NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: AGB 404

COURSE TITLE: BIO RESOURCES MANAGEMENT (3 UNITS)

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Introduction

Biodiversity or Biological diversity literally means different forms of living organisms in any given space and time. It basically describes the various life forms expressed at all levels (the genetic, species and ecosystem levels). Biodiversity is a measure of species richness, species diversity and species uniqueness within specific locations.

The loss of biodiversity has been shown in the abundance of species of highly desired varieties and the diminishing of other acclaimed low quality varieties. This record is higher in developed countries where many habitats have been loss in exchange to industrial and agricultural activities. This reduction in ecosystem exposes living things to adverse conditions and possible elimination.

Nigeria has rich and varied biological resources, which supports its social and economic activities. These resources contribute immensely to the development of agriculture and industrial activities as it promotes food production, raw materials for industries and others. With increase in human population, demands for biological resources, industrialization and biotechnology in agricultural activities, there is reduction in diversity. These have increasing global impacts. It is important that the environment be conserved to sustain diversity of life for the benefit of man.

What you will learn in this course

This course guide tells you briefly what the course is about, what course materials you will be using and how you are to use them.

Course Aims

The aim of this course is to provide a good understanding of the levels biodiversity and their losses; the biotechnological process of preserving the genetic materials, their management and appropriation.

Course Objectives

In addition to the aims above, this course sets to achieve some objectives. After going through this course, you should be able to:

i. Explain the origin of biodiversity as well as name the levels of biodiversity

ii. State the characteristics and explain the elements of the ecosystem

iii. Explain the status of biodiversity and name local species in the Nigerian ecosystem

iv. Explain the types and discuss the uses of biodiversity

v. Define genetic erosion and identify their causes

vi. State indirect and direct causes of genetic erosion in Nigeria

vii. State the effects and methods of managing genetic erosion

viii. Define plant biotechnology and explain traits of interest in plants

ix. Discuss the benefits of plant biotechnology to farmers, producers and consumers

x. Explain the potential risks of plant biotechnology in forestry

xi. State the need as well as strategies for conserving forest trees

xii. Define germplasm, germplasm conservation and explain obstacles to the use of plant genetic resources

xiii. Discuss germplasm appropriation as well as its status in Nigeria

xiv. State the purposes of the Nigerian Conservation Foundation

xv. Identify the constraints to bio-resource management in Nigeria

xvi. Explain bio-resource legislations in Nigeria

xvii. Discuss approaches to biodiversity management

Working through this Course

The ideas have been carefully put together to ensure that adequate explanations are made to enhance better understanding of the course. You are therefore, encouraged to spend quality time to

study this course and ensure that you attend tutorial sessions where you can ask questions, assess your understanding of concepts and compare your knowledge with that of your classmates.

Course Materials

You will be provided with the following:

i. Course guide

ii. Five (5) modules of content of nineteen (18) units

iii. Recommended textbooks and lists of reference materials.

Study Units

There are eighteen (18) study units in this course. This is arranged as follows:

Module1: Biological Diversity

Unit 1: Historical Perspectives

Unit 2: The Ecosystem

Unit 3: The Nigerian Ecosystem

Unit 4: Types and Uses of Biodiversity

Module 2: Genetic Erosion

Unit 1: Genetic Erosion

Unit 2: Genetic Erosion in Nigeria

Unit 3: Effects and Management of Genetic Erosion

Module 3: Plant Biotechnology

Unit 1: Plant Biotechnology

Unit 2: Historical Perspectives

Unit 3: Benefits of Plant Biotechnology

Unit 4: Applications of Biotechnology in forestry

Unit 5: Forest Biotechnology and Conservation

Module 4: Germplasm Appropriation

Unit 1: What is Germplasm

Unit 2: Germplasm Conservations

Unit 3: Germplasm Appropriation

Module 5: Bio-resource Management and Legislation

Unit 1: Bio-resource Management

Unit 2: Biotechnological Legislation

Unit 3: Approaches to Biodiversity Management

Each unit includes a table of contents, introduction, specific objectives, recommended textbooks and summaries of key issues and ideas. At intervals in each unit, you will be provided with a number of exercises or self-assessment exercises. These are to help you test yourself on the material you have just covered or to apply it in some way. The value of these self-tests is to help you gauge your progress and to reinforce your understanding of the material. At least one tutor-marked assignment will be provided at the end of each unit. The exercises and the tutor-marked assignments will help you in achieving the stated learning objectives of the individual units and of the course.

Recommended Texts:
More recent publications are recommended for further reading.

- Buza, L; Young, A and Thrall, P.(2000) : Genetic erosion, inbreeding, and reduced fitness in fragmented populations of the endangered tetraploid pea Swainsona recta. Biological Conservation 93:177–186.

- Ledig FT. 1991. Secret extinctions: the loss of genetic diversity in forest ecosystems. In: Fenger MA, Miller EH, Johnson JF, Williams EJR, editors. Our living legacy: proceedings of a symposium on biological diversity. Victoria (BC): Royal British Columbia Museum. Pp 127–140.

- Ledig FT. 1992. Human impacts on genetic diversity in forest ecosystems. Oikos 63:87–108.

- McGuire PE, Qualset CO, editors. 1990. Genetic resources at risk: scientific issues, technologies, and funding policies. Davis (CA): University of California, Genetic Resources Conservation Program. Report No. 5.

- Neira M.(2011): Biodiversity. http://www.panda.org

- Oladipo, E.(et.al)(2001): First National Biodiversity Report on Nigeria. Biodiversity Report on Nigeria. Accessed on May 5, 2011. From http://www.pabiodiversity.org/economic.html
- Silvert W.(2011): The meaning of biodiversity. http://bill.sivert.org/pdf/Biodiversity.pdf
- Templeton AR, Shaw K, Routman E, Davis SK. 1990. The genetic consequences of habitat fragmentation. Annals of the Missouri Botanical Garden 77:13–27.

Assessment

There are two components of assessment for this course.

These are :

i. Tutor-Marked Assignments (TMA's)

ii. End of course examination

Tutor-Marked Assignment

The tutor-marked assignment (TMA) is the continuous assessment component of your course. It accounts for 30% of the total score. The TMAs must be answered before you are allowed to sit for the end of course examination. Thus, it is expected of you to apply information, knowledge and techniques obtained from the course. The TMAs would be returned after you have done the assignment.

Final Examination and Grading

The examination concludes the assessment for the course. To prepare for this examination, revise all the areas covered in the course. Revision of all the exercises and the tutor-marked assignments before the examination will also be of help to you. The revision should start after you have finished studying the last unit. This examination constitutes 70% of the whole course. You will be informed of the time for the examination. It may or not coincide with the university semester examination.

Summary

AGB 404 intends to introduce you to Bio-Resource Management. By the time you complete studying this course, you will be able to answer the following questions:

1. Explain the origin of biodiversity.
2. Name the levels of biodiversity
3. State the characteristics of the ecosystem and explain its elements

4. Explain the status of biodiversity and name local species in the Nigerian ecosystem
5. Explain the types and discuss the uses of biodiversity
6. Define genetic erosion and identify their causes
7. State indirect and direct causes of genetic erosion in Nigeria
8. State the effects and methods of managing genetic erosion
9. Define plant biotechnology and explain traits of interest in plants
10. Discuss the benefits of plant biotechnology to farmers, producers and consumers
11. Explain the potential risks of plant biotechnology in forestry
12. State the need for forest conservation
13. Name strategies for conserving forest trees
14. Define germplasm and germplasm conservation
15. Explain obstacles to the use of plant genetic resources
16. Discuss germplasm appropriation as well as its status in Nigeria
17. State the purposes of the Nigerian Conservation Foundation
18. Identify the constraints to bio-resource management in Nigeria
19. Explain bio-resource legislations in Nigeria
20. Discuss approaches to biodiversity management.

The questions are inexhaustible. There are many more you can answer. We wish you luck and success with the course and hope you will find it both helpful and interesting.

Best wishes!

Module1: BIOLOGICAL DIVERSITY

Unit 1 HISTORICAL PERSPECTIVES

Contents

1.0 Introduction

In this unit, we will consider biodiversity; its origin, various definitions proffered as well as its levels. It is interesting to note that most times, biodiversity is relatively considered to be a new concept but its first prominence was in the 1980s. It is an abstract and extraordinarily complex concept that is often used in the current public policy to explain issues regarding the biotic components in our environment. Several specialists in different fora have proffered various definitions, which present biodiversity not

simply about animal populations or conservation, but as an umbrella-style political approach to the interactions between human populations and the environment. More often than not, it is simply used as a proxy description of habitat or wilderness; when the phrase 'biodiversity loss' is used, it is more often than not a description of habitat loss or deforestation.

2.0 Objectives

By the end of this unit, you should be able to:

- Explain the origin of biodiversity
- define biodiversity
- name the levels of biodiversity

3.0 Main Body

3.1 Historical Perspectives

The term 'biological diversity' was used first by wildlife scientist and conservationist Raymond F. Dasmann in the 1968 lay book "A Different Kind Of Country" advocating conservation. This term was widely adopted only after more than a decade, when in the 1980s it came into common usage in science and environmental policy. Thomas Lovejoy, in the foreword to the book "Conservation Biology", introduced the term to the scientific community. Until then the term "natural diversity" was quite common, introduced by The Science Division of The Nature Conservancy in an important 1975 study, The Preservation of Natural Diversity".

By the early 1980s, Robert E. Jenkins, Lovejoy and other leading conservation scientists at the time in America advocated the use of "biological diversity". The term's contracted form 'biodiversity' may have been coined by W. G. Rosen in 1985 while planning the 1986 National Forum on Biological Diversity organized by the National Research Council (NRC). Biological diversity first appeared in a publication in 1988 when entomologist E. O. Wilson used it as the title of the proceedings of that forum.

From the period earlier referred to, the term "biological diversity" has achieved widespread use among biologists, environmentalists, political leaders and concerned citizens. A similar term in the United States is 'natural heritage'. It predates the others and was more accepted by the wider audience interested in conservation. Natural heritage is broader than biodiversity because it includes geology and landforms (geodiversity).

3.2 Definitions of Biodiversity

'Biological diversity' or 'biodiversity' can have many interpretations. These interpretations vary from one biologist, conservationist or ecologist to another, and a definition of biodiversity that is altogether simple, comprehensive, and fully operational is unlikely to be found. Some scientific definitions used by resource managers and ecologists and which can help to develop an understanding of the broad concept of biodiversity, have been identified and were presented as:

- The variety and variability among living organisms and the ecological complexes in which they occur.
- The full range of variety and variability within and among living organisms and the ecological complexes in which they occur, and which encompasses ecosystem or community diversity, species diversity and genetic diversity.
- The variety of life and its processes including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.
- The totality of genes, species and ecosystems in a region.

These various definitions, amongst others, seem to describe in different manners in most circumstances and present a unified view of the traditional levels at which biological variety has been identified.

3.3 Levels of biodiversity

Biodiversity can be seen at different basic levels which could be regarded either as a building block or as a unified component. These levels include:

- Genetic diversity: this is the combination of different genes found within a population of a single species and the pattern of variation found within different populations of the same species.
- Species diversity: this is the variety and abundance of different types of organisms which inhabit an area.

- Ecosystem diversity: it encompasses the variety of habitats that occur within a region, or the mosaic of patches found within a landscape.

4.0 Conclusion

Everything in an ecosystem is part of the web of life. When we try to pick anything out by itself, we find that it is hitched to others. The various species, carrying different genetic components interact and depend upon one another for what each offers. This differences are identified in their characteristics, needs and locations.

5.0 Summary

In this unit you have learnt that;

.the term biodiversity as a concept seems new but has its historical background.

.the definition of biodiversity has different perspectives depending on the school of thought from which this being viewed.

. biodiversity is defined in a way as the variety and variability among living organisms and the ecological complexes in which they occur.

. levels of biodiversity include genetic diversity, species diversity and ecosystem diversity.

6.0 Tutor Marked Assignment

1. Explain the origin of biodiversity.
2. Define biodiversity
3. Name the levels of biodiversity.

7.0 References

.Leveque, C. & J. Mounolou (2003) Biodiversity. New York: John Wiley. ISBN 0-470-84957-6

.Margulis, L., Dolan, Delisle, K., Lyons, C. Diversity of Life: The Illustrated Guide to the Five Kingdoms. Sudbury: Jones & Bartlett Publishers. ISBN 0-7637-0862-3

Unit 2 The Ecosystem

Contents

8.0 Reference/ Further Readings

1.0 Introduction

This unit will focus on the Ecosystem. You will appreciate its features and elements which are quite unique. Ecosystem is the contracted form of the ecological system. The relationships or interactions existing amongst the different biotic components as well as with abiotic components form an ecological system. Within the system, the biotic community cannot function independently as much as abiotic components, directly or indirectly, are influenced by the activities of the biotic components

2.0 Objectives

By the end of this unit, you should be able to:

- define the ecosystem
- state the characteristics of the ecosystem
- explain the elements of the ecosystem

3.0 Main Body

3.1 The Ecosystems

The ecosystem may be defined as either an artificially created or natural unit, consisting of biotic and abiotic factors. In real situations, natural units are normally considered for various observations and studies. These natural units can be large or small, depending on prevailing conditions, natural occurrences and availability of factors (living and non-living) . These bears significant influence on natural units and constitutes marked differences observed therein.

As such, ecosystems differ in structure and status. These differences bear direct influence on the variety of biotic components it can support without collapsing. As the biotic community depends, on the abiotic resources found therein, the sustainability of the ecosystem depends on their population and level of interactions existing within.

3.2 Characteristics of Ecosystem

There is much more to biodiversity than the numbers of species and kinds of ecosystems. Ecosystem exhibits three primary attributes: composition, structure, and function. Within each location, these attributes interact one with another.

Ecosystem components: These refer to the inhabiting species in all their variety and richness. The various flora and fauna occupy habitants with distinctive features; and to which they are best –fit. They provide genes for various and diverse interactions.

Ecosystem structure: It refers to the physical patterns of life forms which are different, relative to ecological conditions of an area. This could be described in terms of coastal, forest or arid areas as shown by the type of vegetation and corresponding animal lives, beginning from the most delicate to the most complex in that habitat.

Ecosystem functions : Ecosystem functions are hard to see in action but the results can be felt. These among others, include:

i. The biogeochemical cycles: These are essential for recycling of useful environmental materials.

ii. The natural disturbances: These entail wildfires which release nutrients to the soil, weed- out of weak trees and reset of the succession clock. Other natural disturbances are energy of falling water, which creates spawning beds for salmon even while it carves a mountain's bones; and the release of oxygen into the atmosphere.

These ecological processes create landscapes and diverse environmental conditions out of life itself. These features are all interdependent and thus support biological diversity.

3.3 Elements of the Ecosystem

The functioning ecosystem has different elements which constitute its uniqueness. The uniqueness of functioning ecosystem lies in the degree of diversity found in it. Biodiversity is so complex but has, as the most basic element , its genetic variation.

Genetic variation: Genetic variation occurs within individual populations and between populations of species. The variations observed reflects differences in their:

-physical characteristics

-viability

-productivity

-resilience to stress, and

-adaptability to change.

Distinct species: This term can be described in terms of their abundance or decline which most often attracts concern. Species, such as American elk, rainbow trout and ponderosa pine are in abundance. Others like woodpecker, Siler's pincushion cactus, the Nigerian hippotamus, manatee, crocodile, and others, have populations that are much reduced or which may even face extinction. The reduction in specific species necessitates their conservation. This perpetuates native species in numbers and distributions that provide a high likelihood of continued existence.

Associations of species: Associations of species are often called biological communities. They are usually recognized as distinct stands, patches or sites such as old-growth forests, riparian areas or wetlands. These communities form the biotic parts of ecosystems.

The variety of species in an ecosystem is a function of its structural and functional characteristics, the diversity of its ecological processes and the physical environment. This variety are actively expressed as the elements or make-up of an ecosystem.

4.0 Conclusion

The ecosystem bears a direct influence on biodiversity. Its functions, size and structure determine the richness and variety of inhabiting species. An alteration in the structure, size and function, affects, most times grievously, the biotic diversity within a locati**5.0 Summary**

In this unit you have learnt that;

.characteristics of biodiversity biodiversity are ecosystem components, ecosystem structure and ecosystem functions.

.elements of ecosystem are genetic variation, distinct species and association of species, and

6.0 Tutor Marked Assignment

1. Define the ecosystem

2. State the characteristics of the ecosystem.

3. Explain the elements of the ecosystem

7.0 References

. Keystone Center, “Final Consensus Report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands,”1991

.World Growth(2009) Forestry and Biodiversity : A Healthy Report. Pp1-37

.World Resources Institute , World Conservation Union, and United Nations Environment Programme, Global Biodiversity Strategy,”1992

Unit 3 The Nigerian Ecosystem

Contents

1.0 Introduction

Ecosystems differ one from another. These differences can be assessed, based on the type and quantity of available vegetation. The vegetation is determined by the edaphic factors and the region's climatic condition. The vegetation cover bears direct influence on the type and population of animals accommodated within the specific ecological location. Thus, the species richness in a location is a functional tool to ascertain the status of an ecosystem. Therefore, you will be expected in this unit to come to terms with the status of biodiversity in Nigeria. You will be taken through some indigenous plant species in Nigeria

2.0 Objectives

By the end of this unit, you should be able to:

- explain the status of biodiversity in the Nigerian ecosystem
- name local species of plants within the Nigerian ecosystem

3.0 Main Body

3.1 The Nigerian Ecosystem

The Nigerian ecosystem is rich in biodiversity as it is endowed with a variety of plant and animal species. These species occur in different numbers within the country's vegetation that range from the mangrove, along the coast in the south to the Sahel in the north. Most of the biodiversities sustain the rural economy and with massive dependence, the rate of depletion increases uncontrollably.

Of the 150 food-plants commonly consumed by man, 115 are indigenous African species and the world's major regions of crop diversity include among others the delta of Niger River as well as the humid forest zone of West and Central Africa. Endemism, which is the proportion of species not found anywhere else in the world, is high in Africa. In the Tropical Africa, at the general level, it has been estimated to be 45%. Report show that countries of West and Central Africa sub-regions have identified a large number of under- utilized species that are important to the livelihoods of local population.

On the list are:

- 7 cereals
- 8 legumes
- 4 roots and tubers
- 8 oil crops
- 31 fruits and nuts
- 17 vegetables and spices
- 4 beverages
- 38 medicinal plants and
- 44 genera of forages.

These groups of plants also constitute the food groups used by the Nigerian populace. Reports show that an expanded list of twenty-four indigenous leaf vegetables are eaten in southwest Nigeria only. In addition to serving as vegetables and fruits, some plants are also sources of traditional medicine in southwest Nigeria, as shown in the usage of twenty-four indigenous leaf vegetables.

Within the Nigerian ecosystem, there are several species of local bio-products, with regional differences.

3.2 Local Species in Nigeria

The Nigerian ecosystem is rich in indigenous biotic components. An index of 7,895 plant species identified in 338 families, 2,215 genera and 22,000 animal species, confirms that the country is endowed with a variety of plant and animal species. These animal and plant species occur in different numbers within the country's vegetation, sustaining the rural economy. There are also exotic species, which have adjusted to the climatic conditions; they make up part of the biotic community.

3.2.1 Local Species of Cereals

s/no	Local Cereals	English Name	Local Name	Parts Used
1	*Zea mays*	Maize	Akpakpa	Seeds
2	*Sorghum vulgare*	Guinea Corn	---------	Seeds
3	Oryz*a sativa*	Rice	Edesi	Seeds

3.2.2 Local Species of Legumes

s/no	Local Legumes	English Name	Local Name	Parts Used
1	*Vigna sinensis*	Cowpea	Nsama	Seeds
2	*Phaseolus vulgaris*	Kidney beans	Okofi	Seeds
3	*Mueona urens*	Velvet beans	Ibaba	Seeds
4	*Conophorun tetracarpidum*	----------	Ekporo	Seeds

3.2.3 Local Species of Fruit Trees

S/no	Fruit Trees	English Name	Local Name	Edible Part
1	Chrysophyllum albidun	Star Apple	Udara	Fruits
2	Dacryodes edulis	African pear	Eben	Fruits
3	Persea Americana	Avocado	Eben mbakara	Fruits
4	Treculia africana	African Breadfruits	Adian	Seeds
5	Mangifera indica	Mango	Manko	Fruits
6	Euginea oweriensis	Apple	Apple	Fruits
7	Cola argentea	----------	Ndiya	Fruits
8	Carica papaya	Pawpaw	Udia Edi	Fruits
9	Irvingia gabonensis	Bush mango	Uyo	Fruit/Seeds
10	Gareinia kola	Bitter cola	Efiat	Seed
11	Maesobofrya dusenii	----------	Nyayatet	Fruits
12	Synsepalum dulcificum	----------	Mkpautuk	Fruits

These native species may not necessarily represent the flora community in the country, there are many others which may not gain as much popularity depending on its location and usage, but constitute remarkable components of the floral community.

4.0 Conclusion

Though Nigeria has a vast Biodiversity, it is not evenly distributed. Flora and fauna diversity depends on climate, altitude, soils and the presence of other species. This measures higher in the tropics than in other localized regions. When a wide diversity of species are maintained, the web of life that sustains all biota is preserved.

5.0 Summary

In this unit, you have learnt that;
.bio-products common in Nigerian ecosystem are local cereals, local legumes and local fruit trees
. there are many others which may not gain as much popularity depending on its location and usage.

6.0 Tutor Marked Assignment

1. Explain the status of biodiversity in the Nigerian ecosystem.
2. List four of each of local legumes and fruit trees found in Nigerian ecosystem.

7.0 References/Further Reading

.Grumbine, E.(1993): “Ghost Bears: Exploring the Biodiversity Crisis,”

.Jensen, D. B; Torn, M. and Harte J. (1990): “In Our Own Hands: A Strategy for Conserving Biological Diversity in California,”

.Keystone Center(1991): “Final Consensus Report of the Keystone Policy Dialogue on Biological Diversity on Federal Lands,”1991

. Oladipo, E.(et.al)(2001): First National Biodiversity Report on Nigeria. Biodiversity Report on Nigeria. Accessed on May 5, 2011. From http://www.pabiodiversity.org/economic.html

.U.S. Congress Office of Technology Assessment(1987): “Technologies to Maintain Biological Diversity”

.World Growth(2009): Forestry and Biodiversity : A Healthy Report. Pp1-37

.World Resources Institute(1992): World Conservation Union, and United Nations Environment Programme, Global Biodiversity Strategy”

Unit 4 Types and Uses of Biodiversity

Contents

1.0 Introduction

Efforts have been made in the previous units to define the concept of biodiversity along with its historical perspective and levels. So also, the elements and characteristics of ecosystem, genetic erosion vis-avis its Causes and management were well elucidated. In this unit, you will learn about the types and uses of biodiversity. This knowledge is meant to prepare you to appreciate the nature of biodiversity and how you would be in the position to manage it in the Nigerian environment.

2.0 Objectives

At the end of this unit, you would be expected to be able to:

- explain the types of biodiversity
- discuss the uses of biodiversity

3.0 Main Body

3.1 Types of Biodiversity

There are three main types of biodiversity. These are functional diversity, taxonomic diversity and genetic diversity.

3.1.1 Functional Diversity

Functional diversity ensures that every task that needs doing within an ecosystem gets done. According to Silvert(2011), functional diversity doesn't help to have thousands of species of herbivores in a system if there are no primary producers to feed them and no detrivores to clean up after them.

3.1.2 Taxonomic Diversity

Taxonomic diversity is the most widely recognized from but may also be the least meaningful. It involves identifying the number of diffusant taxa (usually at the specie level) and possibly weighting them by the abundance of individuals. Calculators of taxanomic biodiversity tend to be limited by the taxonomic expertise available, especially at lower trophic levels(Silvert;2011).

3.1.3 Genetic Diversity

Genetic diversity has long been recognised in agriculture, where the danger of disease wiping out a single strain of organism is prevalent. Genetic diversity protects ecosystems against other forms of environmental change, not only against disease. Diversity within a species is the driver behind evolutionary adaptations. The concept of genetic diversity also applies between populations, since species replacement in response to environmental change usually indicates that the replacement species is genetically better suited to the changed conditions.

Genetic diversity becomes especially important in the context of climate change and other local or global environmental shifts, since it plays a critical role in determining how communities will adapt to stress(Silvert,2011).

3.2 Uses of Biodiversity

3.2.1 Food and Shelter

Biodiversity is very important in the provision of food, fuel and fibre for domestic consumption while it equally serves as materials for shelter and other buildings. Apart from those managed within the ecosystem, a lot more grow in the wild.

3.2.2 Environmental Maintenance

Biodiversity helps in the detoxication and decomposition of water, stabilization and moderation of earl climate. To an extent also, moderation of floods, control of drought, temperature and extremes of forci of wind is another role played by biodiversity.

3.2.3 Agriculture

Biodiversity plays an important role in the generation and renewal of soil fertility including, nutrient cycle which result from its decomposition. Biodiversity is responsible for the pollination of plants including many crops and also, in the control of pests and diseases. The maintenance of genetic resources as key input to crop varieties and livestock breeds, medicines and other products is attributed to biodiversity.

3.2.4 Forest Products

An estimated harvest of 50,000 to 70,000 plant species is used for traditional and modern medicine worldwide. About 100million metric tones of aquatic life, including fish, mollusks and crustaceans are taken from the wild every year. So also, meat from wild animals forms a critical contribution to food sources.

4.0 Conclusion

We have stressed that types of biodiversity include functional diversity, taxonomic diversity and genetic diversity. The uses of biodiversity have been categorized into provision of food and shelter, maintenance of the environment, enrichment of soil fertility for agriculture and forest products.

5.0 Summary

Having gone through this unit, it is expected that you should be able to explain;

.Functional diversity as what ensures that every task that needs doing within an ecosystem gets done.

.Taxonomic diversity involves identifying the number of diffusant taxa and possibly weighting them by the abundance of individuals.

.The concept of genetic diversity applies between populations .

.Biodiversity is useful in provision of food and shelter, agriculture, environment and as forest products.

6.0 Tutor Marked Assignment

1. Explain two types of biodiversity

2. Discuss the uses of biodiversity within Nigerian ecosystem

7.0 References/Further Readings

.Neira M.(2011): Biodiversity. http://www.panda.org

.Silvert W.(2011): The Meaning of Biodiversity. http://bill.silvert.org/pdf/Biodiversity.pdf

Module 2 Genetic Erosion

Unit 1 : Genetic Erosion

Unit 2 : Genetic Erosion in Nigeria

Unit 3 : Effects and Management of Genetic Erosion

Unit 1 Genetic Erosion

Contents

3.3 Reasons for Occurrence in Animals

3.4 Reasons for Occurrence in Plants

4.0 Conclusion

5.0 Summary

6.0 Tutor Marked Assignment

7.0 Reference/ Further Reading

1.0 Introduction

In this unit, efforts will be made for you to learn that, as important as the conservation of biodiversity is to any nation's environment, losses of elements still occur. In the last unit, we have defined and explained biological diversity or biodiversity to refer to the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are part. Biodiversity also encompasses the variety of all forms of life on earth that provides the building blocks for our existence and ability to adapt to environmental changes in the future, Jensen,et.al(1990) and Keystone center(1991). However, despite the importance of biodiversity to the survival of present and future generations, there is a high rate of biodiversity loss even as experienced in Nigeria, a situation that is evidenced by reports of reduced or disappearance of native species, Oladipo,et.al(2001). Though the loss of biological diversity has become a matter of concern within scientific and political circles, increase in demand for biological resources rises by the day and is relative to increase in population. This poses serious threats to biodiversity. The elimination or disappearance of certain animal and plant varieties can have adverse effects on the environment.

The loss of biodiversity indicates loss of genetic variability which is measured by the frequency of species extinctions; and the rate of species loss far exceeds the origin of new ones.

2.0 Objectives

By the end of this unit, you should be able to:

- define genetic erosion

-identify causes of genetic erosion

-state reasons for its occurrence in plant and animal populations

3.0 Main Body

3.1 Genetic Erosion

Genetic erosion is the process in which a plant or animal species faces a gradual or drastic diminishing or complete loss of its unique gene pool .

A gene pool is a complete set of unique alleles that occur in the genetic matter of all members of a particular species. When members of a specific population are removed without replacement, the gene pool becomes distorted. This manner of loss can be attributed to technological advancement in improving bio-varieties, since the resource, upon which they are based, are eliminated.

A comprehensive survey of the wildlife situation in Nigeria in 1962 showed drastic reduction in wildlife numbers when compared with neighbouring countries, a trend attributed to excessive hunting. This led to a recommendation preventing hunting or capture of all species threatened with extinction. The recommendation also places a strict limit to the hunting of species with low or reduced numbers, a ban on night hunting and establishment of closed hunting seasons. A substantial loss of species diversity (intra and infra-specific) is due to habitat destruction resulting from land clearance for various uses. Forest exploitation and vegetation clearance are the major causes of natural gene-pool loss as is occurring in many species including *irvingia gobanensis* and *I. Wombulu* in the Nigerian rainforest and Niger Delta.

Most species that were originally diverse in Nigeria are becoming rare. It is obvious that Nigeria's plant diversity, is being seriously eroded as a result of multiplicity of environmental, political and socio-economic factors. These conditions are also reported of in other African Countries, even those that are signatories to the Convention on Biological Diversity (CBD) of the United Nations Environment Programme (UNEP) (1994) and the Global Plan of Action (GPA) on plant genetic resources of the Food and Agricultural Organization (FAO) (FAO, 1998). They seem to identify a singular cause of genetic erosion in crops as the replacement of local varieties by improved or exotic varieties and species. This is as a result of the ever-increasing human population, greater competition for natural resources and some interplay of natural factors.

3.2 Causes of Genetic Erosion

Genetic diversity is a dynamic entity that changes over time. Generally, many issues contribute to genetic erosion. Depending on location, there could be differences of various magnitude which to such extent are crucial. Genetic erosion are caused by natural selection, dependence on improved varieties of crops, bad management practices, high level of mortality and habitat loss.

3.2.1 Natural Selection

Natural selection removes some genetic diversity (at least at the population, if not at the species, level). Too rapid a loss, or losses that aren't associated with natural processes, such as natural selection, can cause problems in a conservation or restoration context. In addition to habitat loss and fragmentation, other less obvious influences can also cause genetic erosion. For example, where there are no outbreeder, mating among relatives (inbreeding) is more likely in smaller populations where the process is cumulative, so that over time matings between unrelated individuals become impossible.

3.2.2 Dependence on Improved Varieties of Crops

The use of only improved varieties of crops and the complete neglect of local varieties and the land races also lead to loss of biodiversity. A major example of this is the use of improved okra (Abelmoscus esculentus) in place of the native materials of the tall okra (A. caillei) that is popularly known to be sensitive to day-length. Local varieties of crops including sword bean (Canavalia ensiformis), African **yam bean (Sphenostylis** stenocarpa) and Lima beans (Phasceolus lunatus) are now becoming extremely rare, as only improved cowpea (Vigna unguiculata) is being cultivated on many farms. Similarly, Dioscorea dumetorum, Dioscorea bulbifera, Trichosanthis species, (Snake tomato), and Digitaria exilis (Hungry rice – 'acha') are no longer in popular cultivation. Restricted planting of many other popular crops have also been reduced and they have been replaced with commercially improved varieties, thereby causing the loss of important gene resources of these plants.

3.2.3 Bad Management Practices

Grazing pressure, fire, and excessive use of systemic herbicides are other factors that affect biodiversity loss. Fire destroys large areas of forest ecosystems annually with the elimination of sensitive species such as Afromosia laxiflora, Ceiba pentandra, Entada abyssinica, Hildegardia barteri and Holarrhera wulfbergia. Although, fire is a natural phenomenon in the savanna, it is steadily entering the rainforest. Indiscriminate

hunting of wildlife for food to compliment subsistence farming and bush burning leads to loss of biodiversity and also depletes the ecosystem by causing death of wildlife; destruction of eggs and plant species, while illegal grazing of livestock in game reserves constitutes a threat to wildlife itself.

3.2.4 High Level Mortality

High level mortality among species eliminates distinct organisms thereby, reducing biodiversity. In periods of natural disaster- flood, drought, fire- out breaks, etc when there is massive disaster, genetic occurs as the species are destroyed

3.2.5 Habitat Loss

Habitat loss resulting from urbanization accelerated by increase in population destroys homes of plants and animals. If the habitat, and not just the plants are removed (such as in land conversion), and there is no subsequent regeneration from seedbanks or previously collected seeds, then loss of genetic diversity can occur immediately, assuming that there is some diversity in the removed plants that is not contained elsewhere. But even if genetic diversity is not lost immediately, it is often reduced gradually in the resulting smaller population.

The loss of genetic diversity in this case can weaken the entire species and can lead to eventual extinction. The disappearance of certain species can have an unfavorable effect on other species that might have depended on them in some manner for their survival and ultimately on the environment as a whole.

3.3 Genetic erosion occurs in animal species for the following reasons

- Members of the endangered species cannot meet and breed as result of habitat loss, habitat fragmentation or geographical distance.
- The individual dies without breeding.
- The individuals do breed, but because they are restricted to a certain area and cannot travel to meet different members of the species, there is low genetic diversity and inbreeding occurs. Inbreeding leads to physical defects that weaken the entire species.

3.4 Genetic erosion occurs in plant species for the following reasons:

- Loss of habitat is a cause of genetic erosion here as well.

- Overgrazing an area can lead to loss of plant species; so also the spoiling of an environment by land clearing or chemical dumping or over-zealous construction.
- Replacing local varieties of plants with those that wouldn't occur there naturally, like plants from another area or genetically modified (GM) plants, can also lead to genetic erosion.
- Modern agriculture is also responsible to a large extent for loss of genetic diversity. Farmers tend to grow a limited number of commercial crop varieties or GM crops, enforcing a uniformity in farming, and so there has been a noticeable reduction in the many crop varieties that were seen with traditional farming.

4.0 Conclusion

Biodiversity loss is one of the world's most pressing crises. It threatens the very basis of more sustainable development and the quality of life. The resources in Nigeria (flora and fauna), which are very vital, are presently threatened by increased population pressure and intensified human development activities. As such, genetic diversity in animals and plants, in domestic populations and in the wild, is being lost at an increasing rate.

The loss of biodiversity occurring as a result of loss of natural habitat and movement restrictions imposed by human developments and activities is more alarming. The advent of scientific plant breeding this century and rapid spread of high-yielding varieties characterized by narrow genetic base had caused the displacement of traditional unimproved species that had large genetic base. Narrowness of the genetic base of a crop may lead to disasters, as shown by historical examples, especially on Irish potato. In Nigeria, there is awareness about the loss of indigenous leaf vegetables as a result of neglect by research and development, fast rate of forest destruction for industrial development and environmental degradation due to pollution as in the Niger Delta region

5.0 Summary

In this unit, you have learnt that;

. Genetic erosion is the process in which plant species or breeds face gradual or drastic diminishing or complete loss of their genetic pool

.Causes of genetic erosion are by natural selection, bad management practices, high level mortality and habitat loss

.Genetic erosion occurs in plants and animals for different reasons.

6.0 Tutor Marked Assignment

1. Define genetic erosion

2. Identify causes of genetic erosion

3. State the reasons for genetic erosion in plants and animals.

7.0 References

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Unit 2 Genetic Erosion in Nigeria

Contents

1.0 Introduction

In the previous unit, we took a look at the definition and causes of genetic erosion. It is important to note that this situation occurs in all environment including Nigeria. So, efforts will be made to explain the different activities in the Nigerian environment that lead to genetic erosion as well as its direct and indirect causes. It is obvious that genetic erosion constitutes great threat to human survival. The extent and impact of the erosion may not be visible to the present generation. Future generations will have to pay dearly for the carelessness of the earlier generations.

2.0 Objectives

By the end of this unit, you should be able to:

- Discuss genetic erosion in Nigeria
- state indirect and direct causes of genetic erosion in Nigeria

3.0 Main Body

3.1 Genetic Erosion in Nigeria

In Nigeria, certain factors are observed as available evidence shows that biodiversity is being lost at a disturbing rate in Nigeria. Generally, the causes of biodiversity loss here, are largely related to human factors. These are due to interactions with the environment for :

-development,

- improved quality of life resulting from industrialization,

-technological advancement and

- rapid growth in urbanization.

3.1.1 Indirect causes of genetic erosion in Nigeria

Indirect causes of genetic erosion in Nigeria include the following:

-economic policies,

- rising demand for forest products,

-poor n cultural practices,

-poor law enforcement and

-weak laws.

-Increased export demands for primates and birds for research

-trade in timber and non-timber species.

- Continued timber cut without replacement.

-Cultural practices that encourage the use of specific species for festivals often limit the population of species particularly occurring under narrow ecological range.

-Most of the laws that control the management of several species are outdated, and their enforcement is inadequate.

3.1.2 Direct causes of genetic erosion

Direct causes of genetic erosion are related to agricultural activities and they include;

- bush burning,

-fuel-wood collection,

- logging,

-grazing and

- gathering.

4.0 Conclusion

The introduction of cash crops like cocoa, coffee, rubber, cotton, groundnut and oil palm into the farming systems since the 1900s was a big impetus for massive deforestation of the natural ecosystems. For example, the land devoted to agriculture increased from 8.9 million hectares in 1951 to about 55.8 million hectares in 1995. The massive rate of deforestation is a direct cause of biodiversity loss. Wood accounts for about 85% of domestic energy use in the country. Preference is often given to wood species with high calorific values that occur largely in the savanna and rainforest ecosystems of the country. Thus high depletion of fuel wood species is easily notable in the savanna and rainforest ecosystem.

5.0 Summary

In this unit, you have learnt that;

.Genetic loss in Nigeria is through interactions with the environment for development, rapid growth in urbanization and technological advancement

.there are direct and indirect causes of genetic erosion in Nigeria.

6.0 Tutor Marked Assignment

1. Discuss genetic erosion in Nigeria.

2. State the direct and indirect causes of genetic erosion in Nigeria.

7.0 References

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Unit 3 Effects and Management of Genetic Erosion

Contents

1.0 Introduction

Human impacts on ecosystem have been going on since its evolution. As human needs increases by the day, Agricultural and lndustrial activities are seen as tools which have altered the magnitude of change lately. The loss of biodiversity offers grave consequences which may required prolonged seasons to correct. Genetic diversity changes over time and space; and spatially reflects patterns in the environment, suggesting adaptation to prevailing conditions. Considering its usefulness, it is imperative that genetic erosion be

viewed seriously. Therefore in this unit, your attention will be drawn to the effects of genetic erosion as well as how it can be managed. As proper management requires up-to-date and relevant procedures to sustain genetic variability, these methods are outline within the context.

2.0 Objectives

By the end of this unit, you should be able to:

- state the effects of genetic erosion
- discuss the methods of managing genetic erosion

3.0 Main Body

3.1 Effect of Genetic Erosion

- Leads to Inbreeding
- Lowers reproductive fitness
- Reduces the ability of the population to genetically respond to a changing environment overtime.
- The genes from some potential parent plants may not be represented in the seeds because of random factors such as : phenological differences,
  - distance from other plants,
  - weather patterns that influence pollen dispersal,
  - random mortality of plants, random abortion of embryos, and others.
- Increased risk of extinction

3.2 Management of Genetic Erosion

i. Ex-situ Conservation:

The management of agricultural crops, solutions or mitigations are focused on ex situ conservation—seedbanks, genebanks, and others. This approach allows genetic diversity to be maintained even if it is not currently represented in agricultural practice. In addition, genetic research on some agriculturally important crops is done to compare genetic diversity between modern and historic cultivars and even with the progenitor wild plant species, where possible. This information helps to illuminate current or to predict future

problems of genetic erosion, allowing an appropriate management response. For native plant species, focus is on conservation of genetic diversity in situ, although ex situ conservation methods are certainly an appropriate parallel conservation strategy, particularly, for rare or endangered species or those experiencing high mortality or rapid loss of habitat.

However, ex situ conservation is not an effective or reasonable substitute for in situ conservation. These are complementary, rather than alternative, conservation strategies . Ex situ collections, for example, is only a sample of the natural range of genetic diversity in the species and are removed from the influence of natural selection and thus cannot accrue new adaptations over time. They are also vulnerable to financial constraints or downsizing, chronic losses in diversity depending on storage methods, catastrophic losses from equipment failures or fires, among other issues.

ii. Avoiding Losses of Habitat:

Avoiding losses of habitat or fragmentation of habitat (that can interrupt sharing of genes between populations, for example) are important management practices.

iii. Good nursery management, based on awareness of possible genetic variation in seed characteristics, germination requirements, and growth patterns, can take measures to avoid inadvertent selection and minimize the impact on the genetic diversity of the original collection.

4.0 Conclusion

The loss of genetic diversity can weaken the entire species and can lead to eventual extinction. The disappearance of certain species can have an unfavorable effect on other species that might have depended on them in some manner for their survival and ultimately on the environment as a whole. It is imperative that biodiversity loss be managed by précised methods to avoid their extinction.

5.0 Summary

In this unit, you have learnt that;

. genetic erosion ultimately leads to reduction in species vigour and extinction of all life forms.

.effects of genetic erosion include inbreeding and lowering of reproductive fitness

.genetic erosion can be managed by ex-situ conservation, avoiding habitat losses and good nursery management.

6.0 Tutor Marked Assignment

1. State the effects of genetic erosion.

2. Discuss the methods of managing genetic erosion.

7.0 References

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MODULE 3 Plant Biotechnology

Unit 1 Plant Biotechnology

Unit 2 Historical Perspectives

Unit 3 Benefits of Plant Biotechnology

Unit 4 Applications of Biotechnology in Forestry

Unit 5 Forest Biotechnology and Conservation

UNIT 1 Plant Biotechnology

Contents

3.2Plant Biotechnology

3.3Traits of Interest in Plants

4.0 Conclusion

5.0 Summary

6.0 Tutor Marked Assignment

7.0 Reference/ Further Reading

1.0 **Introduction**

Technology has gained enormous access into different sectors including Agriculture. Biotic resources are flexible enough to allow genetic manipulation to meet human needs. Plants have been raised through technological innovations because all of the biological processes of trees contain targets for biotechnological alteration and improvement, and the utilization processes offer potential targets for biotechnology as well.

Thus, biotechnology is often associated with generically modified organisms (GMOs) or transformations that involves the introduction of selected foreign genes into the plant genome. This technology identifies these specific genes and modifies them to affect biochemical pathways which results in phenotypes with perceived superior traits.

In this unit therefore, you will be exposed to the concept of biotechnology and attributes of focus in plants.

2.0 Objectives

By the end of this unit, you should be able to:

- define plant biotechnology
- explain traits of Interest in Plants

3.0 Main Body

3.1 Biotechnology

This is a scientific transformation that involves the introduction of selected foreign genes into the plant genome which affect biochemical pathways producing desired phenotypes with superior features.

This technology has been used in transforming trees and crops. Various wild plant species with less or undesirable attributes have been altered to adapt to new or stressful conditions through this standardized process which have proved dependable.

3.1.1 Plant Biotechnology

Plant biotechnology is a precise process in which scientific techniques are used to develop molecular- and cellular-based technologies :

- to improve plant productivity, quality and health;
- to improve the quality of plant products;
- to prevent, reduce or eliminate constraints to plant productivity caused by diseases, pest organisms and environmental stresses.

This process and technology transforms the genetic components of plant species to produce observable improvements.

3.1.2 Traits of Interest in Plants

Gene alteration can result in unique gene combinations unachievable by traditional plant breeding. This allows species to have attributes or traits that would not be possible through natural processes. These attributes can be characterized as:

Silvicultural Traits : these are features like

Growth rate

Nutrient uptake

Crown/ stem

Flowering control

Herbicide

Adaptability Traits: these are features like

Drought tolerance

Cold tolerance

Fungal resistance

Insect resistance

Wood Quality Traits : these are features like

Wood density

Lignin reduction

Lignin extraction

Juvenile fiber

Branching

4.0Conclusion

Innovations leading to the generation of non-genetically engineered crops have been employed to support the increasing food, water and fiber shortages associated with population growth and climate change. Its application in agriculture captures desired features to enhance commercialization of these products which ultimately support human population.

5.0 Summary

In this unit, you have been intimated with the facts that;

.plant biotechnology is a precise process in which scientific techniques are used to improve productivity

.biotic resources are flexible enough to allow genetic manipulation to meet human needs

.plant biotechnology focuses on improving traits of interests based on silvicultural traits, adaptability traits and wood quality traits.

6.0 Tutor Marked Assignment

1. Define plant biotechnology
2. Explain the traits of interests in plants.

7.0 References

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UNIT 2 Historical Perspectives

Contents

1.0 Introduction

Our natural ecosystems are subject to increasing pressures, and negative effects can already be seen in some regions of the world. In the years 1999 – 2000, 9.4 million hectares of forests were lost worldwide. Tropical deforestation accounts for 20 percent of the world's greenhouse gas emissions and the loss of essential terrestrial and freshwater resources for humanity and critical habitats for endangered species.

Biotechnological innovations have been employed to replenish the natural abundance and transform low quality species into highly desirable ones with recorded evidences.

In this unit, it would be necessary to explore the historical and futuristic perspectives of biotechnology. You will be exposed to the extents of achievements in biotechnological world and also consider areas of focus in the future.

2.0 Objectives

By the end of this unit, you should be able to :

- explain the Historical Perspectives of biotechnology
- state indicators of biotechnological achievements
- mention areas for future achievements

3.0 Main Body

3.1 Historical Perspectives

Plant biotechnology in use today is a product of advanced technology, which allows plant breeders to make precise genetic changes to impart beneficial traits to plants. This practice of plant biotechnology has been around for centuries.

The use of less advanced methods by early farmers and plant breeders to improve plants reflected their traditional breeding methods which included selecting and sowing the seeds from the strongest, most desirable plants to produce the next generation. By selecting and breeding plants with characteristics such as higher yield and resistance to pests and hardiness, these early farmers dramatically changed the genetic makeup of plants long before the science of genetics was understood. As a result, most of today's plants bear little resemblance to their wild ancestors.

The tools of modern biotechnology allow plant breeders to select genes that produce beneficial traits and move them from one organism to another. This process is far more precise and selective than crossbreeding, which involves the transfer of tens of thousands of genes and provides plant developers with more detailed knowledge of the changes being made. The ability to introduce genetic material from other plants and organisms opens up a world of possibilities to benefit food production.

3.1.1 Indicators of Biotechnological Achievements

Important commercial plants that have been modified to resist viral infections include; potato, squash, cucumber, watermelon and papaya. These plants resist viruses through a mechanism known as cross-

protection, which is somewhat similar to immunization. Farmers growing these plants are able to reduce pesticide applications to control virus-carrying insects.

Other varieties like Soybean, Corn, Canola and other crop plants have been modified to tolerate safe, broad-spectrum herbicides. Herbicide tolerance allows farmers to use weed controls more selectively. Rather than applying herbicide before planting, farmers can wait until after the crop emerges to apply herbicides where and in the quantities needed.

3.1.2 Biotechnological Achievements in the Future

New advances including a promising array of product, will offer:

- improved yields,
- enhanced nutrition,
- medicinal properties and vaccines;
- healthier cooking oils;
- extended shelf life;
- renewable resources and industrial feedstock's; and other desirable products.

These new varieties of plants could open up lucrative new markets to farmers and provide enhanced food products to consumers .

4.0 Conclusion

Biotechnology emerged to encompass a developing collection of tools for modifying plant physiology and genetics to aid breeding and propagation. Over the years, these various methods have become increasingly sophisticated producing acceptable varieties.

5.0 Summary

In this unit, you have learnt that;

.the tools of modern biotechnology have been used by plant breeders to select genes that produce beneficial traits, transferring them from one organism to another

.commercial plants have been modified to resist viral infections, tolerate safe, broad-spectrum herbicides among others

.biotechnological achievement hopes to produce improved yields, enhanced nutrition, medicinal properties and vaccines, extended shelf life in the future.

6.0 Tutor Marked Assignment

1. Explain the Historical Perspectives of biotechnology

2. State indicators of biotechnological achievements

3. Mention areas for future achievements

7.0 Reference/ Further Reading

Buis S. 2000. Writing woody plant specifications for restoration and mitigation practices. Native Plants Journal 1:116–119.

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Unit 3 Benefits of Plant Biotechnology

Contents

7.0 Reference/ Further Reading

1.0 Introduction

There have been indications of positive achievement using plant biotechnology as analysed in the previous unit. Are they available in our environment? This unit will seek to explain potential benefits accruing to various groups of people.Modern civilization would be impossible without the domestication of a small number of plants, particularly wheat, rice and maize. Domestication generates plants with high yields, large seeds, soft seed coats, non-shattering seed heads that prevent seed dispersal and thus facilitate harvesting, and a flowering time that is determined by planting date rather than by natural day length. These improvements are driven by technological innovations.

2.0 Objectives

By the end of this unit, you should be able to

- discuss the benefits of plant biotechnology to farmers, producers and consumers.

3.0Main Body

3.1 Benefits of Plant Biotechnology

A distinguishing feature of the introduction of technology is increased productivity because it reduces cost or enhances yield. Thus, the application of biotechnology in agriculture has resulted in benefits to farmers, producers and consumers.

1. Pest and Weed Control

Plant biotechnology has helped make both insect pest control and weed management safer and easier while safeguarding plants against disease. For example, genetically engineered insect-resistant cotton has allowed for a significant reduction in the use of persistent, synthetic pesticides that could contaminate groundwater and the environment.

In terms of improved weed control, herbicide-tolerant soybeans, cotton and corn enable the use of reduced risk herbicides that break down more quickly in soil and are non-toxic to wildlife and humans.

2. Herbicide Tolerant Plants

Herbicide tolerant plants particularly are compatible with no-till or reduced tillage agriculture systems that help preserve topsoil from erosion.

The Flavr Savr tomato was the first genetically modified commercial crop food Plant biotechnology has been used to protect plants from devastating diseases. The papaya ring spot virus threatened to ruin the Hawaiian papaya industry until papayas resistant to the disease were developed through genetic engineering — something that saved the U.S. papaya industry. Research on potatoes, squash, tomatoes and other crops continues in a similar manner to provide resistance to viral diseases that otherwise are very difficult to control .

3. Increase in Yields

Biotech plants can make farming more profitable by increasing crop quality and in some cases may increase yields. The use of some of the crops can simplify work and improve safety for farmers, which allow farmers to spend less time managing their crops and more time on other, profitable activities. Biotechnology-derived varieties of pest protected corn, cotton and potatoes and herbicide-tolerant soybeans significantly have reduced pesticide and herbicide use, boosted yields and saved growers tens of millions of dollars. A study by the National Center for Food and Agriculture Policy found that six biotech crops — canola, corn, cotton, papaya, soybean and squash — increased grower incomes by an additional $1.9 billion, boosted crop yields by 5.3 billion pounds and reduced pesticide use by 46.4 million pounds in 2003. These savings came from reduced inputs including time, labor and wear and tear on farm equipment.

4. Quality Traits

Biotech crops provide enhanced quality traits, such as increased levels of beta-carotene in rice and improved oil compositions in canola, soybean and corn. For example, scientists have developed a new strain of rice, called golden rice, that naturally produces betacarotene, the precursor to vitamin A. Golden rice can provide enough beta-carotene to make up for vitamin A deficiencies in the diets of poor children, and it also can increase the amount of vitamin A in breast milk, an important source of nutrition for infants. Furthermore, scientists have enriched the same strain of rice with additional iron to combat anemia, which affects hundreds of millions of the world’s poor.

5. Drought and Salty Soils Resistant Crops

Crops with the ability to grow in salty soils or better withstand drought conditions also are in the works. Thus, Plant biotechnology also can be a key element in the fight against hunger and malnutrition in the developing world.

Today, an estimated 800 million people do not have access to sufficient supplies of food. By 2030, the global population is expected to reach, if not exceed, eight billion people, putting a further strain on food supplies. But while world population is expected to grow rapidly, particularly in developing countries, the amount of available agricultural land is limited. Only 10 percent of the world's land surface is arable, and over farming and soil erosion are growing problems in some areas. To overcome those dynamics, farmers will need to find ways to grow more food while using less land.

4.0Conclusion

Plant biotechnology is a precise process in which scientific techniques are used to develop molecular- and cellular-based technologies to improve plant productivity, quality and health; to improve the quality of plant products; or to prevent, reduce or eliminate constraints to plant productivity caused by diseases, pest organisms and environmental stresses. This process and technology already is in widespread use in the United States today. Plant biotechnology, practically increases the production of main food staples, improves the efficiency of production, reduces the environmental impact of agriculture and provides access to food for small-scale farmers.

5.0Summary

In this unit, you have learnt that,

.the application of biotechnology in agriculture has resulted in benefits to farmers, producers and consumers

.benefits of biotechnology include; pest and weed control, herbicide tolerant plants, increase in yields, quality traits and production of drought and salty soil resistant crops.

6.0 Tutor Marked Assignment

Discuss the benefits of plant biotechnology to farmers, producers and consumers.

7.0 References

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Unit 4 Applications of Plant Biotechnology in Forestry

Contents

1.0 Introduction

In the last unit, we considered the benefits of biotechnology to different human groups who survive in various environments. These areas, are occupied by both plants and animals. Its sustainability depends on the vegetation cover. Biotechnology is an artificial process of recombining genes from different organisms and by passing natural barriers to sexual reproduction. It promotes the engineering of new biochemical pathways to increase species that are stress tolerant. Its application has enabled crops, trees and their products possess traits that meet public demands, easing primitive stress conditions. We will thus consider the benefits and potential risks of plant biotechnology in forestry.

2.0 Objectives

By the end of this unit, you should be able to

- Identify the benefits of biotechnology in forestry
- explain the potential risks of plant biotechnology in forestry

3.0 Main Body

3.1 Applications of Plant Biotechnology

Much of the information related to plant biotechnology focuses on its use with crop production. This primarily is because the technology has been applied and used in this way. It still is being debated and tested in the laboratory for other uses, such as in forestry. Other applications include using biotechnology to produce ornamental flowers with new colors, fragrances and increased longevity.

3.1.1 Crop Production

Plant biotechnology provides farmers with tools that can make production cheaper and more manageable.

For example, some biotechnology crops can be engineered to tolerate specific herbicides, which make weed control simpler and more efficient. Other crops have been engineered to be resistant to specific plant diseases and insect pests, which can make pest control more reliable and effective and can decrease the use of synthetic pesticides. Those crop production options can help countries keep pace with demands for food

while reducing production costs. A number of biotechnology-derived crops that have been deregulated by the USDA and reviewed for food safety by the Food and Drug Administration (FDA) and/or the Environmental Protection Agency (EPA) have been adopted by growers. Many other types of crops now are in the research and development stages. Advances in plant biotechnology could provide consumers with foods that are nutritionally enriched, are long lasting or contain lower levels of certain naturally occurring toxins that are present in some food plants. Developers are using plant biotechnology to try to reduce saturated fats in cooking oils and allergens in foods and increase disease-fighting nutrients in foods. They also are researching ways to use genetically engineered crops in the production of new medicines, which might lead to a new, plant made pharmaceutical industry that could reduce the costs of production by using a sustainable resource

Genetically engineered plants also are being developed for a purpose known as phytoremediation, in which the plants detoxify pollutants in the soil or absorb and accumulate polluting substances out of the soil so the plants may be harvested and disposed of safely. In either case, the result is improved soil quality at a polluted site. Plant biotechnology also may be used to conserve natural resources, to enable animals to use nutrients present in feed more effectively, to decrease nutrient runoff into rivers and bays and to help meet the increasing world food and land demands. Researchers are at work to produce hardier crops that will flourish in even the harshest environments and that will require less fuel, labor, fertilizer and water, helping to decrease the pressures on land and wildlife habitats.

3.1.2 Forestry

Forestry researchers are working on ways to create trees to resist pests, to make it easier to process pulp and paper products and to assist in the restoration of endangered tree species. Developing a more sustainable means of producing wood and paper products is an urgent need. For example, Americans consume 750 pounds of paper every year, not to mention the wood products used for building and other endeavors.

Although the United States has 20 percent more trees than it did on the first Earth Day 25 years ago, it is estimated that an additional 800 million hectares of low-yielding native forest, or 25 percent of Earth's forest estate, will have to be logged to meet worldwide demand in 2050. With humans relying so heavily on forest products, biotechnology could reduce the need to log old-growth forests. For example, trees could be engineered to be grown more efficiently on plantations and to make stronger lumber or more pulp for paper.

Such genetic enhancements could increase the productivity of tree farms and provide trees that would use less energy and fewer chemicals during processing and result in cleaner air and water.

Scientists believe that if there is to be widespread use of Genetically Engineered (GE) trees, it first will be on intensively managed forest plantations — plantations that already are using the most current science and intensive management practices to improve timber quality and production. Research has shown how GE technology could provide commercial plantations with trees that grow faster, produce pulp easier and provide better wood quality than conventional trees. But while the potential benefits are intriguing, the environmental consequences must be carefully considered. And though some observers believe it could be more than 10 years before genetically engineered trees become commonplace, developing countries could move much more quickly. F or instance, there already are large test plots of GE poplars currently being cultivated in China, and other developing countries — driven by internal and external demands — could begin commercial use of GE trees in as little as a year. Some of the concern about GE trees centers on the fact that tree pollen can drift miles away, so even if the technology exclusively is applied to private forests, pollen drift could cause GE trees to migrate into "wild" stands wherever they might be, including national forests, parks and other public lands.

3.1.2.1 Benefits of using biotechnology in forestry

- Revealing trees' unique biological properties which increases wood yield and quality
- Reducing pressure on natural forests by increasing productivity of managed forests
- Improving disease and insect resistance assisting in the restoration of endangered tree varieties
- Reducing the environmental impact of pulping assisting in cleaning up toxic waste
- Serving as a new source for feed and pharmaceuticals.

3.1.2.2 Risks of using plant biotechnology in forest production

- Trees could become invasive, supplanting natural forests
- Environmental impacts could persist because of the long life spans of trees.
- It could be difficult to track "escapes" and to reverse potential damage.
- It could be difficult to predict the consequences for complex ecosystems.

- It could alter the aesthetic qualities of forests.
- It could clash with the cultural need for natural forests consumer concerns could emerge.
- It could foster inequities between large and small landowners.

4.0Conclusion

Biotechnology uses the tools of genetic engineering, which is the process of manipulating genes and involves the isolation, manipulation and reintroduction of DNA into cells. This process introduces new characteristics physiologically, producing desired attributes. These tools have been invaluable for researchers in helping understand the basic biology of living organisms. As products are meeting desired purposes, thes indicates possibilities of greater achievements, especially in agriculture.

5.0 Summary

In this unit, you have been informed that;

.applications of plant biotechnology are basically observed in crop production and forest conservation

.biotechnology in forestry is largely associated with potential benefits and risks factors.

6.0 Tutor Marked Assignment

1. What are the benefits of using biotechnology in forestry

2. Explain the potential risks of plant biotechnology in forestry

7.0 Reference/ Further Reading

.Cole CT. 2003. Genetic variation in rare and common plants. Annual Review of Ecology, Evolution, and Systematics 34:213–237.

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Unit 5 Forest Biotechnology and Conservation

Contents

1.0 Introduction

There is significant social and ecological value in conserving larger areas of biodiversity-rich natural forests and in reducing economic demands on those forests by increasing yields from planted forest. This suggests that total value in plantations is not simply a financial equation. While intensive forestry and biotechnology are not panaceas in the absence of concerted efforts by governments and the private sector to expand protected areas, they are important tools that support sustainable forestry programs. This unit will thus focus on the necessities and strategies for conserving forest trees.

2.0 Objectives

By the end of the unit, you should be able to

- state the need for forest conservation
- state the strategies for conserving forest trees

3.0 Main Body

3.1 Forest Biotechnology and Conservation

The world's forests are under severe pressures from unsustainable logging and road building. The threats are especially acute in the tropics, where just 45% of original extent of habitat remains and the remainder are being lost at rate of 1% per year. Current rates of tropical deforestation are equivalent to an area half the size of Florida being removed from the lower 48 annually.

Of course, commercial timber production is not the only contributing factor, since many other forces are driving the global forest crisis. But the infrastructure associated with timber extraction is often at the vanguard of habitat conversion and threats to endangered species. A compelling example was published recently in nature: gorilla and chimp populations in Gabon and the Democratic Republic of the Congo which showed a drop by 80% from 1983-2000, leading scientists to recommend immediate designation of the species as "critically endangered." The decline was attributable to illegal bush meat hunting and Ebola virus epidemic, but a significant root cause was expansion of new a logging road network into remaining intact tropical forests in western equatorial Africa. Trends in the tropics are highly relevant to the future of forests and the forest and paper industry in North America.

A new report commissioned by AFPA and conducted by Seneca Creek Associates found that illegal logging – mostly but not entirely in the tropics – significantly depresses U.S. and Tropical deforestation accounts for 20% of the greenhouse gas emissions responsible for global warming and the threat of climate instability.

Global warming, in turn, presents enormous risks to the world's biodiversity. Research findings estimates that one-third of all species could be committed to extinction under current global warming scenarios as a consequence of disruption of habitat ranges and other results of changing climate patterns.

Moreover, forest destruction is a major driver of loss of terrestrial and freshwater resources that provide essential ecosystem services for humanity and critical habitat for endangered species around the world. For

instance, the global amphibian assessment recently published by CI, IUCN and Nature serve concluded that more than 40% of salamanders, frogs, toads and other amphibians are in decline, with habitat loss as the major driver underlying this threat. Fortunately, ingredients exist for convergence of interests between the business world, conservation community and the world's consumers.

3.2 Conservation of Forest Trees

Reports by WWF-International titled "The Forest Industry in the 21st Century" concluded that meeting projected increases in global wood demand over the next five decades will not require significant expansion of commercial logging beyond the estimated 600 million hectares of timber lands that currently account for 90% of the world's industrial wood supply.

A broad consensus may be emerging around the elements of a strategy that produces benefits for industry, communities and biodiversity. Thus, Forest trees can be conservation by a strategy that produces benefits for industry, communities and biodiversity. One element of the strategy is a shift away from commercial logging and road construction in biodiversity hotspots and major tropical wilderness areas. Another critical need is to secure and expand protected areas around the world. An additional component is to achieve best environmental practices on existing plantations, without tapping substantial new areas of natural forest for fiber production . The strategy must also include efforts to build international pressure on "bad actors" conducting egregious logging, and strengthen enforcement systems to crack down on illegal timber.

Stepping up appropriate strategies for the future in research, development and technology transfer in forest biotechnology as well as addressing associated societal and regulatory issues seem very demanding. A general response is that the R & D strategy should be focused on whether and how forest biotechnology might contribute to achieving the objectives of conserving threatened forests and biodiversity while meeting society's needs for forest products. For example, does forest biotechnology have potential to enhance fiber production, while enabling reduced chemical applications and improved water efficiency, on intensive plantations established on degraded agricultural lands? It is important to recognize that intensified timber management on existing plantations, while clearly a preferable alternative to liquidating remaining tropical forests, does not unto itself guarantee positive results for conservation. Intensive forestry or biotechnology

should not be oversold as a panacea in the absence of concerted efforts by governments and the private sector to expand protected areas, stabilize and rebuild populations of endangered species, and create conservation corridors that combine protection of key biodiversity areas with ecologically compatible economic uses across the larger landscape(Buis,2000).

4.0 Conclusion

The forest has been the reservoir of biotic components. Its elimination exposes both biotic factors and edaphic factors to adverse conditions with grave consequences on the human population as well. Biodiversity should be taken care of in carefully structured, transparent and independent regulatory frameworks. If shortcuts are taken on regulatory issues and public participation could result in lengthy delays or loss of valuable new technological innovations.

5.0 Summary

In this unit, you have learnt that;

.the threats to the world's forests are especially acute in the tropics

.global warming presents enormous risks to the world's biodiversity

. forest trees can be conserved by a strategy that produces benefits for industry, communities and biodiversity

6.0 Tutor Marked Assignment

1. Why is forest conservation necessary.
2. State the strategies for conserving forest trees.

7.0 Reference/Further Reading

.Buis S. 2000. Writing woody plant specifications for restoration and mitigation practices. Native Plants Journal 1:116–119.

.Cole CT. 2003. Genetic variation in rare and common plants. Annual Review of Ecology, Evolution, and Systematics 34:213–237.

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Module 4 Germplasm Appropriation

Unit 1 What is Germplasm

Unit 2 Germplasm Conservations

Unit 3 Germplasm Appropriation

Unit 1 Germplasm Appropriation

Contents

1.0 **Introduction**

All biotic components are made up of genetic materials. There are naturally preserved for continuity. Recent development shows that their availability may not be consistently guaranteed. Germplasm as it is referred to is the source of the genetic potential of living organisms. It can also be referred to as genetic material of plants or plant genetic resources. This means the seed or other material from which plants are propagated. Biotechnology can never thrive except on its resources. This unit will seek to identify where they can safely preserved.

2.0 Objectives

By the end of this unit, you should be able to:

- define germplasm
- mention potential germplasm storage centres

3.0 Main Body

3.1 What is Germplasm?

Germplasm can be viewed differently. It, thus, attracts various definitions. It can be defined as:

- a collection of genetic resources for an organism;
- the genetic material, especially its specific molecular and chemical constitution, that comprises the inherited qualities of an organism; or
- a set of propagules that carries the desired genetic resources.

These definitions identify the genetic material as the functional property; but in the zoological context, reference could be made to the preservation of gametes and the animals from which they are derived.

3.2 Germplasm Storage Centres

Germplasm can be preserved in standardized places like

- Seed banks
- Crop type collection centers or field gene banks
- Natural ecosystem
- Collection mission

- Cryopreservation centers

4.0 Conclusion

Seeds are the most convenient part of plant for storage, with the exception of a few species that have recalcitrant behavior e.g. *Telfairia occidentalis*. In storage, under good temperature and humidity regimes, seeds can be stored for several years. Therefore, following collection, reliable seed banks must be put in place for conservation of the collected samples. It must be emphasized that regular checks are carried out to test the viability of the stored seeds periodically. The seed bank will serve as a major insurance against permanent loss of any species that had been previously collected.

5.0 Summary

In this unit, you have learnt that;

. germplasm can be defined in different ways among which is the collection of genetic resources for organisms

.germplasm can be preserved in standard places under regulated conditions

. seeds are the most convenient part of plant storage with exception of a few species with recalcitrant behaviour.

6.0Tutor Marked Assignment

1. Define germplasm

2. Name standard places where germplasm can be properly preserved.

7.0 Reference/ Further Reading

Falk DA. 1987. Integrated conservation strategies for endangered plants. Natural Areas Journal 7:118–123.

Given DR. 1987. What the conservationist requires of ex situ collections. In:Branwell D, Hamann O, Heywood V, Synge H, editors. Botanic gardens and the world conservation strategy. London (UK): Academic Press. p 103–116.

Unit 2 Germplasm Conservations

Contents

1.0 Introduction

As you go through this unit, basic facts on germplasm conservation, need to conserve, benefits of germplasm conservation and obstacles to effective use of germplasm will be explored. It would be important to appreciate that conservation is a process that involves adequate planning, controlled exploitation, judicious use and efficient management of resources to ensure their availability for present and future use. As human population increases, there is increase demands on available resources. Conservation of the germplasm thus ensures the continuity of wild species on which biotechnology thrives upon.

2.0 Objectives

By the end of this unit, you should be able to

- Define germplasm conservation
- State the need to conserve germplasm
- Identify the benefits of germplasm conservation
- Explain the obstacles to effective use of germplasm

3.0 Main Body

1.1 What is Germplasm Conservation

This is an activity involving the conscious storage of genetic materials under standardized conditions by regulated agencies for safe-keeping and most importantly to avoid loss by extinction.

This is carried out by technological innovations and approaches that ensure conformity with original conditions even in artificial environment. Biotechnological approaches have been employed extensively in the process, even as research seeks to accommodates new bio-materials.

3.2 Need for Germplasm Conservation

The rapid decline in the abundance of wild or local biodiversity demands the setting apart of genetic material mainly to avoid its disappearance from natural environments. In the excessive demand for desired varieties, certain wild forms tend to be ignored. Thus, it is observed that there is :

- increasing availability of cultivars,
- their supply is more controlled,
- the quality is high,
- their botanical identification is not questionable,
- there are genetic improvement as well as
- agronomic manipulation,
- their post-harvesting is usually good and
- they are relatively safe (little or no adulteration).

3.3 Benefits of Germplasm Conservation

The benefits include the following:

- Building blocks/ gene pool for genetic improvement/enhancemet
- Genes for adaptations/endurance to varying, unfavourable biotic/abiotic stresses/environments
- Contribute to develop high yielding varieties
- Contribute to sound pest and disease management
- Reduce dependency on external inputs.

3.4 Obstacles to the effective use of Germplasm

Several obstacles limit the effective use of plant genetic resources. These include:

- the lack of characterization and evaluation data,
- poor coordination of national policies and poor linkages between the national genebanks and the users of the germplasm.
- Utilization of plant genetic resources maintained by farmers is limited due to lack of information on their characteristics and lack of availability.

  Though, International Research Centres (IRC) and African National Agricultural Research Systems(ANARS) have developed new improved varieties, these varieties often do not reach farmers because of lengthy testing requirements which have to be repeated even in countries with similar agro-ecological conditions. For existing and approved varieties, lack of national capacity to maintain the variety and provide basic seed in a timely manner hampers exploitation of the varieties.

  Other obstacles are:

- Weak Disaster Management

  Disasters (droughts, floods and conflicts) are increasing in frequency around the world including Africa where acute disasters are developing into chronic disasters which lead to food and seed insecurity. However, although it is generally accepted that disasters occur regularly, there is little forward planning or consultation at national or regional levels and African countries currently do not have the necessary capacity to respond to disaster in an effective and sustainable manner. A number of efforts to deal with the impact of disasters such as food aid, food imports by government and supply of seeds as part of relief programmes have had only minimal impact on the overall food situation, and the frequent introduction during disasters of unsuitable varieties erodes biodiversity

and leads to loss of valuable local genetic resources. As a result of the increasing incidence of emergency situations, an increasing proportion of the assistance allocated to Africa is invested in relief operations and a much smaller and decreasing proportion in seed development work needed to increase sustainable seed supply and improve preparedness. This complex situation must be reviewed and solutions found to ensure adequate investment in seed development.

- Inadequate Regional Seed Marketing

There is a lack of collaboration, consultation and harmonization at the regional and continental levels concerning the development, movement and use of high-yielding vegetatively propagated materials and seed. This has led to unduly restrictive seed certification and variety release requirements, which differ from country to country, and which, together with excessive phytosanitary and foreign currency regulations, function as non-tariff barriers that hamper seed exchange. Better coordination and capacity building are needed at the national, regional and continental levels to overcome the constraints related to seed trade through harmonization of seed rules and improved policies.

4.0 Conclusion

Though, International research centres and African national agricultural research systems have developed new improved varieties. However, these varieties often do not reach farmers because of lengthy testing requirements which have to be repeated even in countries with similar agro-ecological conditions. For existing and approved varieties, lack of national capacity to maintain the variety and provide Basic Seed in a timely manner hampers exploitation of the varieties

5.0 Summary

In this unit you have learnt that;

.germplasm can be preserved to avoid its disappearance from natural environment

.the rapid decline in the abundance of wild biodiversity necessitates its conservation

.germplasm conservation has many benefits

.several obstacles limit the effective use of plant genetic resources

6.0 Tutor Marked Assignment

1. Define germplasm conservation
2. State the need to conserve germplasm
3. Identify the benefits of germplasm conservation
4. Explain three the obstacles to use of plant genetic resources

7.0 References

Falk DA. 1987. Integrated conservation strategies for endangered plants. Natural Areas Journal 7:118–123.

Given DR. 1987. What the conservationist requires of ex situ collections. In:Branwell D, Hamann O, Heywood V, Synge H, editors. Botanic gardens and the world conservation strategy. London (UK): Academic Press. p 103–116.

Unit 3 Germplasm Appropriation

Contents

5.0 Summary

6.0 Tutor Marked Assignment

7.0 Reference/ Further Reading

1.0 Introduction

In this unit, focus would be laid on germplasm appropriation. An appropriation may be defined as an act of taking something which belongs to someone else, especially without permission. We will be looking at how farmers' rights to genetic resources are usurped.

2.0 Objectives

By the end of this unit, you should be able to

- discuss germplasm appropriation
- explain the appropriation status in Nigeria

- explain the appropriation status in Nigeria

3.0 **Main Body**

3.1 Germplasm Appropriation

The concept of Farmers' Rights was formulated as a retrospective equity to acknowledge the different contributions which farmers have made towards "conserving, improving and making available plant genetic resources particularly those in the centers of origin/diversity". The rights were vested in the international community, as trustees for present and future generations of farmers. It was proposed that they would be implemented through an international fund for plant genetic resources.

In many regions, there seem to be a lack of collaboration, consultation and harmonization at the regional and continental levels concerning the development, movement and use of high-yielding vegetatively propagated materials and seed. This has led to unduly restrictive seed certification and variety release requirements, which differ from country to country, and which, together with excessive phytosanitary and foreign currency regulations, function as non-tariff barriers that hamper seed exchange.

Most times farmers do not know their rights and may be cheated out of accruing benefits. Better coordination and capacity building are needed at the national, regional and continental levels to overcome the constraints related to seed trade through harmonization of seed rules and improved policies.

3.2 Germplasm Appropriation in Nigeria

Germplasm Appropriation in Nigeria seems to be passive if non-existing. Even though Nigeria has joined the league of International Treaty Community, majority of known species are disappearing from their natural habitats without control, documentations or assessments. Individuals may gather biodiversity for preservation, without legal authority and to no registered controlled environments. Farmers and Users mostly recognized over time that certain herps are no longer found. There is no enforced legislation to promote germplasm appropriation.

4.0 Conclusion

The conservation ethic advocates management of natural resources for the purpose of sustaining biodiversity in species, ecosystems, the evolutionary process, and human culture and society. This should be of benefit to foreign and local farmers.

5.0 Summary

In this unit you have learnt that;

.the concept of Farmer's Rights was formulated to acknowledge the contributions of farmers towards conserving, improving and making available plant genetic resources particularly, those in the centers of origin/diversity

. there seem to be a lack of collaboration, consultation and harmonization at the regional and continental levels concerning the development, movement and use of high-yielding vegetatively propagated materials and seeds.

6.0 Tutor Marked Assignment

1. Discuss germplasm appropriation.
2. Explain the appropriation status in Nigeria.

7.0 Reference/Further Reading

Falk DA. 1987. Integrated conservation strategies for endangered plants. Natural Areas Journal 7:118–123.

Given DR. 1987. What the conservationist requires of ex situ collections. In:Branwell D, Hamann O, Heywood V, Synge H, editors. Botanic gardens and the world conservation strategy. London (UK): Academic Press. p 103–116.

Guerrant EO. 1992. Genetic and demographic considerations in the sampling and reintroduction of rare plants. In: Fiedler PL, Jain SK, editors. Conservation biology: the theory and practice of nature conservation, preservation, and management. New York (NY): Routledge, Chapman and Hall Inc. p321-344.

Module 5 Bio-resource Management

Unit 1 Bio-resource Management

Unit 2 Biotechnological Legislation

Unit 1 Bio-resource Management

Contents

1.0 Introduction

In this unit, your attention will be drawn to bio-resource management, how it is done in Nigeria. The country's projections and constraints to management will be considered. It is necessary to note that the continual depletion of plant and animal species and the degradation of ecosystem stemming primarily from economic motives have become an important issue of growing global concern. Despite the unbridled rate of increase in the exploitation of biodiversity globally, the rate of replacement has not been commensurate with use. Thus, the number of threatened and endangered species is increasing. There is need to preserve their diversity. Focus on the activities of Nigerian Conservation Foundation will be great importance.

Objectives

By the end of this unit, you should be able to:

- define bio-resource management
- explain the status of bio-resource management in Nigeria
- state the purposes of the Nigerian Conservation Foundation(NCF)
- where are the locations of NCF projects
- state Nigeria projections on bio-resource management
- identify the Nigerian constraints to bio-resource management

3.0 Main Body

3.1 Bio-resource Management

Management is an aspect of conservation. It goes hand in hand with adequate planning to control exploitation of resources and employ judicious use of the resources. The management of bio-resources is an integral aspect of natural resource management which carters for all abiotic wellbeing to sustain biotic components. The edaphic and other environmental conditions must be conducive for bio-resource management to be successful. These conditions include proper waste control and management, especially gaseous emissions which promotes global warming – a condition that increasingly supports biodiversity loss.

3.1.1 Bio-resource Management in Nigeria

In Nigeria, government had set up various agencies to manage natural resources within its territory. Thus, bio-resource management is taken alongside the management of natural resources by

- The Establishment of Conservation Agencies
  - The Forestry Department of the State and Federal Ministry of Agriculture
  - The Federal Environmental Protection Agency (FEPA)
  - The Rivers Basin Development Authorities
  - The Department of Wildlife Conservation
  - Zoological and Botanical gardens in some Nigeria Universities
  - The Nigerian Conservation Foundation and Nigerian Game Reserves Authorities.

The Nigerian Conservation Foundation (NCF) is one of the foremost environmental non-governmental organisation (NGO) in Nigeria today.

It was established to achieve the following purposes:

-saving the country's flora and fauna from extinction

-protecting the environment from pollution and degradation

-improving the quality of life of the custodians of our wildlife heritage.

Since its inception, NCF has been deeply involved in specific projects targeted at improving the quality of the Nigerian environment and Its management.

NCF projects are found in different locations across the nation. These conservation centres include

- Game Reserves, for the preservation of rare animals, like

Yankari Game Reserve in Bauchi State

Borgu Game Reserve in Niger State

Kainji Game Reserve in Niger State

Obudu Cattle Ranch in Cross River State

Okomu Sanctuary in Edo State

- Forest Reserves, for the preservation of plants and trees, like

Olomu Forest Reserve in Kwara State

Milki Hill Forest Reserve in Enugu State

Zamfara Forest Reserve in Zamfara State

Shaha River Forest in Ogun State

The centres which protect the environment alongside biotic components are

Hadejia-Nguru Wetland Conservation project

Kano Desertification Control Project, etc.

These projects still need support –financially, technically, etc for sustenance.

3.2 Nigerian Projections on Bio-resource Management

In practice, biodiversity' suggests sustaining the diversity of species in each ecosystem as we plan human activities that affect the use of the land and natural resources. Thus, the Federal Government's policy goal on the conservation of biodiversity is to ensure sustainable use of forest resources and preservation of the many benefits accruing from soil, water, and wildlife conservation for economic development.

Among the current priority programmes in Nigeria are the extension of National Parks and Reserves and the compilation of the flora and fauna of Nigeria. The Nigerian Biodiversity Strategy and Action Plan (NBSAP) reviews the status of biodiversity conservation in Nigeria in an attempt to fill the gaps identified in the country study programme, and develops strategies and action plans to bridge the gaps in the conservation effort.

The Government's mission is that Nigeria's rich biological endowment together with the diverse ecosystems would be secured, and its conservation and management assured through appreciation and sustainable utilization by the Year 2010. Nigeria will continue to be active in the international arena while at the local level infrastructural, human, and institutional capabilities will be developed to ensure equitable sharing of biodiversity benefits over time.

To achieve this goal, the Nigerian strategy will be based on:

a) the inventory, identification, and rehabilitation of all threatened and endangered species of fauna and flora;

b) increasing the network of protected areas to include all ecosystem types consistent with internationally accepted classification;

c) promotion and enhancement measures for both in situ and ex-situ conservation through identification, inventories, evaluation, monitoring, research, education, public awareness, and training;

d) increasing the nation's biodiversity management capability (human, infrastructural, institutional, and technological);

e) the development of economically and culturally sound strategies to combat biodiversity loss;

f) protection and promotion of policy guidance for bio prospecting and indigenous knowledge (intellectual property right); and

g) the rehabilitation of degraded ecosystems.

3.2.1 Constraints to Bio-resource Management in Nigeria

Bio-resource management in Nigeria is of utmost importance and immense support.

The major constraints are

- dearth of trained manpower,
- appropriate technology and
- Inadequate funds for implementation.

4.0 Conclusion

Biodiversity is the degree of variation of life forms within a given ecosystem, biome, or an entire planet. It is also a measure of the health of ecosystems. Greater biodiversity implies greater health and as it is in part, a function of climate, it is of great need to be judiciously managed.

5.0 **Summary**

In this unit, you have been exposed to the fact that;

.the management of bio-resources is an integral aspect of natural resource management which carters for all abiotic wellbeing to sustain biotic components

.in Nigeria, government had set up various agencies to manage natural resources within its Territory

.government's focus is that Nigeria's rich biological endowment together with the diverse ecosystems would be secured, and its conservation and management assured through appreciation and sustainable utilization

.there are many constraints to bio-resource management in Nigeria

6.0 Tutor Marked Assignment

1. Define bio-resource management
2. Explain the status of bio-resource management in Nigeria
3. State the purposes of the Nigerian Conservstion Foundation (NCF)
4. Where are the locations of NCF projects
5. State Nigeria projections on bio-resource management
6. Identify the Nigerian constraints to bio-resource management

7.0 Reference/ Further Reading

Prof. Oladipo, E.(et.al) 2001. First National Biodiversity Report on Nigeria. Biodiversity Report on Nigeria. Accessed on May 5, 2011. From http://www.pabiodiversity.org/economic.html

United Nations Report on: National Resource Aspects of Sustainable Development in Nigeria.2009

Unit 2 Bio-resource Legislation

Contents

1.0 Introduction

Biodiversity as the economic and socio-cultural base of human systems, providing unquantifiable benefits to man and the environment including shelter, food, clothing, medicine, recreation, and resources for industry, needs to be conserved and managed sustainably for present and future generations. Uncontrolled logging and tree felling are the order of the day in many parts of the southern states of Nigeria. This carries with it loss of precious biological diversity. This unit will look at the bio-resource legislations in Nigeria.

2.0 Objectives

By the end of this unit, you should be able to

- discuss legal status on bio-resource
- explain the bio-resource legislations in Nigeria

3.0 Main Body

3.1 Bio-resource Legislations

There are legislations regarding bio-resource. they are related to private and public property rights. They can define protection for threatened ecosystems, but also some rights and duties (for example, fishing and hunting rights). They define species that must be protected because they may be threatened by extinction. The U.S. Endangered Species Act is an example of an attempt to address the "law and species" issue.

Domestication and plant breeding methods are not new, but advances in genetic engineering has led to tighter laws covering distribution of genetically modified organisms, gene patents and process patents. Governments struggle to decide whether to focus on for example, genes, genomes, or organisms and species; but there are global agreements such as the Convention on Biological Diversity), which give "sovereign national rights over biological resources" . These agreements commit countries to

- conserve biodiversity
- develop resources for sustainability and
- share the benefits resulting from their use.

Biodiverse countries that allow bioprospecting or collection of natural products, expect a share of the benefits rather than allowing the individual or institution that discovers/exploits the resource to capture them privately. Bioprospecting can become a type of biopiracy when such principles are not respected. Sovereignty principles can rely upon what is better known as Access and Benefit Sharing Agreements (ABAs). The Convention on Biodiversity implies informed consent between the source country and the collector, to establish which resource will be used and for

what, and to settle on a fair agreement on benefit sharing. Though uniform approval for use of biodiversity as a legal standard has not been achieved in many countries.

3.1.1 Bio-resource Legislation in Nigeria

Without doubt Nigeria is richly endowed with diverse flora and fauna. These vital resources are presently threatened by increased population pressure and intensified human development activities. These activities are of major concern to managers who realize that natural resources are the backbone of industry.

Though there are technologies and capabilities being developed to protect endangered ecosystems, especially watersheds, freshwater and high forests in Nigeria, conservation of biodiversity requires the development and application of appropriate technology, particularly in research, ex-situ conservation, and others. Such technology are not yet operational in Nigeria, though, there are hopes of implementation in the near future.

There is no Land Use Policy in the country other than a Land Use Act. States are being encouraged to derive their legislation from the national framework. A national forest and wildlife law is being developed with the involvement of all stakeholders.

There is no forest certification practice in the country. However, public involvement on forest certification is being articulated in the proposed revised policy which will encourage private sector and NGO participation.

Issues relating to reports on Nigerian Farmers' Rights Legislation and Policy Database shows that there is no legislation found on Patent Laws in Nigeria, neither is there the Plant Breeders' Right Legislation.

4.0 Conclusion

There are relationships between law and ecosystems which has been for decades now and they have consequences for biodiversity. Law regarding species is more recent while Laws regarding gene pools have been in existence but were not popular until recent times, mainly due to needs to preserve or conserve. In Nigeria, some of these issues are lacking and those in place lack popular enforcement.

5.0 S**ummary**

Having gone through this unit, you are aware that;

.bio-resource legislation can define protection for threatened ecosystems, endangered species as well as some rights and duties

.there are global agreements committing countries to conserve their biodiversity, develop resources for sustainability and share the benefits resulting from their use

. presently, there is no Land Use Policy, no Forest Certification Practice, there is no legislation found on Patent Laws neither is there the Plant Breeders' Right legislation in Nigeria.

6.0Tutor Marked Assignment

1. Discuss legal status of bio-resource legislations
2. Explain the bio-resource legislations in Nigeria.

7.0Reference/Further Reading

Prof. Oladipo, E.(et.al) 2001. First National Biodiversity Report on Nigeria. Biodiversity Report on Nigeria. Accessed on May 5, 2011. From http://www.pabiodiversity.org/economic.html

United Nations Report on: National Resource Aspects of Sustainable Development in Nigeria.2009

http://asbp-au.org/about/-programme|programme-rationale/inadequate-regional-seed-marketing

Unit 3 Approaches to Biodiversity Management

Contents

1.0 Introduction

You have been intimated with the concept 'biodiversity' particularly, its definitions and benefits to humans and natural endowments. Emphasis has also been placed on effective management of bio-resources with many strategies employed. In this unit, however, efforts will be made to further stress the approaches that are being adopted to control and manage biodiversity.

2.0 Objectives

It is hoped that at the end of this unit you will be able to ;

- discuss in-situ approach
- explain ex-situ approach
- explain restoration and rehabilitation approach
- discuss land-use approach
- discuss policy and institutional approach

3.0 Main Body

3.1 In-Situ Approach

This approach is very popular among the ecologists and conservationists who use it to protect habitats and ecosystems. Simply, the approach uses methods and tools to protect species, genetic varieties and habitats in the wild. It ensures that the cherished varieties or species of plants do not go into extinction. The usefulness of the species not withstanding both the beneficial and the less beneficial are collectively protected.

3.2 Ex-Situ Approach

This approach is concerned with the deliberate and selective removal of plants, animals and microbial species and genetic varieties from their original environment. What the agriculturalists and specie-orientated biologists do is attributable to this approach. The ultimate goal for the use of this approach is approach is for the maintenance of samples of species.

3.3 Restoration and Rehabilitation Approach

As the name implies, the approach combines the use of the earlier described approaches, that is, in-situ and ex-situ to achieve its objective. The combined approaches are used to re-establish species, genetic varieties, communities, populations, habitats and ecological processes. Ecological restoration is concerned with the reconstruction of natural and semi-natural ecosystems on degraded lands.

This approach therefore, includes the reintroduction of most native species, while ecological rehabilitation is concerned with the repair of ecosystem processes.

3.4 Major- Land-Use Approach

This approach is popular with the tools and strategies as used by those in agriculture, forestry, fisheries and wild-life management and tourism. This is because these fields make use of extensive land and in the process incorporate protection, sustainable use and equity criteria and guidelines as management objectives and practices.

These approaches dominate most landscapes and the near shore coastal zone and so offer the greatest reward for investments in biodiversity management.

3.5 Policy and Institutional Approach

The main focus of this approach is the establishments of easements and the arrangements between public agencies and private interests that are seeking to establish landscape characteristics favourable to biodiversity. The approach works by limiting the use of incentives and tax policies to foster particular land-use practices and to create and enforce land tenure arrangements that promote effectiveness and sustainability.

4.0 Conclusion

Biodiversity management requires deliberate effort at making the species and varieties of the bio-resources in a particular environment. The evolving effective strategies that are being used include the in-situ approach, the ex-situ approach, the restoration and rehabilitation approach, the major land-use approach and the policy and institutional approach.

5.0 Summary

Having gone through this unit, you should be in the position to acknowledge that;

. in-situ approach uses methods and tools to protect bio-resources in the wild

. ex-situ approach is concerned with the deliberate and selective removal of plants, animals and microbial species from their original environment

.restoration and rehabilitation approach includes the reintroduction of most native species and the repair of ecosystem processes

.major land-use approach incorporates protection, sustainable use and equity criteria and guidelines as management objectives and practices.

.policy and institutional approach aids the agencies and pirate interests that are seeking to establish landscape characteristics favourable to biodiversity.

6.0 Tutor Marked Assignment

1. Distinguish between in-situ and ex-situ approaches in biodiversity management.

2. Explain restoration and rehabilitation approach of biodiversity management.

7.0 References/Further Reading

. Gray J. S.(2004): Why should we study and be concerned about marine biodiversity? Hydrobiological

.Neira M.(2011): Biodiversity. http://www.panda.org

.Silvert W.(2011): The meaning of biodiversity. http://bill.sivert.org/pdf/Biodiversity.pdf