work on National Park, Oban and Okwangwo Divisions, Federal Environmental Protection Agency (FEPA), Agricultural Development Projects (ADP). Others include: Project Development Institute (PRODA), Natural Resources Conservation of Nigeria (NARESCON), Tropical Forestry Action Plan (TFAP), National Agricultural Research Project (NARP), International Council for Research in Agroforestry (ICRAF); International Institute for Tropical Agriculture (IITA), Forestry Research Institute of Nigeria (FRIN), Forest Herbarium Ibadan (FHI), Federal Department of Forestry (FEDFOR), Forestry Management and Co-ordinating Unit (FORMECU), Raw Materials Research and Development Council (RMRDC), Nigerian Field Society (NFS), Forestry Association of Nigeria (FAN), and Overseas Development Institute (ODI).

It follows therefore, that meaningful monitoring and evaluation plan aimed at the sustainable management of Nigerian bioresources must involve the institutions mentioned above, among others.

## **6.8 Suggested Projects and Duration**

### ***(a) Immediate and Short-term***

- (i) Training on taxonomy and systematic;
- (ii) Ethnobotany of leafy vegetables, spices and condiments;
- (iii) Blueprint on bioresources of Nigeria;
- (iv) Establishment of regional network on underutilized tropical and subtropical fruit crops;
- (v) Implementation of bioreremediation and biomonitoring of important degraded ecosystems, such as the wetlands of the Niger Delta Area.

### ***(b) Medium-term***

- (i) Medicinal plants' research with local participation ;
- (ii) Tree domestication with local partnerships;
- (iii) Novel products' formulation based on bioresources;
- (iv) Proximate analysis for industrialization with gender specifications.



**(c) Long-term**

- (i) DNA barcoding of Nigeria's bioresources with emphasis on medicinal plants and animals;
- (ii) Inventory and bioprospecting of bioresources and database establishment;
- (iii) Ecological engineering strategies for climate change, e.g. use of agroforestry for rehabilitation of fragile or degraded forest ecosystems;
- (iv) Compilation of Nigerian flora;
- (v) Tissue culture techniques for difficult-to-germinate species.

**6.9 Indicators**

In the estimation of the performance and effectiveness of the above projects, the following indicators will be adopted:

- (a) Quantity and quality of production;
- (b) Benefit derived and contributed to livelihood of communities, i.e. with poverty alleviation potentials;
- (c) Technology developed and transferred, with prospects for industrialization;
- (d) Environmental impacts, whether positive or negative;
- (e) Overall contribution to conservation and sustainable utilization of bio-resources;
- (f) Research and capacity-building potentials.

**6.10 Implementation Levels and Time Frame**

Successful implementation of bioresources management programmes will encompass the following levels of participation:

**(a) Individual and Community Levels**

At the individual and community levels, training and information sharing are crucial to ensure sustainability and equity. This is necessary to preserve the indigenous knowledge and practices involved in establishment and management. Thus, sharing of information may be achieved through workshops involving community leaders and youths, keeping in mind gender specification or consideration.

***(b) Government Level***

One of the most important ways that government (federal, state and local) can contribute to the successful implementation of community bioresource projects is by allocation of funds and other resources to campaigns that will encourage interest and generate awareness of the economic, sociological and ecological importance of the project. Funds are also required for local conservation, initiatives and formation of village forest management committees. Other ways in which governments can play an important role in the community forestry project are by enacting and enforcing legislation to prohibit bush burning and indiscriminate clearing of forests and uncontrolled forest exploitation. Training of local forestry personnel is also necessary. Provision of security for the infrastructural facilities and project establishment and capital is also essential. Marketing and industrialization based on the project production is also an incentive.

***(c) International Level***

Depending on the nature and scope of the community forestry project, there may be need at the international level for personnel to be trained to conduct taxonomic, ecological and ethnobotanical studies of forests and woodlands, especially in the case of tourism project and medicinal plant exploitation. Transboundary bioresources exploitation should also be considered at this level.

***(d) Emergency status and Ecological Spread***

In addition, consideration or cognizance must also be given to the disaster nature, prospects of emergency situation, as well as ecological coverage of the project. The National Action Plan must be implemented to give adequate attention to the diverse ecosystems and their components as indicated below:

(i) *Land* – Rocks, Land or Terrain, Wetlands, and Soil.

(ii) *Water* – Marine and coastal waters, Rain and inland waters, and Ground water.

(iii) *Plants* – Forest plants, Savannah and woodland, Arid land,

Aquatic plants (in both saltwater and freshwater environments), and Food plants (for man and animals).

- (iv) *Fauna* – Domesticated animals, Fisheries, and Wildlife.
- (v) *Others* – Bees, Termites, Caterpillars, and Periwinkles.

#### 6.11 Institutional Collaboration

It is necessary to identify the components of the natural resources which require international collaboration for their successful management. Issues of management of trans-boundary resources, migratory organisms/pests, are best tackled at the international level.

With respect to time frame, programmes and projects within this Action Plan must be classified in accordance with their nature and duration into one of the following categories: Immediate, Short-term, Medium-term and Long-term. It will be the responsibility of the National Implementation Committee to identify and determine the appropriate categories of programmes and projects, their locations and the enlistment of the participating institutions.

#### 6.12 National Bioresources Implementation Committee

The Institutional Framework for plan implementation requires guidelines for sound management and rational utilization of the natural resources in Nigeria which must include all relevant stakeholders in the public and private sector. Accordingly, it is hereby proposed to set up a National Bioresources Implementation Committee comprising the following:

- (i) The Federal Ministries of :
  - (a) Agriculture, Water Resources and Rural Development,
  - (b) Environment , Housing and Urban Development,
  - (c) Science and Technology,
  - (d) Trade and Industry,
  - (e) Energy.
- (ii) Raw Materials Research and Development Council (RMRDC);



- (iii) Small and Medium-Scale Enterprises Development Agency of Nigeria (SMEDAN);
- (iv) National Biotechnology Development Agency (Federal Ministry of Science and Technology) – Secretariat;
- (v) State Government Ministries;
- (vi) Non-Governmental Organizations (NGOs) and International Agencies;
- (vii) Governments, Local Participating Committees and Village Conservation Development Committees;
- (viii) Women Organizations;
- (ix) Universities, Polytechnics and Research Institutes.

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