



SANBI Biodiversity Series 2

The Convention on Biological Diversity:
biodiversity, access and benefit-sharing.
A resource for teachers
(Grades 10–12)

by

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Pretoria

2006



SANBI Biodiversity Series

The South African National Biodiversity Institute (SANBI) was established on 1 September 2004 through the signing into force of the National Environmental Management: Biodiversity Act (NEMBA) No. 10 of 2004 by President Thabo Mbeki. The Act expands the mandate of the former National Botanical Institute to include responsibilities relating to the full diversity of South Africa's fauna and flora, and builds on the internationally respected programmes in conservation, research, education and visitor services developed by the National Botanical Institute and its predecessors over the past century. The vision of SANBI is to be the leading institution in biodiversity science in Africa, facilitating conservation, sustainable use of living resources, and human well-being. SANBI's mission is to promote the sustainable use, conservation, appreciation and enjoyment of the exceptionally rich biodiversity of South Africa, for the benefit of all people. *SANBI Biodiversity Series* will publish occasional reports on projects, technologies, workshops, symposia and other activities initiated by or executed in partnership with SANBI.

Illustrations: Tano September

Technical editor: Emsie du Plessis

Design & layout: Daleen Maree

Cover design: Daleen Maree

How to cite this publication

SOLOMON, A. & LE GRANGE, P. 2006. The Convention on Biological Diversity: biodiversity, access and benefit-sharing. A resource for teachers (Grades 10–12). *SANBI Biodiversity Series 2*. South African National Biodiversity Institute, Pretoria.

ISBN 1-919976-30-2

© Published by: South African National Biodiversity Institute

Obtainable from: SANBI Bookshop, Private Bag X101, Pretoria, 0001 South Africa.

Tel.: +27 12 843-5000. E-mail: bookshop@sanbi.org. Website: www.sanbi.org.

Printed by 4Images Bureau & Printers (Pty) Ltd, Building B, The Woods, 41 De Havilland Crescent, Perse-
quor Technopark, Pretoria, 0002 South Africa.

CONTENTS

Foreword	iv
About this resource	v
Educator's notes	vi
1. Introduction	1
2. Understanding the UN Convention on Biological Diversity (CBD)	1
2.1 Objectives of the CBD	2
2.2 What are member states responsible for?	2
2.3 The role of South Africa with regard to the CBD	3
2.4 Grade 10: Lesson plans and activities	6
2.5 Grade 11: Lesson plans and activities	9
2.6 Grade 12: Lesson plans and activities	13
3. The Conservation of biological diversity	14
3.1 What is biological diversity?	14
3.2 Threats to biological diversity?	15
3.3 Human influences on the environment	15
3.4 What is South Africa doing to conserve its biological diversity?	21
3.4.1 Legislative response	22
3.4.2 Establishment and management of protected areas	23
3.4.3 Rehabilitation of the environment	24
3.5 Grade 10: Lesson plans and activities	30
3.6 Grade 11: Lesson plans and activities	38
3.7 Grade 12: Lesson plans and activities	42
4. The sustainable use of biological resources	48
4.1 What is meant by sustainable use of genetic resources?	48
4.2 Access to genetic resources	48
4.3 What is South Africa doing in terms of providing access to genetic resources?	49
4.4 Grade 10: Lesson plans and activities	52
4.5 Grade 11: Lesson plans and activities	60
4.6 Grade 12: Lesson plans and activities	64
5. Fair and equitable sharing of benefits arising from use of genetic resources	71
5.1 What is meant by fair and equitable benefit-sharing?	71
5.2 Access to indigenous knowledge systems (IKSs) and sharing its benefits	74
5.3 Grade 10: Lesson plans and activities	78
5.4 Grade 11: Lesson plans and activities	83
5.5 Grade 12: Lesson plans and activities	90
References and further reading	99

FOREWORD

The Southern African Biodiversity Support Programme funded by the Global Environmental Facility ratified the international Convention on Biological Diversity in 1995. Article 13 of the Convention highlights the need for public education and awareness and the requirement to increase capacity and knowledge about the Convention. This resource deals with the Convention, including the sustainable use of biological resources and access to South Africa's biological resources and benefit-sharing, in an attempt to further understanding about South Africa's rights and responsibilities in the conservation and management of our biodiversity in the global context. Although access and benefit-sharing is receiving increased attention at international, regional and national levels many people remain confused about the concepts that the issue encompasses and the best ways to ensure that there is a fair sharing of the benefits received from the use of our biodiversity. In many cases there is little or no understanding about some of the basic elements involved and the steps that can be taken to protect the rights of countries, like South Africa, who have a rich biodiversity and its people who have nurtured the biodiversity.

Recognising that there is a big gap in educational resources available on environmental topics, SANBI has taken the opportunity, through the Global Environment Facility-funded Southern African Biodiversity Support Programme, to commission the development of a resource on biodiversity and access and benefit-sharing. This resource was designed to support the outcomes-based approach of the National Curriculum Statement for the Further Education and Training (Grades 10–12). It is hoped that this resource will contribute to fill this gap and support the Departments of Education in training teachers for the Further Education and Training band.

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17 May 2006

ABOUT THIS RESOURCE

This resource on the Convention on Biological Diversity (CBD) was commissioned by the Southern African Biodiversity Support Programme Project managed by the South African National Biodiversity Institute (SANBI).

The resource is aligned to the national curriculum for Grades 10–12. The aim of the resource is to develop and enhance awareness and understanding of access and benefit-sharing as stipulated in the Convention on Biological Diversity.



Comments on this CBD resource

Any comments and contributions to the enhancement of the resource can be communicated to:

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Acknowledgements

Thanks go to all the people who contributed to this resource by providing expertise and information. The following people are gratefully acknowledged: Ms Alexis Symonds (SANParks), Mr Fadli Wagiet (Western Cape Education Department, EMDC South), Mrs Florence Gamanie (Working for Water Programme), Mr Deon Plaatjies (Strand Secondary), Mrs Hazel Solomons (Cidar High), Ethne Snel, Ms Phillpine Mapiyeye (Project Administrator, SANBI) and Dr Maureen Wolfson (SABSP Project Manager, SANBI).

The drafting and production of this resource was supported by GEF, IUCN, SADC and the Department of Environmental Affairs and Tourism.



EDUCATOR'S NOTES

Description of this resource

This resource is aligned to the National Curriculum Statement FET Grade 10–12 (General). The Life Sciences Learning Area is used as the main learning area, integrated and supported by various other relevant learning areas.

It focuses primarily on the two knowledge areas, environmental studies and diversity, change and continuity, and uses the UN Convention on Biological Diversity as a frame of reference for exploring and discussing the prescribed content. It provides adequate background information for the learner to develop knowledge and understanding about the following content areas towards attainment of the respective learning outcomes through the lenses of the respective assessment standards (Tables 1 and 2).

Table 1. The Life Sciences Learning Area as in the National Curriculum Statements

Learning Outcome		Content
LO 1: Scientific Inquiry and Problem-solving Skills <i>The learner is able to demonstrate an understanding of the nature of science, the influence of ethics and biases in the life sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society.</i>	Grade 10	• Biodiversity of plants and animals and their conservation. • Significance and value of biodiversity to ecosystem function and human survival. • Threats to biodiversity. • Extinction of species, Red Data listing and endangered species. • Biospheres, biomes and ecosystems.
LO 2: Construction and Application of Life Sciences Knowledge <i>The learner is able to access, interpret, construct and use Life Sciences concepts to explain phenomena relevant to Life Sciences.</i>	Grade 11	• Investigation of human influences on the environment. • Management and maintenance of natural resources (sustaining our environment). • Historical developments: indigenous knowledge systems, biotechnology, environment, legislation, social behaviour and ethics. • Exploitation vs sustainability: exploring issues. • Industrialisation and the impact of industry. • Management of resources, and the use and abuse of resources.
LO 3: Life Sciences, Technology, Environment and Society <i>The learner is able to demonstrate an understanding of the nature of science, the influence of ethics and biases in the Life Sciences, and the interrelationship of science, technology, indigenous knowledge, the environment and society.</i>	Grade 12	• Rehabilitation of the environment. • Land issues and exploring the land issue. • Investigation of a local environmental issue, problem-solving and decision-making.

The following table provides the learning outcomes and assessment standards for Life Sciences. Each assessment standard has three numbers for a specific grade (Grade 10, 11, 12). For example, 1.1.1 should be read as follows:

• First number (1) represents the Learning Outcome, e.g. Scientific Inquiry and Problem-solving Skills.

- ☛ Second number (1) represents the focus of the assessment standard, e.g. identifying and questioning phenomena and planning an investigation.
- ☛ Third number (1) represents the assessment standard as specified for a grade, e.g. identify and question phenomena.

Table 2. Assessment standards for the Life Sciences learning area

Learning Outcome 1: Scientific Inquiry and Problem-solving Skills

AS 1: Identifying and questioning phenomena and planning an investigation		
Grade 10	Grade 11	Grade 12
AS 1.1: Identify and question phenomena	AS 1.1: Identify phenomena involving one variable to be tested	AS 1.1: Generate and question hypotheses based on identified phenomena for situations involving more than one variable
AS 1.2: Plan an investigation using instructions	AS 1.2: Design simple tests to measure the effects of this variable	AS 1.2: Design tests and/or surveys to investigate these variables
AS 1.3: Consider implications of investigative procedures in a safe environment	AS 1.3: Identify advantages and limitations of experimental design	AS 1.3: Evaluate the experimental design

AS 2: Conducting an investigation by collecting and manipulating data		
Grade 10	Grade 11	Grade 12
AS 2.1: Systematically and accurately collect data using selected instruments and/or techniques and following instructions	AS 2.1: Systematically and accurately collect data using selected instruments and/or techniques	AS 2.1: Compare instruments and techniques to improve the accuracy and reliability of data collection
AS 2.2: Display and summarise the data collected	AS 2.2: Select a type of display that communicates the data effectively	AS 2.2: Manipulate data in the investigation to reveal patterns
		AS 2.3: Identify irregular observations and measurements
		AS 2.4: Allow for irregular observations and measurements when displaying data

AS 3: Analysing, synthesising, evaluating data and communicating findings		
Grade 10	Grade 11	Grade 12
AS 3.1: Analyse, synthesise, evaluate data and communicate findings	AS 3.1: Compare data and construct meaning to explain findings	AS 3.1: Critically analyse, reflect on and evaluate the findings
	AS 3.2: Draw conclusions and recognise inconsistencies in the data	AS 3.2: Explain patterns in the data in terms of knowledge
	AS 3.3: Assess the value of the experimental process and communicate findings	AS 3.3: Provide conclusions that show awareness of uncertainty in data
		AS 3.4: Suggest specific changes that would improve the techniques used

Learning Outcome 2: Construction and Application of Life Sciences Knowledge

AS 1: Accessing knowledge		
Grade 10	Grade 11	Grade 12
AS 1.1: Use a prescribed method to access information	AS 1.1: Use various methods and sources to access information	AS 1.1: Use various methods and sources to access relevant information from a variety of contexts

AS 2: Interpreting and making meaning of knowledge in Life Sciences		
Grade 10	Grade 11	Grade 12
AS 2.1: Identify concepts, principles, laws, theories and models of Life Sciences in the context of everyday life	AS 2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships	AS 2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts
AS 2.2: Describe and explain concepts, principles, laws, theories and models	AS 2.2: Evaluate concepts, principles, laws, theories and models	

AS 3: Showing an understanding of the application of Life Sciences knowledge in everyday life		
Grade 10	Grade 11	Grade 12
AS 3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life	AS 3.1: Analyse and evaluate the costs and benefit of applied Life Sciences knowledge	AS 3.1: Evaluate and present an application of Life Sciences knowledge

Learning Outcome 3: Life Sciences, Technology, Environment and Society

AS 1: Exploring and evaluating scientific ideas of past and present cultures		
Grade 10	Grade 11	Grade 12
AS 3.1: Identify and investigate scientific ideas and indigenous knowledge of past and present cultures	AS 3.1: Compare scientific ideas and indigenous knowledge of past and present cultures	AS 3.1: Critically evaluate scientific ideas and indigenous knowledge of past and present cultures

AS 2: Comparing and evaluating the uses and development of resources and products, and their impact on the environment and society		
Grade 10	Grade 11	Grade 12
AS 2.2: Describe different ways in which resources are used and applied to the development of products, and report on their impact on the environment and society	AS 2.2: Compare different ways in which resources are used in the development of biotechnological products, and analyse the impacts on the environment and society	AS 2.2: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment

AS 3: Comparing the influence of different beliefs, attitudes and values on scientific knowledge		
Grade 10	Grade 11	Grade 12
AS 3.1: Analyse and describe the influence of different beliefs, attitudes and values on scientific knowledge and its application to society	AS 3.1: Compare scientific ideas and indigenous knowledge of past and present cultures	AS 3.1: Generate and question hypotheses based on identified phenomena for situations involving more than one variable
AS 1.2: Plan an investigation using instructions	AS 1.2: Design simple tests to measure the effects of this variable	AS 1.2: Design tests and/or surveys to investigate these variables
AS 1.3: Consider implications of investigative procedures in a safe environment	AS 1.3: Identify advantages and limitations of experimental design	AS 1.3: Critically evaluate and take a justifiable position on beliefs, attitudes and values that influence developed scientific and technological knowledge and their application in society

How the activities have been compiled

The activities have not been arranged sequentially. At the end of each section there may be one or more activities that you could use to develop knowledge on the topic and related topics.

The activities for each grade level are different but increase in complexity from Grade 10 to 12 according to the assessment standards.

1. Introduction

The resource deals with the Convention on Biological Diversity (CBD). It tries to simplify the CBD as far as possible and applies the information to assist in understanding key topics in the field of environmental studies while also trying to attain the learning outcomes of relevant learning areas.

It presents the CBD as a frame of reference for understanding the issues, problems and trends pertaining to the environment and its biological diversity and resources.

Section 2 focuses on the Convention on Biological Diversity. It sets the context for the sections that follow. It provides background information and lists the objectives of the Convention. One of the subsections presents a summary of what states or parties to the Convention are responsible for according to the stipulations of the Convention. The section concludes with a short summary to the undertakings of South Africa as signatory to the Convention. At the end of the section are activities to assist with developing the learner's understanding of the Convention.

Sections 3–5 contain an exposition of the three objectives of the CBD. The section explores key concepts that will help learners to understand the complexities and nuances of each objective and the activities envisioned by the Convention.

Section 3 deals with the topics biodiversity, threats to biodiversity, human influences on the environment and rehabilitation respectively. It seeks to answer the question: What is South Africa doing in terms of the first objective of the Convention? The section concludes with activities focusing on these topics.

Section 4 explores what is meant by sustainable use of biological components. It explains the concept and implication of access to genetic resources.

Section 5 discusses fair and equitable sharing of benefits arising from use of genetic resources. It also explains linkages between benefit-sharing and indigenous knowledge systems and how the Convention safeguards indigenous knowledge against unfair patenting of indigenous knowledge.

The knowledge and content areas described within the National Curriculum Statement are woven into the discussions on the Convention and its implications for South Africa and other relevant parties.

This is an interactive resource and requires that learners become active in the knowledge building process. It aims to take a highly technical document and make it into a handbook to help learners explore the important concepts for daily living in this global world. This resource engages with many of the principles of the National Curriculum Statements, but with special reference to the principle of Human Rights, Inclusivity, Environmental and Social Justice.

It further aims to activate the interest of learners in local and global issues that affect their lives. The Convention on Biological Diversity has implications for human behaviour and survival. It brings the conservation of biodiversity home and makes it everyone's business.

2. Understanding the UN Convention on Biodiversity (CBD)

The Convention on Biodiversity is a legally binding treaty that is aimed at addressing the threats to biodiversity and environmental sustainability. It aims to protect, understand and use environmental resources sustainably. The treaty came into effect in December 1993, a year after the United Nations Conference on Environment and Development which resolved that such a treaty be implemented. A total of 188 member countries, including South Africa, have ratified the CBD.



Word bank

Ratify: When countries ratify a treaty or convention, they agree to abide by the terms and conditions contained therein.

2.1 Objectives of the CBD

Its three objectives are:

1. The conservation of biological diversity.
2. The sustainable use of its components.
3. The fair and equitable sharing of benefits arising from the use of genetic resources.

These objectives are to be met through the implementation of a number of measures at both international and national levels. It places the following responsibilities on member countries:

- To develop national strategies.
- To integrate biodiversity issues into sectoral and cross-sectoral plans.
- To establish monitoring programmes.
- To implement extensive measures for *in situ* and *ex situ* conservation (e.g. establishing protected areas, controlling alien organisms, restoring degraded ecosystems).
- To adopt incentive measures.
- To establish research and training programmes.
- To conduct public education and awareness-raising activities.
- To introduce measures to facilitate access to genetic resources and benefit-sharing.

Word bank

***In situ* conservation:** Means the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.

***Ex situ* conservation:** Means the conservation of components of biological diversity outside their natural habitats (e.g. in a zoo).

2.2 What are member states responsible for?

Article 3. Principle of the CBD

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction.

The CBD reaffirms that states (different countries) have sovereign rights over their own biological resources and therefore are responsible for conserving their biological diversity and using their biological resources sustainably.

The Convention raises concerns about the negative impact of human activities and states that humans are viewed as the main reason for the reduction of biological diversity.

States must develop scientific, technical and institutional capacities to plan and implement appropriate measures to reduce the negative impacts of human activities on their environment.

States must act to reduce the loss of biological resources and diversity. In order to conserve their biodiversity, it is important that states put every measure in place to conserve species in their natural habitats and conserve these ecosystems and natural habitats. This is referred to as *in situ* conservation.

Article 14 stipulates that all development must be mindful of the impact of certain activities on the environment and may be required to conduct Environmental Impact Assessments (EIAs) of the project. The aim of the EIA must be to highlight the effects that the development will have on the biological diversity with a view to avoiding or minimising such effects.

Important to note is that the Convention places the onus for management and maintenance of the natural resources on national governments. In its preamble, the CBD also stresses the need for international collaboration to minimise or eradicate negative impacts on the environment. The 'nimby' (not in my back yard) mentality must be challenged.

In accordance with the CBD (Article 6), South Africa has several policies and legislation in place that guide its practices of conservation and protection of its natural resources.

It has also ratified several international conventions relating to the environment and its biological diversity. Furthermore, it developed several national strategies, plans and programmes to ensure the conservation and sustainable use of its biological diversity.

South Africa has signed and ratified a large number of international conventions, treaties, protocols and other agreements. Since the early 1990s, South Africa's policy and legislative framework has been strongly influenced by these international agreements and the principles of sustainable development.

2.3 The role of South Africa with regard to the CBD

South Africa ratified the CBD in 1995. In so doing, it committed itself to take all measures possible to meet the objectives set by the CBD. In the light of the above information on the Convention you will be able to get a sense of the great responsibilities placed on signatory countries.

We will now apply what we know about the Convention and explore what is meant by some of its key articles. We will use the South African context as our frame of reference. From time to time we may include an international example but will try as far as possible to focus on what South Africa is doing to contribute to meeting the objectives set by the Convention.

Before you move to the next three sections, which will deal with each of the three objectives of the CBD separately, please take some time and complete the activities at the end of this section. The activities will help you to review your understanding of the CBD, as this prior knowledge is necessary for the sections that follow.



Lesson plans and activities

The following lesson plans were developed as examples of how you can explore issues of the Convention on Biological Diversity in the curriculum. These are examples and can be adapted and expanded to meet your specific educational needs. You will find a range of curriculum-aligned lesson plans and activities in the different sections of the resource. The lesson plans have been developed to varying degrees. Some of the activities have been developed in such a way that they can be combined into one complete lesson plan. Alternatively, you can use these activities separately to ascertain how much learners understand about a given topic. Selections of the activities are stand-alone activities and require additional preparation for teaching. Remember to develop your lesson plans and activities in line with the curriculum learning outcomes and assessment standards of the particular learning areas.

2.4 Grade 10: Lesson plans and activities

2.4.1 Topic: Understanding the CBD	Grade 10: Environmental issues and depletion of resources
Learning Area: Life Orientation Learning Outcomes: LO 2: Citizenship Education Assessment Standards: AS 2.1: Identify social and environmental issues and participate in a group project to address a contemporary social and environmental issue (e.g. the role of the state and individual as a signatory to the CBD).	Integration: Prior Learning: Understanding of policies and legislation.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Marking grid.	
Resources: Section 2. A copy of the SA constitution. Any relevant policies and conservation posters.	
Teacher Activity: Provide some information on what biodiversity is. Explain the role of policies and legislation. Define the difference between national and international policies.	

Activity 1

Ask learners to read the content under Section 2 and answer the questions:

1. Describe the aims of the Convention on Biological Diversity in your own words.
2. How are the three objectives of the CBD relevant to your life?
3. Refer to the responsibility statements in the CBD. Select the statements that mention one of the following issues:
 - ☛ Rights of the state.
 - ☛ Capacity-building.
 - ☛ Environmental impact studies.
 - ☛ International collaboration.
 - ☛ Supporting environmental policies.

Activity 2

Divide learners into groups and ask them to write a fact sheet for the school paper. They will have to form their groups, allocate tasks and ensure that the following aspects are covered in the article:

- ☛ Introduce the Convention on Biological Diversity.
- ☛ Explain its purpose and objectives.

- Explain its importance for the country and our lives.
- Describe our roles as South Africans to support the implementation of the policy.

Activity 3

Ask learners to read Case Study 1 and answer the questions that follow:

Case Study 1. 'Rooibos' now on everyone's lips—30 June 2005

After 10 years and over R6 million in legal fees, Rooibos Ltd has won the battle over ownership of the generic term 'rooibos', according to a company statement. The name of the tea, an everyday word in South Africa, was registered as a trademark in the US by Forever Young Ltd in 1994.

According to the settlement agreement announced on Wednesday, Forever Young and the new owner of the trademark, Virginia Burke-Watkins, voluntarily and unconditionally agreed to the cancellation of their registration of the word 'rooibos' in the US and various other countries. 'Rooibos' is Afrikaans for 'red bush'. The tea is grown only in the Cedarberg area of the Western Cape, about 200 kilometres north of Cape Town. There is no alternative source of supply anywhere in the world.

Rooibos Ltd was the main driving force behind the case, with help from the national and Western Cape governments. A tea-processing and marketing company owned by farmers, Rooibos Ltd is the largest producer and marketer of rooibos internationally, handling about 70% of sales.

'The livelihood of all rooibos farmers as well as tea manufacturers was threatened by this name-registration issue,' said Martin Bergh, managing director of Rooibos Ltd. 'We had to do something about it.'

In 1994, Forever Young registered the name 'rooibos' in the US and numerous other countries, restricting the use of the word to only those willing to do business with the company. In 2001, Forever Young sold the registration to Virginia Burke-Watkins of Dallas, Texas.

Business Day reports that in 2004, Burke-Watkins sent letters to rooibos distributors in the US, insisting they stop using the term in their marketing material and demanding \$5 000 (over R30 000) compensation from them. This year a Missouri district court ruled that as rooibos was a generic term, it could not be used as a trademark, the newspaper reports. Burke-Watkins lodged an appeal and the hearing was expected to take place in 2006. Rooibos Ltd also brought an application to the US patents and trademarks office to cancel the registration. Bergh told *Business Day* the direct implication of the judgement was that distributors would be able to use the term without having to pay. The indirect effect would be that distributors, who were not investing in marketing in the US because of the uncertainty over the name, would now start building up their market. Rooibos sales in the US are worth an estimated R70 million at retail level, Bergh said. That compares with about R300 million of retail sales value in South Africa. According to *Business Day*, Germany is the biggest market for rooibos tea, importing more than South Africa consumes.

Bergh told the newspaper that although rooibos tea is a dryland (not irrigated) product and vulnerable to weather conditions, the industry produces about 9 000 to 10 000 tons of the tea a year, which could easily be doubled. The cost of the case to Rooibos Ltd has been astronomical. Because the lawsuit was in the interest of the entire rooibos-producing industry, it was decided to approach the South African government for financial assistance and support. The Department of Trade and Industry pledged R2 million, and the Western Cape provincial government R250 000.

The red bush

Rooibos is a caffeine-free herbal tea with numerous scientifically tested health benefits. It is one of the many indigenous South African plants that make up the Cape Floristic Region. A world biodiversity hotspot and one of South Africa's six World Heritage Sites, the region has more plant species than the whole of the British Isles or New Zealand.

Overall sales of rooibos in the US climbed from just over \$1 billion (R6.7 billion) in 1993 to about \$5.1 billion (R34.1 billion) in 2003, according to the Tea Council of the US.

'Rooibos sales in America, in spite of the registered name obstacle, have quadrupled every year since 1999,' says Hugh Lamond, president of California-based Herbal Teas International.

Rooibos has a delicate flavour as well as documented health benefits from polyphenols and antioxidants, which may delay the ageing process and help protect against heart attacks and certain types of cancer.

Many varieties of rooibos teas are available in grocery shops, speciality and natural food stores throughout the US, Canada, Europe and Japan. Rooibos Ltd also exports the tea to manufacturers and wholesalers in the US and Canada.

Questions

1. Identify the main role-players in the case study. Also indicate their roles and responsibilities in a table.
2. Explain the role that the CBD plays in this case.
3. Explain why this case was so important for South Africa and the affected communities.

Activity 4

1. Ask learners to brainstorm the concept 'biological diversity'.
2. Learners should do the following as a class project:
 - Do a biodiversity audit of the school ground. They should present their information in a table.
 - On a map of the school grounds, indicate where the different plants and animals are found.
 - Collect one sample of each plant species and press and dry it so that it can become part of the biodiversity archives of the school.
 - Write a state of biodiversity report of the school grounds.
 - Each year, write a state of biodiversity report of the school grounds.
3. Using the results, ask learners to develop a biodiversity policy statement for the school.
4. The policy statement can be advertised at school or in the local community newspaper.

2.4.2 Additional ideas for activities

Below is a list of ideas that you can use to develop activities for your lesson plans.

- Prepare a poster explaining the Convention on Biodiversity.
- Investigate and make a list of the countries that have ratified and/or signed the Convention on Biological Diversity.
- Design a world map on which the countries that have ratified the CBD can be indicated.
- Develop a role-play which will explain the CBD and its purpose.
- Investigate who the main role-players in the Convention on Biological Diversity are.
- Develop a poster that will explain the links between the South African Bill of Rights and the Convention on Biological Diversity.
- Search for case studies that describe the Convention on Biological Diversity.
- Research the history of how and why the Convention on Biological Diversity policy was developed.



2.5 Grade 11: Lesson plans and activities

2.5.1 Topic: Sustaining our environment	Grade 11: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 1: Scientific Inquiry and Problem-solving Skills LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 1.2.1: Systematically and accurately collect data using selected instruments and/or techniques. AS 1.2.2: Select a type of display that communicates the data effectively. AS 1.3.1: Compare data and construct meaning to explain findings. AS 2.1.1: Use various methods and sources to access information. AS 2.2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships. AS 2.2.2: Evaluate concepts, principles, laws, theories and models.	Integration: Prior Learning: Understanding of policies and legislation. An understanding of biological diversity.
Assessment Possibilities Assessment method: Group assessment, individual assessment Assessment tool: Rubric, marking grid	
Resources: Section 2. A copy of the SA constitution.	
Teacher Activity: Provide some information on what biodiversity is. Provide guidance on writing of an article and preparation of the questionnaire.	

Activity 1

Write a newspaper article on the CBD covering the following questions:

- 👉 How would you describe the Convention on Biological Diversity?
- 👉 Why is the CBD important for the world?
- 👉 Is the CBD relevant to South Africa? Explain briefly.
- 👉 How does the CBD benefit the South African people?

Activity 2

Draw a bar graph representing the number of CBD signatory countries of each of the continents on earth. The X-axis must represent the continents and the Y-axis the number of CBD signatory countries. In your opinion, give an explanation for what the graph represents.

Activity 3

The learners have to complete the questionnaire.

1. Divide the learners into groups. This activity consists of the following tasks:
 - Each group must add one question to the CBD questionnaire (see point 4 on the questionnaire).
 - Each member must ask two blue-collar workers, two white-collar workers, two students or learners and two retired persons to complete the questionnaire.

CBD Questionnaire**1. Personal details:****Male**☐**Female**☐**2. Occupation:**

Occupation	Tick choice
Blue-collar worker	
White-collar worker	
Student/learner	
Retired person	

3. Age group:

Age in years	Tick choice
13 to 20	
21 to 30	
31 to 40	
41 and over	

4. Questions:

Questions	Yes	No
1. Are you aware of the CBD?		
2. Do you think it is important to protect the country's biodiversity?		
3.		
4.		
5.		

2. The groups should compile all the information from the questionnaires collected by the members of the group and represent the combined information for each question in the table below. Duplicate the table for each of the questions.

Questionnaire table

Question 1: Are you aware of the CBD?	Responses	
Category	Yes	No
Male		
Female		
Blue-collar worker		
White-collar worker		
Student/learner		
Retired person		
Age 13 to 20		
Age 21 to 30		
Age 31 to 40		
Age 41 and older		

3. Analyse and draw conclusions from the data. Represent your analysis and conclusions in a report.

Activity 4

Divide the class into six groups. Two groups will work on Article 3, two on Article 6, and two on Article 7. Each group should prepare a poster that captures the main points of the article. The class should decide which poster on each of the articles is the best.

Taken from the Convention on Biological Diversity

Article 3: Principle

'States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.'

Taken from the Convention on Biological Diversity

Article 6: General measures for conservation and sustainable use

'Each Contracting Party shall, in accordance with its particular conditions and capabilities:

- a) Develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect, inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and
- b) Integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.'

Taken from the Convention on Biological Diversity

Article 7: Identification and Monitoring

'Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Article 8 to 10:

- a) Identify components of biological diversity important for its conservation and sustainable use having regard for the indicative list of categories set down;
- b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;
- c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and
- d) Maintain and organise, by any mechanism, data derived from identification and monitoring activities pursuant to subparagraphs (a), (b) and (c) above.'

Activity 5

Ask learners to imagine that they have been invited to the parliament of South Africa to give an important address on the Convention on Biological Diversity. They must make a list of the key points they would use in their speech and give a few real examples to emphasise why the CBD is important for South Africa.

Ask two or more learners to present their speeches, approximately 5 minutes after which the rest of the learners are given an opportunity to assess their peers in terms of how well they think the speech captures the main points of the Convention.

Activity 6

Ask learners if they have any questions about the content of the CBD. List these questions. Divide the class into groups and assign each group one of these questions to respond to. They must present their answer to the class. The class can then discuss the answers and add information if necessary.

Activity 7

Ask learners to describe what South Africa has done in terms of the CBD from the date on which it ratified the CBD until the present. They must present their findings on a timeline. Let learners form groups of four. They must present their timelines to the rest of the group. Each group must then compile a group timeline that reflects the findings of all the group members. The group presents their timeline to the rest. Allow for discussion of the difference in these timelines.

2.5.2 Additional ideas for activities

The ideas suggested are only examples of activities. They can be used when you develop your lesson plans.

- 🐿 Prepare a poster explaining the Convention on Biodiversity.
- 🐿 Develop a role-play that will explain the CBD and its purpose.
- 🐿 Investigate who the main role-players are in the Convention on Biological Diversity.
- 🐿 Develop a poster that will explain the links between the South African Bill of Rights and the Convention on Biological Diversity.
- 🐿 Search for case studies that describe the Convention on Biological Diversity.
- 🐿 Research the history of how and why the Convention on Biological Diversity policy was developed.
- 🐿 Develop a CBD policy statement for your community (school) that reflects the mission statement, objectives and problem statement.
- 🐿 Interview an expert in policy development to find out how policies are developed.
- 🐿 Interview a government official to find out whether the CBD is being implemented.
- 🐿 Ask the learners in class to brainstorm the process of how they think a national policy is developed. The information should be explained in a five-step flow diagram.

2.6 Grade 12: Lesson plans and activities

2.6.1 Topic: Exploring policy-making and the CBD—local environmental issues	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge History LO 1: Historical Enquiry (Practical Competence) LO 3: Knowledge Construction and Communication (Reflexive Competence) Assessment Standards: Life Sciences AS 2.1.1: Use various methods and sources to access relevant information from a variety of contexts. AS 2.2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts. History AS 1.2: Access a variety of relevant sources of information in order to carry out an investigation. AS 3.4: Communicate knowledge and understanding in a variety of ways including discussion (written and oral), debate, creating a piece of historical writing using a variety of genres, research assignments, graphics and oral presentation.	Integration: History
	Prior Learning: Understanding of policies and legislation. Exploration of the SA constitution.
Assessment Possibilities: Assessment method: Peer and group assessment. Assessment tool: Memorandum. Marking grid.	
Resources: Section 2. SA constitution and any relevant policies. Information on countries that have ratified the CBD.	
Teacher Activity: Provide some information on what biodiversity is. Explain the role of policies and legislation. Define the difference between national and international policies.	

Activity 1

Each learner must prepare the following two topics for a class discussion that will be facilitated by the teacher:

1. What is the role of policies and legislation in a country?
2. Will policies and legislation be enough to deliver the vision and aims of the CBD? Support your answer with 'evidence.'

Activity 2

Learners should answer the following questions after reading Section 2. Encourage them to obtain additional relevant information from other sources.

1. How relevant is the CBD in your daily life?
2. What would the effect on South Africa be if the CBD were not one of its policies?

Activity 3

Design a poster with the following information on it:

1. A world map that highlights the countries that:
 - ☛ Ratified the CBD.
 - ☛ Are signatories to the CBD.
2. The responsibilities of a country that ratified the CBD and one that is a signatory to the CBD.
3. Indicate on the map the 10 countries that have the highest biodiversity in the world.

Activity 4

Divide the learners into groups of five. Each group must present a report, *The state of biodiversity at the school and surrounding area*. (The class must decide the perimeter of the surrounding area.) The report must be based on a biodiversity audit that the learners did of the school grounds and surrounding area. The report must also include recommendations to improve the state of biodiversity. The best report must be part of a letter that must be sent to the relevant local government agency to bring to their attention your concerns and what you expect them to do about it.

2.6.2 Additional ideas for activities

The activity ideas can be used when you develop your lesson plans.

- ☛ Prepare a poster explaining the Convention on Biodiversity.
- ☛ Develop a role-play that will explain the CBD and its purpose.
- ☛ Investigate who the main role-players in the Convention on Biological Diversity are.
- ☛ Develop a poster that will explain the links between the South African Bill of Rights and the Convention on Biological Diversity.
- ☛ Search for case studies that describe the Convention on Biological Diversity.
- ☛ Research the history of how and why the Convention on Biological Diversity policy was developed.
- ☛ Develop a CBD policy statement for your community (school) that reflects the mission statement, objectives and problem statement.

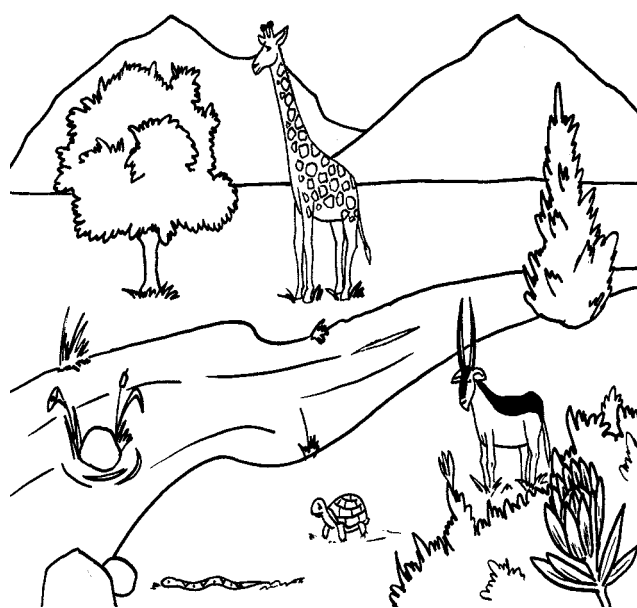
3. The conservation of biological diversity

3.1 What is biological diversity?

Biodiversity or 'biological diversity' is everything that lives in nature, for example, plants, trees, insects, fishes, big animals and small animals and micro-organisms. Biodiversity is also about differences between things. It describes many different kinds of things living together in the same space that often have to share complex relationships. A biologically diverse place is where one would find many hundreds of different types of plants and trees. Living on these plants might be different types of animals, e.g. insects, birds and wildlife. Biodiversity with its variety of living organisms can be divided into three parts, namely:

1. Genetic diversity

Parents pass on their genes to their children, which then determine the physical and biochemical characteristics of the child. Genetic diversity refers to the differences of genes within species.



2. Species diversity

Species are groups of morphologically similar plant, animals, micro-organisms or other living organisms able to produce fertile offspring. It is therefore the variety and abundance of species within a certain area.

3. Ecosystem diversity

Ecosystem diversity is the variety of ecosystems, for instance communities of plants, animals and micro-organisms (biotic), and the soil, water and air (abiotic) on which they depend—within a certain area, or the variety of species within different ecosystems.

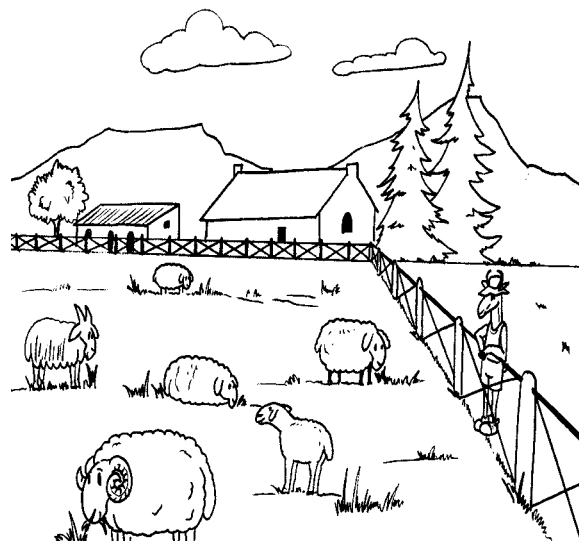
3.2 Threats to biological diversity?

The degradation of the South African biodiversity has a long history. Today, we are faced with the issues that continue to endanger the country's biodiversity. The main threats to biodiversity inside and outside protected areas can be summarised as follows:

- ☛ Human development.
- ☛ Invasive alien plant and animal species.
- ☛ Over-abundance of certain wildlife populations.
- ☛ Pollutants.
- ☛ Excessive use of resources.
- ☛ Climate change.

Examples of the human impacts can be described as:

- ☛ Unsustainable hunting and gathering—over-exploitation of animal and plant species for hunting and gathering until there is nothing left.
- ☛ Over-extraction of water, such as damming rivers so that rivers, wetlands and estuaries downstream dry out and birds, reptiles, plants and fish die.
- ☛ Pollution—chemical spills, pollution in the air, rivers and sea from factories, large farms, cars, aeroplanes and ships and waste products are main causes. Effects of the pollution nearly always cause problems far away from its origin.
- ☛ Land degradation—unsustainable farming and agricultural practices and structural developments are some of the main actions that result in land degradation.
- ☛ Alien species—these are species introduced into the country by travellers who bring with them either on purpose or accidentally, animals such as cats, goats, rats, plants and plant seeds not indigenous in a specific area. Invasive alien species are harmful to the local environment as they are users of huge amounts of water, cause diseases and destroy the biodiversity of the areas where it occurs, for example Port Jackson trees which have invaded and now endanger the fynbos diversity.
- ☛ Climate change—human-assisted climate change is a global problem and considered by many scientists to be the single most important threat to biodiversity globally.



3.3 Human influences on the environment

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity describes very clearly what the main issues are with regard to the impact of the use of South Africa's biological diversity for economic activities. Each area of economic activity places a demand on the biological diversity and impacts on the resource according to its many uses.

These different areas are referred to in the White Paper as economic sectors, which:

1. Directly use biological resources, are dependent upon the renewal of such resources, and which by overuse may impact on biodiversity (e.g. fishing, hunting, grazing and collection and use of medicinal plants).
2. Depend upon ecological processes, but which require the direct transformation of natural systems and actively impact on biodiversity (e.g. cultivation, afforestation).
3. Do not directly depend upon ecological processes or on the consumptive use of biological resources, but which may inadvertently have an impact on biodiversity (e.g. mining, tourism).

We must bear in mind that the activities that require the use of these biological resources include modern, highly technical and commercialised and traditional activities.

When we explore the sectors relying on the use of the biological resources we can cluster them into at least four main categories.

Those **industries** that rely on local species collected from the wild, e.g. fishing, wood harvesting, hunting, wildflowers, traditional medicine and other industries that produce or market natural products.

Traditional and subsistence users require these biological resources for food. They gather or harvest plants or hunt animals as per their requirements. They also rely on these biological resources for medicinal use, to construct shelters, for fuel (many still rely on wood for fuel), for building materials and trade. There is a growing interest in the arts and crafts produced by indigenous communities and these products are becoming increasingly commercialised.

Agriculture is another sector that has a direct demand on the local biological resources for grazing pastures for livestock.

Certain sectors do not place a direct demand on the biological resources but still depend on the ecological processes such as the generation of soils, the pollination of crops and pest control but change the natural habitats of the indigenous biodiversity to meet their needs. By changing we mean: actually removing the indigenous biological resources for activities such as cultivation and afforestation.

Another category does not depend on the ecological processes or the biological resources, but nevertheless impacts on the biodiversity, for example the **mining and energy** industries. They depend on non-renewable resources, chemical or biological processes. Other examples include housing, transport, tourism and recreation. It is not difficult to see how these activities can impact negatively on the biological diversity.

The impacts of these sectors on the biological diversity are largely negative and may result in:

- Habitat degradation, loss and fragmentation.
- Over-exploitation of species.
- Pollution of soil, air and water.
- Invasion by harmful alien organisms.
- Climatic change.

Humans, through our industrial and commercial processes are largely responsible for biological diversity loss. The extent of biodiversity loss varies according to the type of ecosystem (for example, terrestrial or aquatic) it impacts upon. Some ecosystems are far more sensitive than others and it could mean the end of certain species (see Case Study 2 for an example of the indirect impact of human activities, such as fishing, on the aquatic biodiversity).

Case Study 2. Invasion of alien species

South Africa has been fortunate in that its marine ecosystems have not been severely disrupted by invasive alien species, despite the great potential for seeding from ships. The two major invasions in South African waters are believed to have been introduced accidentally by ships or oilrigs. The European mussel *Mytilus galloprovincialis* has invaded the west coast (Grant & Cherry 1996), where it has restructured intertidal communities. This species is also farmed commercially. The invasion by the European shore crab *Carcinus meanis* has been restricted to sheltered bays and harbours along the southwest coast, but the species has the potential to devastate populations of molluscs (Le Roux *et al.* 1990). There is also a possibility of accidental or deliberate introduction of species for culturing, which may establish them in the natural environment. Poor control of the mariculture industry has been blamed for the introduction of a South African sabellid worm parasite to California where it has infected several abalone farms and has presented a potential threat to indigenous wild stocks (Lafferty & Kuris 1996; Tegner 1996).

South Africa has experienced episodic invasions of unicellular algae. *Oriococcus anophagefferens* bloomed in Saldanha Bay and threatened the mariculture industry there. It is a small alga that was noticed only when it bloomed. The occurrence of this same species along the American Pacific coast suggests that it may also be an invader from ships. *Gymnodinium* cf. *mikimotoi* bloomed in False Bay in 1988, when it was recorded for the first time. It has since been recorded most years after that, suggesting that it is an introduced species. It caused large invertebrate mortalities and presented a health hazard. Ship ballast water is the most common transport mechanism for invasive algal species (National Research Council 1995).

Source: Conservation of Marine Biodiversity in South Africa.htm

Word bank

Invasive alien species: An alien species that causes, or has the potential to cause, harm to the environment, economy or human health.

The consequences of human activities not only impact negatively on the environment but may also impact on the livelihood of local communities who rely on these biological resources for their subsistence and well-being.

The White Paper on Biological Diversity includes the findings of an extensive analysis of the impact of human activities per sector. We have included it below for you to study and get a better understanding of just how important it is that we plan all activities in such a way that we are mindful of the impact it will ultimately have on the biological diversity and the health of our environment.

Take a few minutes and think about the issues raised. What do you think will be the long-term consequences of these activities for the environment and for us? What about future generations? Will they be able to enjoy our environment and its biological diversity as we do now? Do you now understand why it is important to have legislation in place to keep these human activities in check and regulate certain sectors?

Table 3 describes the negative impacts that the different users (sectors) through their activities have on biological diversity in South Africa.

Table 3. Negative impacts of sectoral activities on biological diversity in South Africa

Impact economic sector	Habitat loss and fragmentation	Over-exploitation of species
Agriculture	Primarily through cultivation, requiring the removal of natural vegetation, and through bush encroachment.	Over-grazing in parts of the country may result in certain species being over-exploited. Through over-harvesting of wildflowers.
Impact economic sector	Air, water and soil pollution	Introduction of harmful alien species
Agriculture	Largely through the use of agrochemicals, through siltation, and from mariculture and aquaculture enterprises. Through the introduction of alien species for mariculture and aquaculture.	In some instances, through the introduction of high-yielding exotic species for cultivation or pastoral purposes.
Biotechnology industry		Potential risk through the transfer, handling, use and release of genetically modified organisms.
Chemical industry	Activities related to the chemical industry may result in air, water and soil pollution.	
Impact economic sector	Habitat loss and fragmentation	Over-exploitation of species
Defence	Through the use of the land and sea for weapons testing and training.	Over-exploitation of species in areas used for purposes of defence.
Domestic households	Indirectly, through requiring the range of different economic services described above.	Through the harvesting of certain plants and animals for food, building, fuel or medicinal purposes.
Power generation	Through the clearing of land for the construction of infrastructure. Potentially through global warming.	
Fisheries	Through physical damage to the habitat from certain fishing gear.	Over-exploitation of target and non-target species, with ramifications for other species and supporting ecosystems.
Impact economic sector	Air, water and soil pollution	Introduction of harmful alien species
Defence	Through the production and use of various weapons.	
Domestic households	Through the generation of sewage and household waste, as well as pollutants associated with cooking and heating.	Through the use of harmful alien species in gardens.
Power generation	Air, water and soil pollution through the burning of coal and related processes, and the generation of waste from the nuclear industry.	
Fisheries	From mariculture and aquaculture enterprises, as well as from fishing gear.	Through the introduction of alien species for mariculture and aquaculture.
Impact economic sector	Habitat loss and fragmentation	Over-exploitation of species
Forestry	Through afforestation, which involves the replacement of natural vegetation.	Over-exploitation of both commercial and subsistence levels of certain woodland species in parts of the country.
Housing and infrastructure	Through the clearing of land for development.	May occur through the over-use of indigenous plants for building materials.

Mining industry.	Through the clearing of land and disturbance of marine and coastal habitats for prospecting and mining activities. The abstraction of water may impact on wetland systems.	
Impact economic sector	Air, water and soil pollution	Introduction of harmful alien species
Forestry	Through, inter alia, the pulp and paper industry and the use of agrochemicals.	In some instances, through the introduction of high-yielding exotic species for commercial forestry and recreational purposes.
Housing and infrastructure	May occur from construction activities.	Through the use of harmful alien species in gardens and parks.
Mining industry	Activities related to the mining industry may result in water, air and soil pollution. Up to 80% of total solid waste generated in the country arises from the mining industry.	
Impact economic sector	Habitat loss and fragmentation	Exploitation of species
Tourism and recreation.	Through the construction of tourist-related facilities, particularly along the coast. Through exceeding the tourist carrying capacity in certain areas. Through impact of off-road vehicles.	Through recreational fishing and the over-exploitation of 'collectable' species.
Trade		Over-exploitation of species in demand for medicinal or wildlife trade purposes.
Transport	Through road and rail construction and shipping-related activities.	
Water	Through dam construction and water-transfer schemes.	
Impact economic sector	Air, water and soil pollution	Introduction of harmful alien species
Tourism and recreation	Through litter, principally plastic waste.	Through the introduction of exotic fish species for angling.
Trade	Through trade in chemicals and other harmful substances.	Through the unintentional introduction of harmful alien species.
Transport	Air, water and soil pollution through road, rail, air and sea.	Through the unintentional introduction of alien species through road, rail, air and sea.
Water	Through excessive removal of water from watercourses and the consequent concentration of pollutants.	Through inter-basin transfer schemes which unintentionally introduce alien species.

Source: <http://www.environment.gov.za/PolLeg/WhitePapers/Biodiversity/Chapter3b.htm>.

One of the most concerning negative impacts of humans on the environment concerns pollution. Read Case Study 3 to learn about the negative impact of human activity on the environment and human well-being. What do you think is the impact of these activities on the biological diversity of the country?

Case Study 3. Bushmans River turns toxic—Explosion of algae leads to canoeists and farm labourers falling ill

Pollution in the Bushmans River created an unusual explosion of algae in the water that turned the river a virulent green and led to scores of canoeists, among them SA Slalom champ, Guy Collyer, and farm labourers falling violently ill.

That was the message from Umgeni Water following its analysis of water samples taken from the river this week, after farmers between Estcourt and Weenen reported that their labourers were falling ill and that they could not use the river water to irrigate their fields.

The symptoms of the canoeists and labourers appear to be the same, including severe vomiting and diarrhoea. Farmers adjacent to the Bushmans River reported yesterday that the river still appears heavily polluted.

This is despite a municipal statement earlier this week that the river has been cleaned up after a pollution incident from a local factory.

Collyer said he was off work for four-and-a-half days and spent time on a drip with severe vomiting and diarrhoea. 'I am still a little bit weak and this has very definitely affected my training schedule. I should be fully fit by the end of this week,' he told *The Witness* yesterday.

Winterton canoeist Lance Luffingham said that after the canoe race he returned to the Bushmans River to search for a lost paddle and was shocked by the state of the river.

'From the weir, the river was black and stank of oil. On passing the bacon factory I noticed a solid stream of sewage entering the river. Then about 1 km down there was another solid stream of greenish raw sewage coming down the cliffs and into the river. By the time I got to Sulphur Springs, the river was black and I was paddling on raw sewage. I decided to abort my paddle due to the smell and risk of getting sick.'

Weenen farmers Graham MacNally and Johan Buys both said they have labourers who fell ill, allegedly after using the river water.

Both said the river is still a 'nasty green' colour. They said pollution incidents have happened before, with devastating impacts on crop yields.



However, Department of Water Affairs (DWA) Water Quality deputy director Lin Gravelet-Blondin said DWA released 5 000 litres of water per second for 22 hours yesterday from the Wagendrift Dam and this has flushed much of the algae downstream. He added that the department's greatest concern that the algae are toxic has been allayed by Umgeni's sample analysis. 'The combination of low water flow and heat contributed to the algal explosion, as did the pollution,' he confirmed.

People from the Estcourt and Weenen area also phoned Umgeni Water to complain of 'slimy green bathwater' this week.

Umgeni water scientist Ian Bailey also said the presence of pollutants from upstream Estcourt factories fed the algal explosion. He has also called for an investigation of industrial pollution into the Bushmans River.

This prompted municipal and DWA officials to scour the riverbanks yesterday in an effort to identify discharging sewer pipes and to trace these back to their source.

The Witness reported on Tuesday that Gravelet-Blondin has demanded an investigation into why the bacon factory has not been shut down despite the fact that it has acknowledged responsibility for pumping insoluble fat into the river.

'Luckily the algae were not of a toxic form, which could kill a horse. It was still shocking for people to turn on the tap and have green slime coming out,' he said.

Source: *The Natal Witness*, 8 November 2002.

3.4 What is South Africa doing to conserve its biological diversity?

South Africa is the third most biologically diverse country in the world. It has rich ecosystems and landscapes, ranging from desert to subtropical forest, and also great diversity of marine and coastal systems. Nearly 10% of the world's plants are found in South Africa and about 7% of the birds, reptiles and mammals. Table 4 shows the species richness in South Africa and how it compares to the rest of the world. South Africa has an extremely high number of diverse insects and plants. About 150 different types of marine fishes are found in South Africa, making up at least 16% of the earth's variety.

The diversity of vascular plants makes up at least 7.5% of the earth's diversity. One of our richest plant species heritages is Fynbos. These plants are found only in South Africa and as a result South Africa has been declared one of the hotspots of the world. Because of its biological diversity importance, at least 20% of the Fynbos is being conserved in South Africa.

Table 5 shows information on the different biomes in South Africa. It provides the numbers of vegetation types and also the percentage that is available and conserved in South Africa. The results indicate that we have high numbers of species but that conservation varies dramatically. South Africa's biodiversity is also highly threatened—by alien invasive species, habitat changes, climate change and the overuse of resources. In all cases more conservation attention is required to ensure that we do not lose our biological diversity. All the species are in critical need of conservation.

Word bank

Biome: A specific geographical area with distinct vegetation that exists because of the climate in the area.

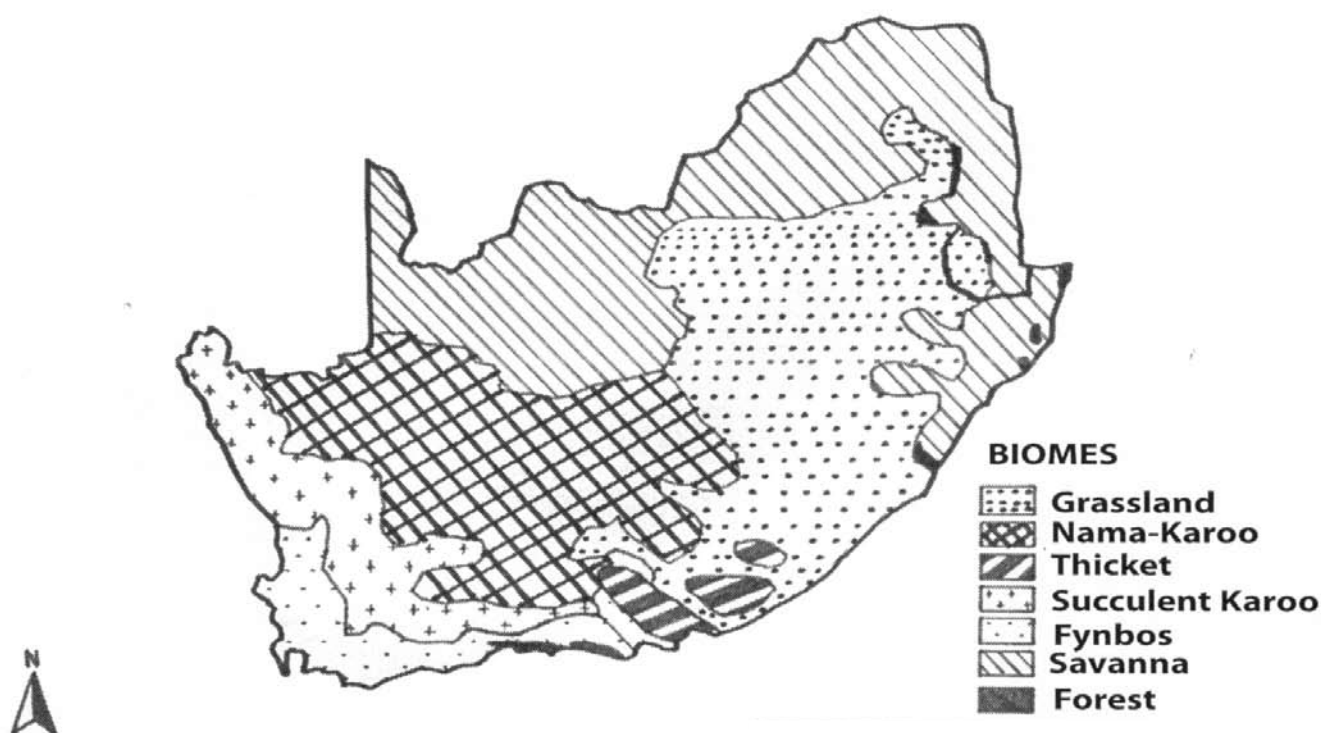
Table 4. Species richness in South Africa

Plants and animals	Total number of species in South Africa	% of earth's
Mammals	300	5.8%
Birds	880	8.0%
Amphibians	110	2.1%
Reptiles	401	4.6%
Freshwater fishes	112	1.3%
Marine fishes	150	16.0%
Invertebrates	9 000	5.5%
Vascular plants	24 000	7.5%
Insects	70 000	—

Table 5. Conservation of South African biomes

Biome	Number of vegetation types	% of South Africa's land area	% conserved in South Africa
Forest	3	0.59%	17.90%
Fynbos	5	3.39%	20.25%
Renosterveld	5	2.90%	1.67%
Grassland	15	24.46%	2.52%
Nama-Karoo	6	24.41%	0.57%
Succulent Karoo	4	6.77%	2.82%
Savanna	25	34.24%	10.15%
Thicket	5	3.44%	4.5%

White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity, p. 15. Source: <http://www.environment.gov.za/PolLeg/WhitePapers/Biodiversity/Chapter3b.htm>.



3.4.1 Legislative response

To protect our rich biodiversity, certain laws had to be implemented. The Biodiversity Act, signed by President Thabo Mbeki in May 2004, provides for the management and conservation of South Africa's biodiversity, through biodiversity planning and monitoring, the protection of ecosystems and species, the control and management of alien and invasive species, the regulation of bioprospecting, fair and equitable benefit-sharing and the regulation of permits.

Table 6. Laws and conventions signed to conserve South Africa's biological diversity

Legislation
National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003)
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)
Convention on the International Trade in Endangered Species, 1973 (CITES)
The Ramsar Convention, 1975
Convention to Combat Desertification, 1977

As you can see from Table 6, South Africa has gone to great lengths to ensure that it manages, protects and conserves its natural resources and biological diversity.

The CBD also guides the process of management and maintenance of South Africa's natural resources and stipulates in **Article 8** that states are responsible for *in situ* conservation.

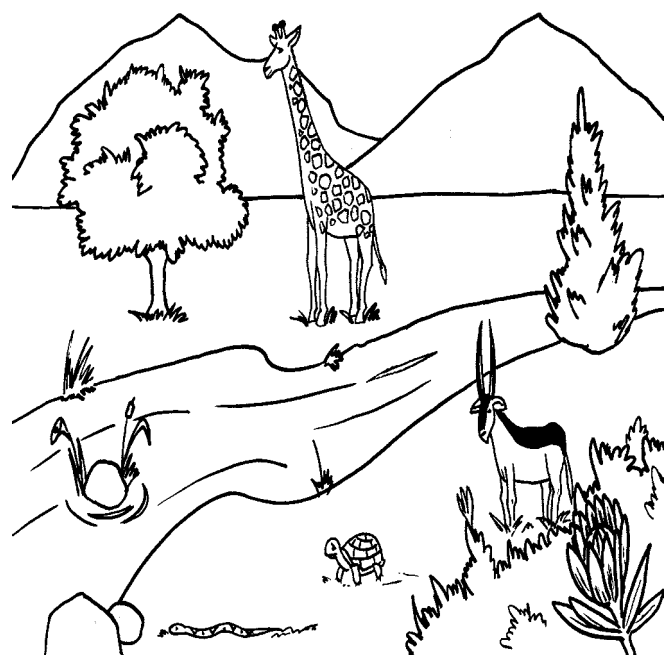
3.4.2 Establishment and management of protected areas

A protected area can be defined as a geographical area that is designated or regulated and managed to achieve specific conservation objectives. South Africa has 21 different types of protected areas, which are grouped into six internationally identified categories (Table 7). As a result of their diversity, the areas have to be managed by various different groups:

Terrestrial

Terrestrial protected areas have received most of the biodiversity conservation attention and are there-

fore well developed. An estimation of about 74% of plant, 92% of amphibian and reptile, 97% of bird and 93% of mammal species of South Africa are thought to be represented in the 422 formally protected areas, which make-up approximately 6% of the land surface area. As impressive as it sounds, the figures do not guarantee the genetic diversity of the species. Even though there are protected areas, much of the biodiversity is not protected as is experienced in biomes such as the Lowveld, Fynbos, Succulent Karoo, Nama-Karoo and Grasslands.



Wetlands

Most of the wetlands in South Africa fall outside the protected areas and are poorly conserved. The areas that do receive conservation protection are the 15 Ramsar Sites in the country, which take up about 488 859 hectares (1 hectare is as big as a rugby field).

Marine Protected Areas

The marine protected areas are generally located along the South African coastline. Two of them are the largest 'no-take' reserves in the world. The marine areas are also poorly planned, protected and managed, leaving the biodiversity resources open to exploitation and abuse. Unfortunately, the marine protected areas do not protect all marine habitats such as sandy beaches, estuaries, dunes and different types of rocky shores.

Word bank

IUCN: The World Conservation Union.

Table 7. IUCN Protected Area Categories

Category	Name	Management objective	SA legal or other equivalent category
Category Ia	Scientific reserves	Managed mainly for scientific research and monitoring	Special nature reserves. Wilderness areas.
Category Ib	Wilderness areas	Managed mainly for wilderness protection, subsistence and recreation	Special nature reserves. Wilderness areas.
Category II	National parks and equivalent reserves	Managed mainly for ecosystem protection and recreation	National parks. Provincial parks. Nature reserves. Indigenous state forests.
Category III	Natural monuments and areas of cultural significance	Managed mainly for conservation of specific, natural or cultural features	National monuments. Monuments. Botanical gardens. Zoological gardens. Natural heritage sites. Sites of conservation significance.
Category IV	Habitat and wildlife management areas	Managed mainly for conservation through nature management intervention	Provincial, local and private nature reserves. Conservancies.



Category V	Protected land and seascapes	Managed mainly for land and seascape conservation and recreation	Protected natural environments. Natural resource areas. Scenic landscapes. Urban landscapes.
Category VI	Managed resource protected area	Managed mainly for the sustainable use of natural ecosystems	Mountain catchment areas.

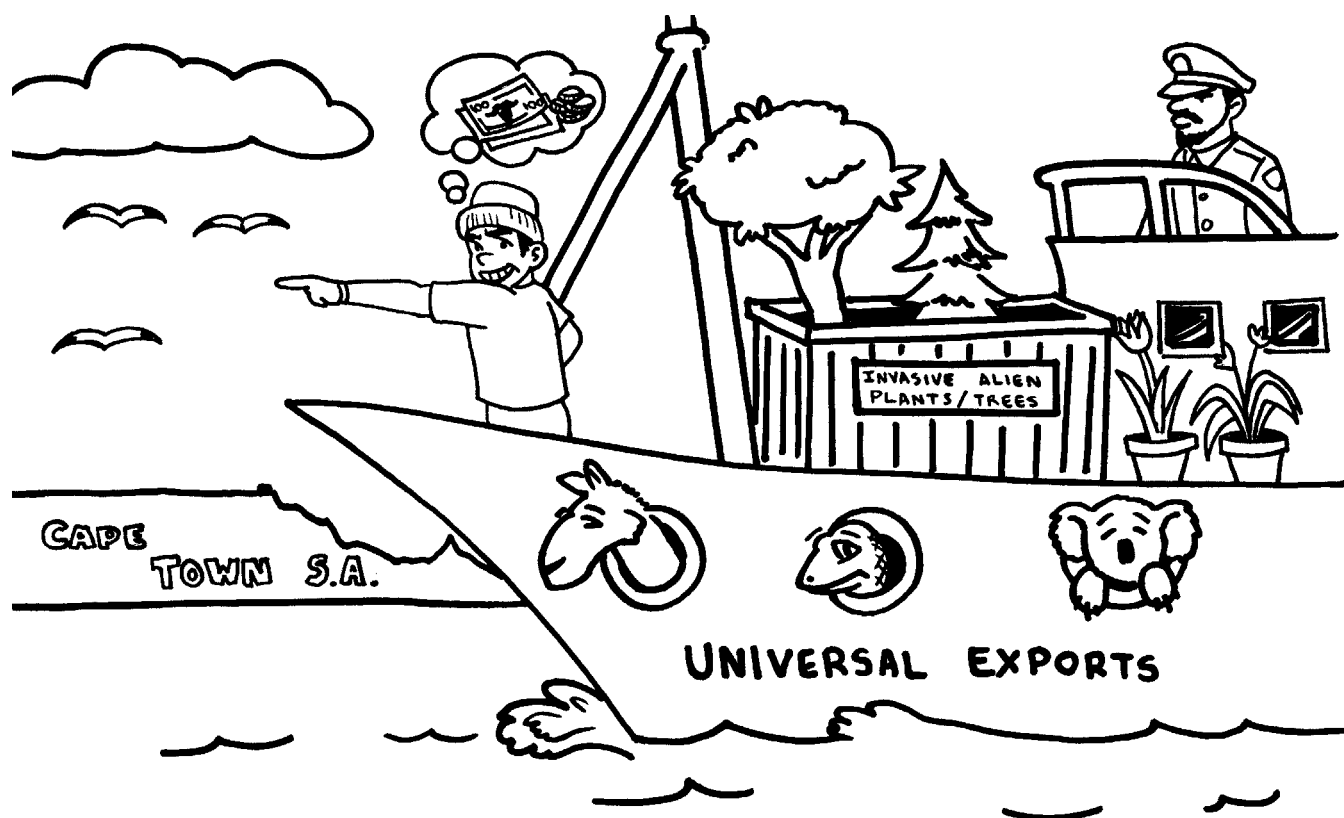
Source: South African Biodiversity Policy.

In the light of the above, we hope you are beginning to realise that there are very serious implications for the environment and human well-being if we do not give serious thought to conserving our biological diversity and our environment.

One of the main actions required of us is to ensure that we make every effort to rehabilitate the environment and help create the conditions for the earth to heal itself.

3.4.3 Rehabilitation of the environment

The preamble of the CBD indicates that there is a general lack of information and knowledge about biological diversity and that there is an urgent need to develop scientific, technical and institutional capacity so that we can respond to the issues. A further agreement is that governments agreed to conserve ecosystems and natural habitats and to also maintain and recover viable populations of species in their natural



environments. Objective 1.5 of the South African Biodiversity Policy goes further to state the following: 'restore and rehabilitate degraded ecosystems, and strengthen and further develop species recovery plans where practical and where this will make a significant contribution to the conservation and sustainable use of biological diversity'.

Many of the natural environments and species in South Africa have been either destroyed or are under threat of being destroyed. The rapid spread of invasive alien species in the country has destroyed large

natural areas. Alien species have strong competitive abilities, which help them to become invasive very quickly. The infestation of invasive alien plants, for example, is a very big problem in our country because they destroy natural vegetation; use large amounts of water, cause diseases and fuel fires that destroy properties and land. As a response, government developed a multi-departmental programme, *The Working for Water Programme*, to respond to the impact of invasive alien plants in South Africa. Except for the eradication of invasives nationally, the programme is also responsible for researching and exploring better management and rehabilitation options for the control of invasive alien plants.

Huge amounts of money are ploughed into research institutions such as universities to assist with finding successful rehabilitation methods and tools. In the case of invasive alien plant infestations, rehabilitation research has to find out how indigenous plants can be used to win back the immediate environment and reduce the seed set of the invasive alien plants in the ground.

The South African National Biodiversity Institute is an institution that falls under the Department of Environmental Affairs and Tourism. Apart from other responsibilities, the Institute has a responsibility to focus on scientific research that will contribute information and knowledge to the improved management of our biodiversity in South Africa. Many studies are now under way to explore how we can win back some of the biodiversity we have lost and are in the process of losing.

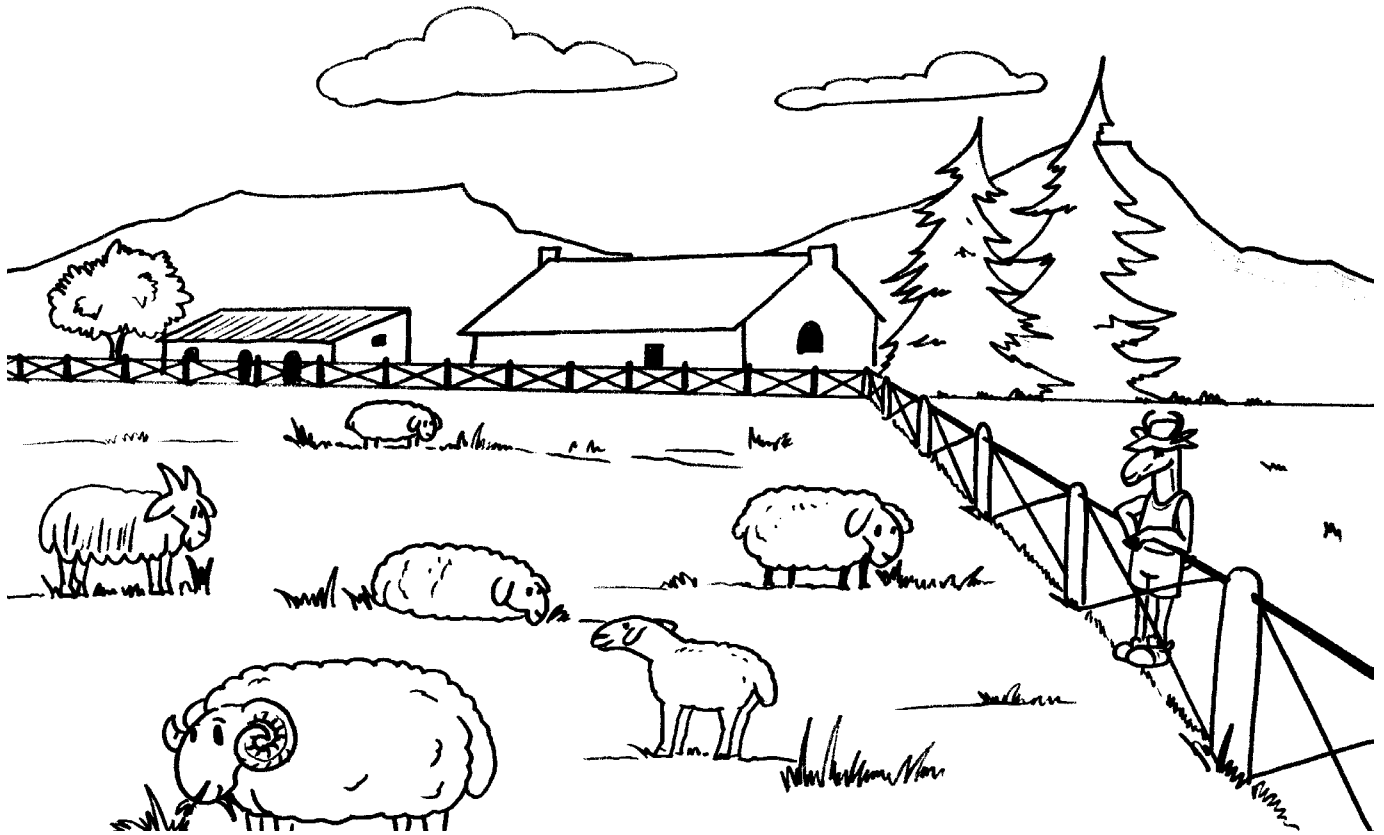
Rehabilitation is a big word that simply means to heal or correct something that is wrong or problematic. We have to rehabilitate something or someone when something is wrong. For example, if an athlete hurts her knee while running, she will have to go for therapy so that she can rehabilitate her knee. She will have to do exercises that can strengthen her knee so that she can run again. The same principle applies to rehabilitation of the environment. If we continue to destroy our environment through our human actions, we are heading for trouble. One of the ways to ensure opportunities for conservation and rehabilitation is to establish conservation areas such as the national parks and nature reserves that are access-controlled by government and environmental organisations. One of the reasons for this control of access is to ensure that we protect our endangered biodiversity and also to allow areas to rehabilitate to a more healthy condition.

Rehabilitation is not a short-term process but a journey that usually takes a long time before one can see results. For example, seeing local plants and trees growing in an area that has been infested with invasive alien plants such as the Port Jackson, will take many years. It will also mean ongoing monitoring of the area to ensure that all efforts are made to remove the invasive trees.

Rehabilitation is not an easy issue to deal with and does not always have quick-fix solutions. An example of its complexity can be recognised in the problem of desertification. Desertification is the destruction of natural healthy land into a desert environment where local plants and animals die and disappear. There are several reasons for the desertification, including global warming and human settlements and practices. Studies done in the Namaqualand areas, for example, found that desertification of the areas increased as a result of the farming practices of communal farmers. It was found that communal lands were heavily over-grazed and that natural vegetation was destroyed. Large areas in the communities were covered with plants that were poisonous to the animals and also out-competed the local plants, thus increasing the desert status of the areas. Over-grazing has resulted in a change in the ecology and in loss of income and valuable plant species. What would be the solution? Should these areas be declared protected? The solution is not as simple. One of the reasons for the over-grazing in the region is the result of the apartheid government system that forced the local Nama and San people to change and restrict their nomadic farming practices to small enclosed areas, which were over-populated with local farmers. The local people were therefore forced to change their traditional farming methods and this ultimately led to the destruction of the natural environment on which they were dependent for their livelihoods. Clearly the rights of the local people were infringed, resulting in complicated problems.

Any policy interventions to protect our biodiversity should take note of socio-economic, political and biophysical issues for sustainable solutions. Reduction of livelihoods and sources of income as a result of biodiversity loss and conservation protection are some of the critical issues with which local people are faced

all around the country. It is the complicated debate of reducing poverty versus protecting the biodiversity that government, NGOs, CBOs and the public are grappling with. If we continue utilising our biodiversity for economic activity and poverty alleviation, without recognising the need to protect the environment, we are ultimately destroying the very source of our income and survival. When does use become sustainable and how do we determine what is sustainable? How do we ensure the balance between use and protection?



South Africa has committed to the conservation and sustainable use of the biological diversity for the benefit of present and future generations in the Convention, ultimately meaning that government has to explore ways of dealing with the challenges of sustainability. Our constitution in its Bill of Rights also reflects the commitment in a stipulation that says:

- Every person has the right to a healthy and safe environment.
- Every person has the right to have the environment protected for the benefit of present and future generations, through reasonable legislature and other measures that: (i) prevent pollution and ecological degradation, (ii) promote conservation, (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Balancing sustainability of our biodiversity in a country burdened with a 40% unemployment rate and huge poverty conditions is obviously not an easy task. South Africa has therefore contextualised, in line with the international stipulations, the CBD for its biodiversity conditions. South Africa has a long history of conservation as can be seen in the historical and indigenous management systems that indigenous African people such as the San, Khoi and Nguni practised. These practices were negatively impacted by colonisation of the country, which brought with it guns that influenced hunting practices, ranching of cattle, sheep and goats, deforestation and the introduction of foreign plants and animals.

The challenge now for us in South Africa is to find a balance between existing conservation practices and indigenous use and conservation practices. We have to explore the strengths and weaknesses of different methods and approaches and use the information to help us in developing relevant policies that can assist in sustainable management of our biological diversity.

The following activities will give you an opportunity to explore the information in this section in a more interactive way. Various lesson activities have been developed which you can use for this purpose.



Lesson plans and activities

3.5 Grade 10: Lesson plans and activities

3.5.1 Topic: What is biodiversity?	Grade 10: Environmental Studies and Diversity, Change and Continuity
Learning Area: Life Sciences Learning Outcomes: LO 1: Scientific Inquiry and Problem-solving Skills LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 1.1.1: Identify and question phenomena. AS 1.1.2: Plan an investigation using instructions. AS 1.1.3: Consider implications of investigative procedures in a safe environment. AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life.	Integration: Prior Learning: Understanding biological diversity. Familiarity with South African constitution.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Rubric.	
Resources: Section 3. Audit sheet.	
Teacher Activity: Discuss understanding of biological diversity. Discussion should link national biodiversity to local context. Provide some information on what biodiversity is. Explain audit activity.	

Activity 1

In groups, do the following scientific investigation regarding the state of biological diversity on your school ground. The scientific investigation must be presented in the form of a report.

Stages of a scientific investigation

Investigative question:

1. What is the state of biological diversity on the school grounds?

Hypothesis:

2. Change the investigative question into a hypothesis.
3. Plan the investigation (biological diversity audit) using the following instructions:
 - ☛ Prepare a 10 m² plot on the school grounds.
 - ☛ Use the audit worksheet below to conduct an audit of a 10 m² plot on the school grounds.
 - ☛ Conduct a study of the selected plot and use the information gathered to complete the audit form.
4. Implement the procedure and consider safety implications.
5. Organise the information that you collected in the table below.
6. Analyse and interpret the information to ascertain whether your hypothesis is correct or not.

7. Describe how you will improve the state of biological diversity at your school.

Audit Worksheet 1: Biodiversity

Category of species	List the types of species that you see (e.g. trees, flowers)	Count the number of species types you see	What are the possible reasons for your findings (e.g. why so many or so few plants)
Plants			
Animals			
Insects			
Birds			
Others?			

Questions:

1. What is the dominant biological category in your findings? Provide possible reasons for this result.

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2. What is the least available biological category in your findings? Provide possible reasons for this result.

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3. Based on your findings, would you say that your school grounds are biologically rich or poor and why?

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4. Using your research information and the CBD, develop a biodiversity policy statement for your school. The statement could be put up in class and in the school's entrance hall.

3.5.2 Topic: Threats to biodiversity	Grade 10: Diversity, Change and Continuity
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge Life Orientation LO 2: Citizenship Education Assessment Standards: Life Sciences AS 2.1.1: Use a prescribed method to access information. AS 2.2.1: Identify concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. AS 2.2.2: Describe and explain concepts, principles, laws, theories and models. AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. Life Orientation AS 2.1: Identify social and environmental issues, and participate in a group to address a contemporary social and environmental issue.	Integration: Life Orientation Prior Learning: Understanding biological diversity and the conservation of the biological diversity. Understanding of local environment. How to brainstorm and how to search for information.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Rubric. Group reports.	
Resources: Section 3.	
Teacher Activity: Explain the activities; discuss how the table must be completed. Explain the relevance of the CBD for the country. Provide information on what biodiversity is. Demonstrate how to reference.	

Activity 2

Research one of the threats to biodiversity by following the steps set out below:

- Select one of the following threats as the topic of your research project:
 - 🐾 Habitat loss.
 - 🐾 Pollution.
 - 🐾 Wildlife trade.
 - 🐾 Alien species.
 - 🐾 Poaching and hunting.
- Describe and explain the threat by obtaining information from Section 3, books, magazines and internet (e.g. Google your topic). In your description and explanation, also elaborate on how the threat impacts on the everyday life activities of people in South Africa.

3. Assume your topic is a local environmental issue. Develop a plan of action that will address the environmental issue.

3.5.3 Topic: Threats to biodiversity	Grade 10: Diversity, Change and Continuity
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge Life Orientation LO 2: Citizenship Education Assessment Standards: Life Sciences AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. Life Orientation AS 2.1: Identify social and environmental issues, and participate in a group project to address a contemporary social and environmental issue.	Integration: Life Orientation Prior Learning: Understanding conservation of the biodiversity. How to analyse a document.
Assessment Possibilities: Assessment method: Individual assessment. Assessment tool: Letter.	
Resources: Section 3. Read case studies.	
Teacher Activity: Explain the extracts from the CBD. Provide some information on what biodiversity is. Provide some guidance on the structure of the letter.	

Activity 3

Instruct learners to read the news article *Is need or greed behind the KZN toll road?* and write a 300-word letter to the Minister of Environmental Affairs and Tourism to register their objections to the proposed toll road. The letter should clearly explain (a) the problems the proposed toll road will pose for biodiversity and (b) the government's obligations as signatory to the Convention on Biological Diversity.

Indicate to learners that they will have to use the article on *Mtentu Camp* to help them to strengthen their case.

Case Study 4. Is need or greed behind the KZN toll road?

Opposition to the proposed toll road along the KwaZulu-Natal Wild Coast is mounting, with the strong possibility of a court challenge being mounted on social and environmental grounds.

The Wildlife and Environment Society has come out firmly against the construction of a new section of road between Port Edward and Port St Johns and suggested that an impact assessment process paid lip service to environmental protection.

The Botanical Society has also condemned the project and a new coalition grouping known as the Wild Coast Conservation Forum has been formed in Port St Johns by local businessman John Costello.

Costello said although the Forum had raised objections on several environmental grounds, 'we are not a bunch of tree-huggers who are opposed to development'.

Costello said the construction of a toll road on the northern section of the Wild Coast and the establishment of an 80 m wide reserve off limits to local communities had the potential to disrupt the lives and culture of 'thousands' of people.

'The question that has to be asked is whether this is a project supported and initiated by local communities, or by a bunch of road-builders soliciting work for themselves?

'Is this a development which arises from individual need or the greed of outside agencies?' he asked.

Costello argued that the National Roads Agency and a consortium of construction firms and banking institutions had presented the tolling of the N2 route when no one appeared to have investigated the 'no development' option required in terms of environmental laws.

'The proponents are asking the public to endorse their chosen route, with no investigation of alternatives ... we have been advised that the proper procedures have not been followed and that the whole process therefore becomes fraudulent.'



'Is this a development which arises from individual need or the greed of outside agencies?'

Costello would not comment on whether a legal challenge was being prepared, noting that the process had not run its full course.

But he suggested that the responsibility for such a challenge should be from government agencies charged with protecting the environment.

'Where is Valli Moosa (national Minister of Environmental Affairs and Tourism)?' he asked.

Wildlife and Environment Society conservation manager Cathy Kay said: 'The whole planning process for the road is flawed because the road consortium has not allowed for the investigation of alternative routes outside the designated corridor.'

'This is an economic decision. It seems that economics are always weighed up against the environment—and the environment loses every time.'

She said the Society believed that the proposed route had the potential to damage valuable indigenous terrain and would have 'an enormous negative impact on irreplaceable vegetation'.

'The road will cut right through the **Pondoland Centre of Endemism***, which is regarded as one of the 235 hotspots of biodiversity worldwide. It is one of the most sensitive areas on the Wild Coast,' said Kay.

She said the road-building consortium assessed only the impact of the road on a narrow strip along either side of the road itself.

A draft environmental impact report was released, suggesting that the project would have no 'significant' impacts that could not be managed or mitigated.

Source: Article by Tony Carnie in *Daily News*. Published on the web by IOL on 2002-10-29, 11:08:13.

* This Centre of Endemism hosts close to 200 endemic or near-endemic plant species. This unique flora occurs on the Msikaba Formation and all construction should take place well away from this geological formation. The Pondoland Centre of Endemism has been internationally recognised as one of the 235 global botanical hotspots of plant diversity by the World Conservation Union (IUCN), World Wildlife Fund (WWF) and Conservation International (CI) (<http://www.wildlifesociety.org.za/WESSA%20BotSoc%20position.htm>)

Case Study 5. Mtentu Camp

Botanically, this area is located between the floral kingdom of the Cape Fynbos and lush and tropical vegetation of KwaZulu-Natal. As a result, it is an area of incredible richness and variety. Internationally, it is one of the top 100 most important ecological areas on our planet. Conservation International, WWF and IUCN have rated Pondoland as one of the earth's critical 'hotspots' and an area of significant importance that must be preserved. In an area of around 3 000 hectares within Mkambati, there are more plant species in this small area than in all of Great Britain and around the same number as in the entire Kruger National Park. There are many plants that cannot be found anywhere else on earth and it is one of the planet's major 'centres of endemism'. The Pondoland Centre of Endemism hosts close to 200 endemic or near-endemic plant species.

But it is not only the extraordinary vegetation that makes this area special—the scenery is truly outstanding. In Mkambati, herds of game graze against the backdrop of the blue ocean. There are only about half a dozen waterfalls on earth that cascade directly into the sea and the Pondoland Coast has three of these—two are within Mkambati. The reserve has around 23 different waterfalls, two incredible river estuaries and a breeding colony of endangered Cape vultures.

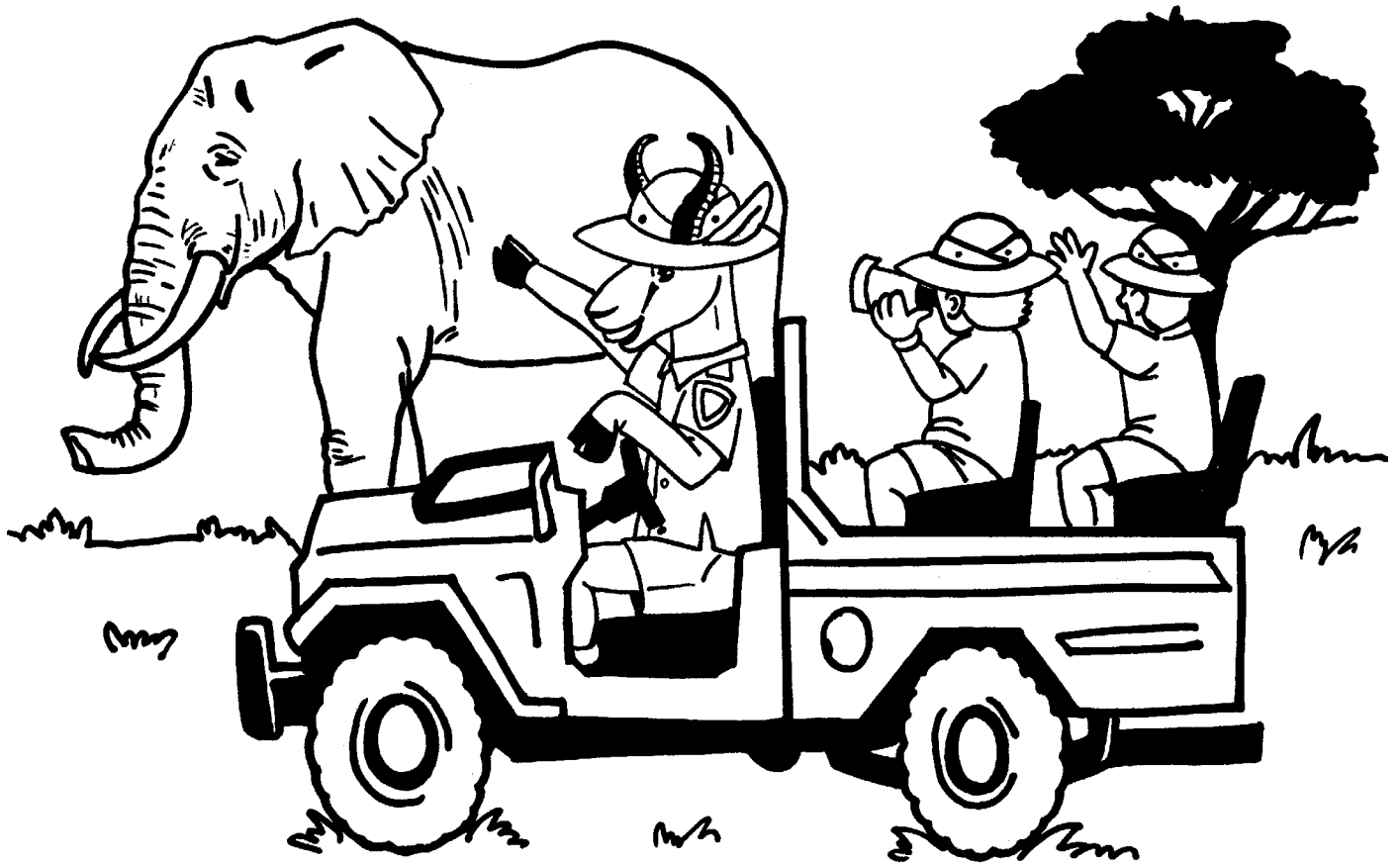
Out at sea, the Mkambati story gets even more amazing. Each year, the planet's largest single migration takes place just offshore, when countless sardines migrate northwards past Mkambati in May and June, and create what is known as the 'Greatest Shoal on Earth'. This was featured in the August 2002 edition of *National Geographic*. David Doubilet, *National Geographic*'s foremost underwater photographer, rates his dives at Mkambati during the shoal as one of his top five dives anywhere on earth. The shoal varies in size every year and can be up to 16 km long, 6 km wide and 60 metres deep. Schools of up to 50 000 dolphins and many thousands of sharks are known to follow this shoal, making it one of the wildlife spectacles of the world. In our winter months right through to about November each year, whales patrol the coastline.

Mkambati is going through a period of transformation. From beautiful nature reserve run by the province for 30 years, ownership has now reverted back to the Pondo community who live inland from Mkambati Reserve. Wilderness Safaris has partnered with this community and the province to create a world-class reserve and to build wonderful, eco-friendly camps on the Reserve. As part of our partnership with the community, it will be doubled in size—making it a reserve of around 12 000 hectare, excluding the marine reserve out to sea.

The main attraction of this unique reserve will be the beaches and the coastline. Mtentu Camp will be built right on the beach along the coastline, so that it will be one of the few places in South Africa where guests can walk

out from their rooms directly onto a pristine beach, with no road in the way. Guests will be able to enjoy incredible game drives, with the Indian Ocean as the backdrop to many game sightings, or enjoy ocean adventures, especially when the sardine run is at its peak.

Other activities include boating excursions, beach activities, game and nature drives, nature walks, mountain biking and horse rides. One of the finest excursions will be the canoeing up the Mtentu River and its gorges and visiting the crystal clear rock pools in the mountains. Visitors to Mkambati can also drive into the neighbouring rural Pondo community for a cultural experience.



3.6 Grade 11: Lesson plans and activities

3.6.1 Topic: Human influences on the environment	Grade: 11 Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: Life Sciences AS 2.1.1: Use various methods and sources to access information. AS 2.2.2: Evaluate concepts, principles, laws, theories and models. AS 2.3.1: Analyse and evaluate the costs and benefits of applied Life Sciences knowledge. AS 3.3.1: Compare scientific ideas and indigenous knowledge of past and present cultures.	Integration: Prior Learning: Understanding conservation of biodiversity. How to analyse a document.
Assessment Possibilities: Assessment method: Individual assessment. Assessment tool: Letter.	
Resources: Section 3. Read case study <i>Environmental impact assessments are seriously flawed</i> .	
Teacher Activity: Explain the extracts from the CBD. Provide some information on what Biodiversity is. Provide some guidance on the structure of the letter. Provide guidance on how to prepare arguments.	

Activity 1

Divide the class into two groups. The learners must read Case Study 6 and obtain additional information from other sources (give them the *Cape Argus* website so that they can search for John Yeld's articles on the issue). The one group (developers) will support the uncontrolled development of golf courses and the other group (environmentalists) will oppose this view. Each group should develop arguments to support their views in a class debate. Their arguments should also be written as an article for a community newspaper where the two statements/arguments are printed under the heading: *Golf courses, who benefits? You decide!*

Case Study 6. Environmental impact assessments are 'seriously flawed'

Biodiversity is the lifeblood of the planet. Birds, reptiles, insects and mammals depend on plants for their survival.

Alarmingly, South Africa has the second highest number of plant extinctions in the world. While the Cape Floral Kingdom recently earned international recognition as South Africa's newest World Heritage Site, other conservation initiatives also seem to bode well for the preservation of what remains of the Western Cape's unique biodiversity. Or do they?

The South African government has made great strides in promulgating legislation to protect the environment. This includes the National Environmental Management Act (1998) and the Living Marine Resources Act.

The Biodiversity Act was signed into law by President Thabo Mbeki on 31 May 2004. In addition, the government has ratified international conventions such as the Convention on Biodiversity, Ramsar, Convention on the International Trade in Endangered Species (Cites) and the World Heritage Convention.

The Western Cape has also moved to redress the damage done to its natural heritage. The Property Rates Bill of 2003 makes protected areas exempt from land tax. Where agriculture has decimated indigenous fynbos, private landowners now have an incentive to preserve what is left.

The world, too, has recognised the importance of the Cape Floral Kingdom, and the World Bank and United Nations Development Programme have donated millions of US dollars to the Cape Action Plan for People and Environment (C.A.P.E.) project, which aims to have 'effectively conserved the natural environment and biodiversity of the Cape Floristic Region' by 2024.

However, uncontrolled and unscrupulous development threatens such worthy ambitions. Currently, the City of Cape Town is objecting to a proposed toll road development that will cut through the Cape Flats, a biodiversity hotspot with over 1 400 indigenous plant species. The R300/N21 also threatens irreplaceable Renosterveld in the Durbanville area and a number of Red Data species of both flora and fauna.

In addition, Cape Nature Conservation's plea for high-level intervention in the proliferation of golf courses and estates along the southern Cape's Garden Route has attracted the attention of the new provincial MEC for Environmental Affairs and Development Planning, Tasneem Essop. She has initiated an investigation into the sustainability of such developments to help formulate a provincial policy guideline for golf estates.

There are already at least 22 golf courses along the Garden Route and a positive record of decision was announced for yet another in September 2003.

The R1 billion Kingswood Golf Estate, with its 730 residential units and 18-hole golf course, will be situated between the George Golf Club and Fancourt Estate.

Our indigenous flora is being engulfed by grass and concrete, and the food chain severely disrupted.

These developments are contentious for other reasons. Doubt has been cast on the planning approval given for some of these estates and a number of court cases are under way.

The *Cape Times* has also noted that in 2003, environmental laws in the Western Cape were disregarded by developers in 140 recorded instances. The application for the proposed 600 ha Fynboskruin development near Sedgefield was rejected in the Environmental Impact Assessment (EIA) as 'too ecologically valuable to be disturbed'.

Then Minister of Environmental Affairs And Tourism, Valli Moosa, gave his approval anyway, ostensibly for the benefit of tourism and the economy.

Despite the job creation invariably touted in the developers' justification for their projects, there is increasing scepticism both from the public and now, it seems, from Essop: 'While it can be argued that golf estates are of value for tourism and job creation, this still needs to be assessed. The negative impacts on our natural resources, especially our limited water resources, may well outweigh the benefits.'

In spite of the vocal support of new Environmental Affairs Minister, Marthinus van Schalkwyk, for placing 'people firmly at the centre of conservation', there is an increasing perception that these developments are not for the community but for corporate profits. There are legal obligations to perform EIAs before such developments are given the go-ahead.

However, a number of serious flaws in the process have been noted. In its response to the draft EIA on the R300/N21 toll road, the City of Cape Town noted that 'there are numerous errors and omissions in the text and terminology of the draft EIA'.

A seeming insurmountable problem with the EIA process is that the consultants that undertake the assessment are paid by the developer. An unbiased EIA is unlikely in such circumstances.

In addition, the public participation process in many of these EIAs has been inadequate. The draft EIA on the R300/N21 toll road amounted to five hefty volumes of specialist information, inaccessible to most of Cape Town's population, even if they could view the report on the internet or in 10 libraries around the city.

Legislation without enforcement is a toothless lion.

These issues need urgent attention—otherwise we will all soon have to take up golf to enjoy the ‘great outdoors’.

Source: Article by Laurianne Claase (responsible for media liaison for the Zeekoevlei Environmental Forum), in the *Cape Times*. Published on the web on 6 August 2004.

3.6.2 Topic: Investigation of human influences on the environment	Grade: 11 Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 1: Scientific Inquiry and Problem-solving Skills LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 1.1.1: Identify phenomena involving one variable to be tested. AS 1.2.1: Systematically and accurately collect data using selected instruments and/or techniques. AS 1.2.2: Select a type of display that communicates the data effectively. AS 1.3.1: Compare data and construct meaning to explain findings. AS 2.1.1: Use various methods and sources to access information. AS 2.2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships. AS 2.2.2: Evaluate concepts, principles, laws, theories and models.	Integration:
Assessment Possibilities: Assessment method: Peer assessment. Group assessment. Assessment tool: Rubric.	
Resources: Section 3. Investigation and instructions guideline.	
Teacher Activity: Explain how to conduct the investigation and record information.	

Activity 2

Pair learners up or ask them to choose a partner in the class. Each pair must select one of the issues in the section under *Human influences on the environment* that they would like to investigate. They must choose a physical location where they could best find information about the selected problem. For example, if they decide to investigate pollution, they may choose a nearby canal or river. Each group will follow these steps to complete their investigation:

1. Research question: What is the human impact on biodiversity on the site you have chosen?
2. Change the research question into a hypothesis to be investigated.
3. Design your scientific investigation process.
4. Implement the scientific investigation by:
 - ☛ Systematically and accurately collecting data.
 - ☛ Selecting a type of display that communicates the data effectively.

5. Analyse, synthesise and evaluate data.

6. Communicate your findings by stating whether your hypothesis is true or false.

3.6.3 Topic: Human influences on the environment	Grade 11: Environmental Studies
Learning Area: Life sciences Learning Outcomes: LO 1: Scientific Inquiry and Problem solving Skills LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 1.1.1: Identify and question phenomena. AS 1.1.2: Plan and investigation using instructions. AS 1.1.3: Consider implications of investigative procedures in a safe environment. AS 3.3.1: Analyse and describe the influence of different beliefs, attitudes and values on scientific knowledge and its application to society.	Integration: Prior Learning: Understanding biological diversity and impacts on the environment.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Rubric.	
Resources: Section 3. Format for letter-writing. Examples of relevant environmental policy documents.	
Teacher Activity: Explain the extracted table from resource. Explain the relevance of the CBD for the country. Provide some information on what biodiversity is. Explain the framework for the letter.	

Activity 3

1. Ask learners to read the information provided in Table 3 *Negative impacts of sectoral activities on biological diversity in South Africa*, which explains the negative impacts of various economic sectors on biological diversity.
2. In a class discussion, solicit their understanding of and opinions on the information.
3. Ask learners to select an economic sector and to develop a poster to explain the information.
4. Learners should list at least four different pieces of legislation (policies) that can be used to help in regulating the negative impact of the sector better. The information must be presented in a table.
5. Learners should explain how the CBD could be applied to assist in regulating the economic sector better.
6. Ask learners to write a letter to the minister of the specific sector to explain the negative impacts of the sector on the biological diversity and also to suggest possible solutions of how the negative impacts can be reduced.

3.6.4 Additional activities

Activity 1

Draw a pie chart of the threats to biodiversity.

Ask learners to draw a pie chart that shows which of the threats to biodiversity listed in the section, in their opinion, has the most negative impact on biological diversity in South Africa. They must write a short report that explains their pie chart.

Activity 2

Divide learners into groups of four. Each group must choose a topic out of this section on which they will base a cartoon strip. Provide an example from a newspaper or another relevant resource. They must communicate a message out of this section through the comic strip. Copies of each strip must be distributed to all the groups and the groups can then discuss the impact of the cartoon strip. This activity allows the learners to package the information and tests their own understanding of the information.

Additional ideas for lesson plans

- 🐾 Learners should indicate how the CBD can be used to regulate sectors.
- 🐾 Select one of the economic sectors and develop a poster to explain the information.
- 🐾 Select one of the economic sectors and explain how the CBD can be used to assist in reducing the negative impacts.
- 🐾 Select one of the economic sectors and find at least four different acts of legislation that can be used to reduce and manage the environment better. Information should be reported in table form.
- 🐾 Select two economic sectors and find at least four different pieces of legislation (policies) that can be used to manage the biological resources better. Also indicate how the selected legislation will support the sustainable management of the biological resources. Information should be presented in table form.
- 🐾 Select an economic sector and find a case study that matches or explains the information in the table. Analyse the chosen case study and explain how it demonstrates and links to the information on the specific economic sector. The information should be presented as a research report.

3.7 Grade 12: Lesson plans and activities

3.7.1 Topic: Conservation of biological diversity (local environmental issues—land issues)	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 2. 2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts.	Integration: Prior Learning: Understanding benefit-sharing and access. Knowledge of impacts on biodiversity. Know how to write a statement
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 3. Case study, newspaper article (Case Study 1).	
Teacher Activity: Discuss the role of stakeholders in managing and conserving our environment. Provide information on researching potential business ventures.	

Activity 1

1. The luxury golf estate and office park development has been approved. Write a strongly motivated letter to the editor of your local newspaper in which you express your objection to the approval.

2. Divide the class into groups of five learners. Each group must write a report on the Environmental Impact Assessment they made for the luxury golf estate and office park project. In their report, they must state, with reasons, whether they support or oppose the project.

Case Study 7. Golf estate for QE Park site—Development hailed as good for the city, despite ecologists' misgivings

Plans for a luxury golf estate and office park incorporating part of Queen Elizabeth Park and the Victoria Country Club (VCC) could bring thousands of jobs and an estimated R400 million into the local economy over 10 years.

In what has been described as a 'win-win' trade-off between conservation and leisure, Ezemvelo will lose around ten hectares of QE Park but gain protected status over a six-hectare site containing the critically endangered Hilton daisy as well as other rare wetland and mist-belt flora and fauna.

VCC stands to receive a much-needed cash injection of up to R12 million as return for a luxury, 500-unit housing estate and office park around the golf course.

The developers have agreed to restock game into QE Park, rehabilitate the mist-belt grasslands and drop fences between QE Park and the development, allowing for species migration. This is in line with current golf estate planning.

However, although they welcome the protection of the Hilton daisies, environmentalists argue that the development will destroy ecologically fragile and rapidly diminishing mist-belt grassland habitats that support numerous endangered species. They have also questioned the feasibility of rehabilitating a grassland habitat.

Botanical Society KZN Chairman, Dr Jason Londt, argued that future development pressures in the area could threaten the Hilton daisies, even though they would become formally protected.

'The many implications of a residential development adjacent to a nature reserve need to be spelled out in a way that make the public sufficiently well informed to be able to make sensible input before it is too late,' he argued.

Both sides have agreed on the need for sustainable development in Pietermaritzburg and both sides have agreed that this should not be at the cost of flagship species like the Hilton daisy, which is a key indicator of grassland health.

The Witness reported two years ago that the Ezemvelo Board did not give its support to the same proposed development. The Board has been accused of ignoring the concerns of its own staff about the impact of ribbon development on these grasslands.

The developers, Riels Associates, told *The Witness* this week that half of the new investment will be generated from national and international spenders, while local spenders provide the other half of the investment. The project is in line with the Msunduzi Integrated Development Plan, which specifies the allocation of land for residential development over the next 10 years.

Riels Associates developer Richard Kelland, who has been working on the project for the last four-and-a-half years, said the sale of some 500 plots would generate up to R100 million for the local economy within the first three years. These plots would be priced according to outside real estate parity. The Council's Exco gave their authorisation to the project in September.

The next three- to 10-year construction phase would generate R500 million, half of which would be generated from outside the local economy.

Victoria Country Club chairman Jeff Walker welcomed the development, saying the club expects to raise R8–12 million from the deal. 'This comes at the right time as we desperately need irrigation and green upgrading. In addition, with the backing of this development, we could be able to put in place all the sorts of new, innovative designs that other golf courses round the country are doing, like signage, shelters, manicuring and so on.'

One independent ecologist told *The Witness* this week that the development is not sustainable, adding that over 90% of mist-belt grasslands have been irreparably transformed.

'The edge effects of this development are of concern. They include the arrival of kikuyu grass and other alien species, and the use of insecticides in the gardens.'

Ezemvelo spokeswoman Maureen Mndaweni said the proposed development had been referred to KZN Agriculture and Environmental Affairs MEC Dumisani Makhaye for approval.

There will be a Development Facilitation Act pre-hearing on 13 February, followed by a site visit on 3 March and the DFA hearing for the rezoning of the site on 11 March.

'This will provide adequate opportunity for the public to get involved,' Kelland said.

Source: *The Witness*, 12 December 2003.

3.7.2 Topic: Investigation of human influences on the environment	Grade 12: Environmental Studies
Learning Areas: Life Sciences Learning Outcomes: LO 1: Scientific Inquiry and Problem-solving Skills LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 1.1.1: Generate and question hypotheses based on identified phenomena for situations involving more than one variable. AS 1.3.1: Critically analyse, reflect on and evaluate the findings. AS 1.3.2: Explain patterns in the data in terms of knowledge. AS 2.1.1: Use various methods and sources to access information from a variety of contexts. AS 2.2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts. AS 2.3.1: Evaluate and present an application of Life Sciences knowledge.	Integration:
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 3. Case study.	
Teacher Activity: Discuss the role of stakeholders in managing and conserving our environment.	

Activity 2

1. Ask learners to read the article on frogs.
2. Divide the class into five groups.

3. Give each group one of the questions to discuss:
 - 🐸 Is this article relevant to their lives? Why/Why not?
 - 🐸 How will the extinction of the frog affect them and the environment?
 - 🐸 Do the frogs contribute to biodiversity?
 - 🐸 What are the main factors that impact on the survival of the frogs?
 - 🐸 What solutions can they suggest for this situation?
4. Each group must capture their ideas on newsprint.
5. Each group must choose a reporter who must report back to the whole class. Ten minutes question time will be allowed after each report.

Case Study 8. A frog fence has been erected to save our giant amphibians from extinction— Don't let them croak

Life as a giant African bullfrog can't be fun. In a short life fraught with the danger of being wiped out by development, cannibalised by a rival frog or squashed by a speeding car, it is no wonder this frog prefers to spend most of its time buried underground. But soon the bullfrog—or at least those in the Onderstepoort Wetland, north of Pretoria—can feel a little safer: a special 'frog fence' has been erected along the N4 highway to prevent them from migrating across the busy road and being flattened.

The exercise cost Bakwena Platinum Corridor Concessionaire, the builders of the highway, R250 000. It involved erecting a small-aperture mesh fence to channel the frogs' movement to tunnels that run beneath the road. Some 30 cm of the 1.5 m high fence is below ground level and it runs for about 2.5 km.

The frog, which was Red Data-listed as 'near threatened' in 2000, is the largest amphibian in South Africa and males can reach a body mass of more than 1 kilogram. It comes out only when environmental and climatic conditions are suitable for breeding. The last known large-scale breeding event occurred between 1992 and 1994. It is this reliance on specific breeding conditions that makes it susceptible to extinction. To add to its woes, residential and industrial expansion in and around Johannesburg is encroaching on the amphibian's territory. 'The biggest threat in Gauteng is over-development, which is destroying their natural habitat. In other places, it is pollution; in others, the frogs get squashed by cars,' said doctoral student Caroline Yetman of the Centre for Environmental Studies at the University of Pretoria. She added that, in some provinces such as Limpopo, locals eat them.

Daniel Okeyo, Professor of Zoology and Biodiversity at the University of Fort Hare, concurred with Yetman. He said when property developers go into an area, they drain all the water, causing the frogs to dig deeper into the earth. Sometimes developers bring in foreign soil and this changes the natural habitat.

'If a place is developed, the frogs may move to a different area, but as frogs are territorial they may be involved in fights with the frogs of the territories into which they have moved. Fighting in a foreign territory usually results in defeat for the stranger and cannibalism of the weaker. Cannibalism will result in population decline,' explained Okeyo. Yetman said the Centre for Environmental Studies was also involved in trying to protect the frogs' extinction. 'We are putting up road signs to caution motorists about the frogs. We also intend producing educational materials for school children and getting more sites to be protected,' she said.

Source: *Mail & Guardian*, 7 to 13 October 2005 (Percy Zvomuya).

Activity 3

A research assignment.

1. The teacher calls seven learners at a time to the front of the class. Each child will draw a number (1–7) from a hat. Each number corresponds with one of the seven threats to biodiversity in Section 3. In this way, each learner will have his or her topic for the research assignment.

Learners should:

2. Collect two articles that address the issue that they will investigate. (Articles can be taken from newspapers, magazines, the internet or any other sources.)
3. Develop a research question to guide the issues that they will investigate. For example, how does human development impact upon the biodiversity in South Africa?
4. Change the research question into a hypothesis.
5. The assignment should be completed using the following headings:
 1. Introduction.
 2. Method of data collection.
 3. Findings and discussion.
 4. Conclusion.
 5. References.

3.7.3 Topic: Investigation of human influences on the environment	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.1.1: Use various methods and sources to access information from a variety of contexts. AS 2.2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts. AS 3.2.1: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment.	Integration: Prior Learning: Understanding of biological diversity. Knowledge of the local environment.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Rubric. Group reports.	
Resources: Section 3. Information on invasive alien plants, internet, library, books.	
Teacher Activity: Explain tasks and provide guidance on how to approach the research. Guide on the sourcing of resources.	

Activity 4

'Invasive alien plants are a danger to South Africa's biological diversity. They have the ability to spread rapidly and destroy indigenous biological species by taking over growth areas and out-competing the local plants.'

Scenario

You have applied to study environmental management at the local university. One of the requirements from the university is that you have to complete a short project that has to be completed as a research report and submitted to the university.

Activity

Identify and select an invasive alien plant common to your community or your province and indicate how this plant impacts on the local biological diversity. The local Working for Water offices, library or internet (www.wfw.gov.za) will have information.

Instructions on how to approach the project

Learners have to provide the following information in their research report:

- ☛ Picture or drawing of the plant.
- ☛ Scientific and common name of the invasive alien plant.
- ☛ Description of the plant.
- ☛ Indicate the geographical locality(ies) of the plant on a map of South Africa.
- ☛ Describe the way it spreads (mechanisms).
- ☛ The way it impacts on the local economy of the community (e.g. fuelwood, food, decorations, building materials). Explain how it is used.
- ☛ Discuss the negative impacts of the plant on the biological diversity.
- ☛ How is it controlled?
- ☛ Suggest a management plan, indicating how you will try and control the spread of the invasive alien plant.
- ☛ List the relevant information (article/s) from the CBD that you will use to support your management ideas.

The report should not be longer than four pages and should indicate the variety of sources consulted to find the information. Include a reference list in the report.

3.7.4 Additional ideas for activities

- ☛ Use Table 1 and do a comparative analysis and evaluation of the economic sectors that impact negatively on the biological diversity.
- ☛ Develop a role-play to demonstrate the importance of the sustainable use of our biological resources. Speak about a variety of issues that impact on the biological diversity.
- ☛ Identify an issue in your community that negatively impacts on the biological diversity of the area and suggest how it can be solved. Include all stakeholders in your proposal.
- ☛ Research relevant articles with a South African context that talk about the negative impacts on biological diversity.

4. The sustainable use of biological resources

The most difficult section of the Convention to understand is around the use, access, ownership and benefit-sharing of genetic resources. We will deal with the question of ownership and benefit-sharing especially as it relates to indigenous knowledge systems in the next section. This section focuses particularly on what is meant by sustainable use of genetic resources and how South Africa is faring in terms of providing access to genetic resources.

4.1 What is meant by sustainable use of genetic resources?

Sustainable use entails the introduction and application of methods and processes for the utilisation of biodiversity to prevent its long-term decline, thereby maintaining its potential to meet current and future human needs and aspirations.

Word bank

Biological resources: Includes plants, animals or any other organisms.

Article 10 of the Convention provides guidelines on how countries can ensure that biological resources be used in a sustainable manner. It stipulates that states should:

- ☛ *Integrate* consideration of the conservation and sustainable use of biological resources into national decision-making.
- ☛ *Adopt* measures relating to the use of biological resources to avoid or minimise adverse impacts on biological diversity.
- ☛ *Protect* and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.
- ☛ *Support* local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced.
- ☛ *Encourage* co-operation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources.

4.2 Access to genetic resources

The Convention on Biological Diversity is very clear in its statement about the rights, ownership and responsibilities pertaining to the genetic resources of countries. Each country owns its genetic resources and can therefore determine how the genetic resources should be used, who may gain access to these resources and what benefits should be derived from the use of such resources. As a signatory to the CBD, South Africa has a responsibility to other countries and should allow them access to its genetic resources and should determine the terms for access and benefit-sharing.

According to the CDB, access to biological resources means to obtain biological material from within a country for the purposes of research, conservation and commercial or industrial application.

The South African government has not had a very good track record in terms of regulating access to the genetic resources of this country, nor has it recognised the need to attach value to the biological richness within our borders. For too long it allowed foreign business unrestricted access to our genetic resources and in so doing missed out on significant benefits for our economy and the communities directly and indirectly affected by this free access.

Recently, it was discovered that not only did these international organisations and corporations benefit from exploitation of the country's resources, but some have also been enriching themselves with the knowledge

and wisdom of indigenous communities without even acknowledging these indigenous knowledge systems. A few landmark cases have raised consciousness about the need for South Africa to exercise stricter control of access to our biological resources.

It is not only necessary for the government to control access, it should also represent the interest of the many communities whose knowledge is subject to piracy and who do not always have the expertise to negotiate with these corporations and implement equitable and fair agreements.

To demonstrate its commitment both to supporting the CBD and to the indigenous constituencies, the government is actively engaged in negotiations to bring synergy between key legislation. This is the case with its commitment to make the International Undertaking on Plant Genetic Resources for food and agriculture and the Convention on Biological Diversity tally. It has also established a Committee on Plant Genetic Resources to deal with this process.

4.3 What is South Africa doing in terms of providing access to biological resources?

South Africa has committed to conserve and sustainably use the biological diversity for the benefit of present and future generations, ultimately meaning that government has to explore ways of dealing with the challenges of sustainability. In its Bill of Rights, our constitution also reflects the commitment in its stipulation that:

- Every person has the right to a healthy and safe environment.
- Every person has the right to have the environment protected for the benefit of present and future generations, through reasonable legislature and other measures that: (i) prevent pollution and ecological degradation; (ii) promote conservation, (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The biodiversity policy and strategy for South Africa has three overriding priorities:

- The eradication of poverty.
- The sustainable development of its economy.
- The social development of its people.

These priorities, together with the objectives of the CBD, mean that government also commits to ensuring the reconstruction and development of South Africa through:

- Ensuring that the essential ecosystem services and biological resources required to meet basic human needs are protected and maintained.
- Not restricting economic development unnecessarily and ensuring that such development is sustainable.
- Enhancing the provision of jobs through the conservation of biodiversity and sustainable use of biological resources.
- Ensuring that opportunities derived from the conservation of biodiversity and sustainable use of biological resources give preference to the poor.



- Enhancing the development of human resources necessary to conserve biodiversity and use biological resources sustainably.
- Increasing participation in the institutions of civil society engaged in conserving and using biodiversity.

One of the main objectives of the regulations on access-sharing is to make sure that the wealth that is generated from the genetic resources is shared equitably and that it does not cause irreversible damage to the biological diversity where the resources are being extracted.

In South Africa, the government has made great efforts to ensure that the poverty resulting from inequitable sharing of the benefits is addressed. It has embarked on several initiatives that engage local communities in international partnerships aimed at raising the standard of living while at the same time engaging them in protecting the biological diversity of this rich country.

Section 5 on benefit-sharing will look closer at how South Africa has been able to make significant progress in terms of sharing the benefits from the use of not only genetic resources but also indigenous knowledge for financial gains.



Lesson plans and activities

4.4 Grade 10: Lesson plans and activities

4.4.1 Topic: Access to biological resources. Sustaining our environment through management and maintenance of natural resources	Grade 10: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Life Orientation LO 2: Citizenship Education Assessment Standards: Life Sciences AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. AS 3.3.1: Analyse and describe the influence of different beliefs, attitudes and values on scientific knowledge and its application to society. Life Orientation AS 2.1: Identify social and environmental issues, and participate in a group project to address a contemporary social and environmental issue. AS 2.4: Display an understanding of the major religions, ethical traditions and indigenous belief systems in South Africa, and explore how they contribute to a harmonious society.	Integration: Life Orientation
	Prior Learning: Biological diversity.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Marking grid.	
Resources: Section 4. Example of a proposal.	
Teacher Activity: Provide some information on what biodiversity is. Provide a description of a national park. Explain how to prepare for the debate. Explain how to prepare a proposal.	

Activity 1

Divide the class into three groups to debate the following statement:

‘A national park that has many endangered plant and animal species should allow unrestricted access to the local community’.

Group 1 should represent the indigenous community defending the statement.

Group 2 should represent the parks management who do not agree with the statement.

Group 3 should represent the Parliamentary Standing Committee for the Environment.

The debate should consider the following in their arguments:

🗣️ What is the basis of their position? *Why should access be allowed or disallowed?*

- ☛ Mention how the CBD and other policies support their position.
- ☛ What are the implications for biological diversity?

The first two groups should present their arguments to a committee of their peers representing the Parliamentary Standing Committee for the Environment.

Activity 2

After the debate, the Parliamentary Standing Committee will instruct the two groups to discuss and analyse the positives and negatives of their arguments and develop a joint proposal that will satisfy both the community and the park management. The proposal must indicate:

- ☛ How the community and park intend to work together.
- ☛ What their roles and responsibilities will be.
- ☛ How they will manage access to the park.
- ☛ How this agreement will help to implement the Convention on Biological Diversity.

4.4.2 Topic: Access to biological diversity	Grade 10: Environmental Studies
Learning Area: Life Sciences	Integration:
Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. AS 3.2.1: Describe different ways in which resources are used and applied to the development of products, and report on their impacts on the environment and society.	Prior Learning: Biological diversity. Natural resource management.
Assessment Possibilities: Assessment method: Individual assessment. Assessment tool: Marking grid.	
Resources: Case studies. Section 4.	
Teacher Activity: Provide some information on what biodiversity is. Provide an introduction to case studies. Provide instructions on how to complete the assignment.	

Activity 3

Read Case Studies 9 and 10 and complete the questions in the following table:

Questions	Case Study 9: International	Case Study 10: Local
1. In which place or country does this case study take place?		
2. What is the main issue of this case study?		

3. Who are the main role-players in the case study?		
4. What biological resources are being investigated?		
5. Which group of people is being negatively affected?		
6. Which role-player/s is/are negatively affected by the situation?		
7. What are the similarities of the case studies?		
8. What are the differences between the case studies?		
9. Why in your opinion is the use of the CBD important in the case study?		
10. Which parts or sections of the CBD are being used to help solve the situation?		
11. What is your personal opinion of the situation and do you think it was dealt with fairly?		

Case Study 9. Identification of approaches to involve stakeholders in access to genetic resources and benefit-sharing processes

Just recently, on 23-25 February 2001, SEARICE with the support of the *Deutsche Gesellschaft für Technische Zusammenarbeit* (GTZ) GmbH of Germany co-organised with the Borneo Resources Institute the first-ever **South-South Biopiracy Summit** in Miri, Sarawak, which gathered experts and civil society organisations from South-East Asia, Peru, Ecuador and South Africa to look at the trends on the issue of access to genetic resources worldwide and take stock of what the grassroots organisations working with local and indigenous communities have done, and to identify future directions for community and advocacy work.

In the process of doing so, the results of the Summit's action planning activity identified activities or initiatives that may be considered as approaches to the involvement of stakeholders in access to genetic resources and benefit-sharing processes and some complementary options to address access and benefit-sharing in the framework of the Convention. One good thing making these approaches and complementary options useful to the Experts Panel, is that they already have the benefit of actual implementation and thus lessons and experiences can be drawn from the way these initiatives were implemented on the ground.

Some of these approaches to the involvement of stakeholders in access to genetic resources and benefit-sharing processes, would include the following:

- Use of customary laws and practices found in local and indigenous communities to establish community protocols that will then be used as part of the processes used to determine access to genetic resources.
- Localisation of access regulations at the local government level that will aid in the enforcement of national access regulations.
- Greater representation of local and indigenous communities in bodies and processes created by national governments that will make decisions on access and benefit-sharing questions.
- Use of coastal-based marine resources management strategies for the involvement of fisher folk communities in marine bioprospecting activities.

The complementary options to address access and benefit-sharing in the framework of the Convention:

- Criminalisation of biopiracy.
- Greater co-ordination and information sharing between national governments and professional societies to enforce professional codes of conduct and ethical standards to sanction erring international and local scientists and researchers who do not adhere to the objectives of the Convention.



- (c) Regional access legislation to establish a set of minimum standards for access and benefit-sharing among countries with shared or common genetic resources such as the ASEAN Framework Agreement on Access to Genetic Resources.
- (d) Intensified support and funding in awareness-raising efforts to secure the support of the general public in these endeavours.
- (e) Documentation and development of community-based mechanisms for the protection of traditional knowledge which may be deemed part of any *sui generis* mechanisms that may be institutionalised by Contracting Parties to the Convention.
- (f) Development of community property regimes that will determine the rights and responsibilities of the state vis-à-vis the local and indigenous fisher folk communities to protect their rights in discussions involving access to marine genetic resources.

Customary rules and practices of local and indigenous communities have been used as community protocols by an indigenous community called the Talaandig tribe in the Southern Philippines and in a Kadazan Dusun community in Sabah, Malaysia. These community protocols embody a set of procedures, based on the *adat* or customary rules and practices of the particular community concerned, which the community will use to determine whether they will allow bioprospecting activities to happen in their areas.

The Philippines, being the first to come up with a stand-alone access regulation from among the Contracting Parties to the Convention, can also be considered as one of the first to have its local government units come up with local ordinances that will enable the local and indigenous communities and the local government units to have a say in the enforcement and implementation of access regulations. These local government ordinances are already in place in the Municipality of Lantapan in Bukidnon Province in the Southern Philippines as well as in the City of Puerto Princesa on Palawan Island.

The need for greater representation of local and indigenous communities and bodies or processes that may be created by the Contracting Parties to the Convention to facilitate access to their genetic resources is expected to strengthen the implementation of whatever regulation or biodiversity conservation strategy may be established by the Contracting Parties.

Local and indigenous fisher folk communities are confronted with greater threats to their livelihood and marine resources and they do not realise the importance of getting involved in discussions relating to access to marine genetic resources. Based on the experience of the Tambuyog Development Centre in the Philippines, it might be useful to integrate discussions of access and benefit-sharing issues into the development of whatever coastal resource management strategies may be developed to arrest greater threats to the marine ecosystem.

It appears from the experience of the Philippines that there is an emerging need to criminalise or penalise acts that do not comply with the provisions of any access regulation that may be incorporated by the Contracting Parties in their national legislation in accordance with the mandate of Article 15 of the Convention.

This is important to ensure compliance with these regulations and to deter would-be violators. If these acts of biopiracy are not made criminal acts or the penalties for their violations not increased, the law enforcement authorities will find it difficult to apprehend and charge violators in proper courts. This should also increase the leverage of the Contracting Parties in negotiating for fairer and more equitable sharing of benefits with interested collectors of their genetic resources.

Case Study 10. Biowatch SA seeks leave to appeal court costs order and gets support from churches

A wide cross-section of South African religious communities, including the Christian, Muslim, traditional African, Hindu, Buddhist and Baha'i faiths, have supported Biowatch South Africa's attempt to appeal the costs order granted to Monsanto South Africa (Pty) Ltd. In a letter to Biowatch, Bishop Geoffrey Davies, convenor of the South African Faith Communities Environmental Institute, said Biowatch's appeal should be evaluated to consider the withdrawal and setting aside of the court decision regarding costs.

'We believe there has been a transgression of justice,' Davies said, 'in the Department of Agriculture's refusal to grant Biowatch access to information (and) in the court then requiring Biowatch to pay the costs of the action undertaken on behalf of the citizens of South Africa.' Davies said the Institute was 'alarmed that Biowatch was required to pay the costs of court action for what should be public knowledge.'

A national meeting of religious communities in March had called for full public participation in decision-making around genetically modified crops. The meeting noted with dismay the 'underhand' promotion of genetically modified organisms (GMOs) and the monopoly of transnational companies in food production and the destruction of biodiversity through monoculture agriculture and forestry. 'We believe that the rights of our people are being seriously compromised by multinational corporations seeking monopolistic control over the essentials of life. We are particularly concerned with access to and control over food and water. We are most concerned that the Department of Agriculture would not give Biowatch the information they requested. Biowatch had to resort to the courts to obtain information that should have been public knowledge,' Davies said. He added that the Institute was 'most disturbed' that GM food was not labelled, whereas organic food, which was not controversial, was licensed and labelled.

In March, Biowatch sought leave to appeal against the High Court's order that the organisation pay the legal costs of Monsanto South Africa. We also sought leave to appeal the absence of any costs order in our favour. The costs order in favour of Monsanto South Africa arose out of the major victory that Biowatch South Africa achieved to gain access to information about GM crops in South Africa. The Registrar of Genetic Resources was ordered to release this information by 30 April this year—a development that will at last lift the veil of secrecy that has shrouded this industry, and enable the public to know how decisions are made about the growing of GM crops in South Africa. Acting Judge Dunn made no other orders about costs. This is extremely disappointing because Biowatch South Africa was substantially successful in its application and Acting Judge Dunn found the Registrar of Genetic Resources had adopted a passive role. The cost order in favour of Monsanto South Africa is likely to have a deterrent effect on future public interest litigation. It creates the impression that if any part of a request for information is found to be insufficiently specific, even a successful litigant may be heavily penalised. The costs order against Biowatch South Africa will impede the organisation's capacity to gain access to, analyse and disseminate to the public the very information for which the court ordered access because much needed resources would be diverted away from the organisation's core business. There was no order for payment of Biowatch South Africa's costs, even though the organisation was successful in its application to the court.

If the application for leave to appeal is successful, the full bench of the Pretoria High Court or, alternatively, the Supreme Court of Appeal will hear the appeal. The South African Freeze Alliance On Genetic Engineering (SAFeAGE), Earthlife Africa and the Wildlife and Environment Society of South Africa (WESSA) have also supported Biowatch seeking leave to appeal the court's costs order.

Source: *The Biowatch Bulletin*, March/April 2005.

4.4.3 Topic: Benefiting from the biological resources	Grade 10: Environmental Studies
Learning Area: Life Sciences	Integration:
Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.1.1: Use a prescribed method to access information. AS 2.2.1: Identify concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. AS 2.2.2: Describe and explain concepts, principles, laws, theories and models. AS 2.2.3: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. AS 3.2.1: Describe different ways in which resources are used and applied to the development of products, and report on their impact on the environment and society.	Prior Learning: Understand biodiversity. Understand the CBD. Ability to analyse case studies.
Assessment Possibilities: Assessment method: Individual assessment. Assessment tool: Memorandum.	
Resources: Section 5. Case study and library resources.	
Teacher Activity: Briefly explain the CBD in South African context. Explain the assignment. Arrange the grade/school assembly.	

Activity 4

Ask learners to read the given information and, using general knowledge and the information in Case Study 11, to do the following assignment. They should conduct additional research to complete the assignment.

- Learners should develop a poster that highlights the essence (main ideas) of Case Study 11. The poster can be presented at the grade/school assembly.
- Write a speech on the topic of benefit-sharing in South Africa, which should be presented at the grade or school assembly.
- Design a flyer on the topic that must be handed out to all learners at the assembly after the speech has been given. The flyer could include some of the following headings:
 - 🐾 What will happen with our environment if we continue to collect biological resources?
 - 🐾 Why it is important to protect and sustainably manage our biological diversity.
 - 🐾 How access to biological resources can be managed in South Africa.
 - 🐾 How government policies are ensuring equitable access to natural resources.
 - 🐾 Government departments involved in the implementation of the Convention on Biological Diversity.

Case Study 11. Benefit-sharing in South Africa: fact or fiction?

In South Africa, benefit-sharing has been catapulted into the spotlight as an issue requiring urgent attention to justify conservation as a legitimate land use. Issues of equity are especially pertinent to the country, having had a long history of injustice, dispossession and discrimination through years of apartheid policies. Included in this history were forced removals of black communities from land to be later designated for conservation purposes, and the removal of people's rights to use natural resources for their livelihoods. These iniquities, combined with a past neglect of social problems in South African conservation practice, have resulted in the widely held perception that biodiversity conservation serves the recreational interests of the privileged elite and is irrelevant to most of South Africa's people.

Slowly attitudes are changing, largely through a realisation of the potential economic benefits to be gleaned from the country's biodiversity through such activities as tourism and the development of new medicinal, cosmetic and food products. Certainly opportunities abound. As the third most biologically diverse country in the world, a large number of South Africa's species occur nowhere else in the world. Few countries can boast having an entire plant kingdom within national borders—the Cape Floral Kingdom—and the highest recorded species diversity of any similar sized region in the world. Together with well-developed institutions and research capacities in the country, these attributes provide an extremely favourable environment for bioprospecting—the exploration of biodiversity for commercially valuable genetic and biochemical resources.

Adding value to the country's natural resources is well recognised as an important avenue for economic development in South Africa. This recognition exists despite previous approaches that disregarded indigenous genetic resources and prohibited practices such as traditional healing. With biodiversity now globally recognised as an important resource for new commercial products, various government initiatives are responding to potentially lucrative opportunities. The Innovation Fund, for example, an initiative of the Department of Arts, Culture, Science and Technology, identifies biotechnology and 'value addition with respect to exploitation of our natural flora and fauna' as two of three focal areas warranting the allocation of scarce government funds. The Indigenous Knowledge Programme, co-ordinated by the same department, similarly includes a focus on opportunities associated with biodiversity in its aims to 'unearth, promote and protect the African heritage'. The government's policy on biodiversity, formulated in response to its obligations under the CBD, stipulates as a key goal the need to ensure that benefits derived from the use and development of South Africa's genetic resources serve national interests (DEAT 1997). Furthermore, it identifies as a priority the development of legislative and institutional measures to control access to genetic resources and ensure equitable benefit-sharing. Specifically, the policy sets standards for best practice through a number of requirements for the development of bioprospecting agreements, ranging from scientific capacity-building through to the protection of traditional knowledge. Underpinning all these intents is the commitment from government to reduce social inequality and improve the quality of life in poverty-stricken areas.

Source: Wynberg (2001), *Benefit-sharing in South Africa: fact or fiction?*

Activity 5

Ask learners to complete the following assignment:

Consider the natural resources in your own community. How will you make sure that your local community can benefit from access to the biodiversity of your area without destroying the resources?

4.4.4 Topic: Access to biodiversity in your community	Grade 10: Environmental Studies
Learning Area: Life Sciences	Integration: History
Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge History LO 1: Historical Enquiry (Practical Competence) Assessment Standards: Life Sciences AS 2.1.1: Use a prescribed method to access information. AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. History AS 1.3: Extract relevant information and data from the sources and organise it logically.	Prior Learning: Understand biodiversity and have an understanding of policy-making processes.
Assessment Possibilities: Assessment method: Self assessment. Assessment tool: Memorandum.	
Resources: Section 4. Information on policies and laws.	
Teacher Activity: Provide information on the policies and laws pertaining to the CBD. Introduce the questionnaire.	

Activity 6

- Learners should collect copies of the policies mentioned in the table below to complete the tasks below. Copies of the policies can be obtained from the local offices of the Department of Environmental Affairs and Tourism, local library or the internet (use Google as your primary search engine).

Explain the following policies by completing the missing information:

Table 8. Legislation and its role in conservation

Policy	What does it implement?	What does it say about access to resources?	Who are the stakeholders?
White Paper on Environmental Management Policy (1999)	Promote the sustainable use of natural resources.	Promote equitable access to natural resources.	Community, conservation, government.
Genetically Modified Organisms Act (15 of 1997)			
Protected Areas Act (57 of 2003)			
Biodiversity Act (of 2004)			
Traditional Medicines Bill (66 of 2003)			

- Why do you think it is important to have policies that control and manage access to biological benefits?

3. Draw a flow diagram that shows the development of the different policies and how they influence each other.

4.5 Grade 11: Lesson plans and activities

4.5.1 Topic: Sustaining our environment, e.g. access to biological resources	Grade 11: Environmental Studies
Learning Area: Life Sciences	Integration:
Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge	
Assessment Standards: AS 2.2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships. AS 2.2.2: Evaluate concepts, principles, laws, theories and models.	Prior Learning: Understand biodiversity and have an understanding of policy-making processes.
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Memorandum.	
Resources: Section 4. Information on policies and laws. Case Study 12.	
Teacher Activity: Provide information on the policies and laws pertaining to the CBD.	

Activity 1

Learners should read Case Study 12 and answer the following questions:

1. What are the benefits of an Access and Benefit-sharing Strategy?
2. What are the important aspects to consider when developing an ABS strategy?
3. Draw a flow chart indicating the different stakeholders involved in the ABS strategy.
4. Develop an ABS strategy for your community to make sure that the biodiversity in your area is conserved. Present your plan in a report.
5. Draw a flow chart that indicates who the stakeholders participating in your ABS strategy will be.

Case Study 12. Benefits of a National Strategy on Access and Benefit-sharing

Access and Benefit-sharing (ABS) partnerships can be a source of sustainable economic development, providing a country and its stakeholders with benefits such as improved capacity for conservation, new products and income to meet basic needs such as healthcare and food security, as well as support for value-added scientific research. However, ABS embraces a complex, varied and unpredictable set of issues, linked to policy-making in many areas of government, as well as to domestic and global markets. The uses of genetic resources are diverse and the stakeholders involved range from multinational companies to indigenous communities, each with different priorities.

Key stakeholders may lack the resources, motivation and awareness to participate. When developing an ABS strategy, politically powerful champions may be required to secure the involvement of key ministries, as well as co-operation between federal/national and state governments. Relevant stakeholders have to be involved from the start and throughout the process. However, planning exercises are often challenged by a mismatch between expectations and available resources. Before starting, the strategy team must ensure it has sufficient time, human

resources, money, public awareness and stakeholder commitment.

Some ABS measures have not achieved their conservation and development objectives because they do not reflect the needs and capacities of domestic and foreign stakeholders. To avoid this, an ABS strategy should be guided by: (i) the best available information on a country's genetic resources and associated knowledge and its human and institutional capacities, (ii) the legal framework governing the conservation and sustainable use of these resources, in particular access and benefit-sharing, and (iii) the needs of stakeholders, including their demand for access to genetic resources and priorities for benefits that can be obtained through ABS partnerships. An ABS strategy should reflect best practice in the benefits available under different types of ABS partnership, e.g. for academic research or commercial development. It should also reflect a good understanding both of markets for products derived from genetic resources within a variety of industry sectors, e.g. pharmaceuticals or botanical medicines, as well as the way in which scientific institutions use genetic resources.

Strategy involves the development of a coherent vision of future direction and new ways of doing things. Dialogue with the providers and users of genetic resources, both within the country and abroad, can elicit insights and lessons learned about the trends, risks and opportunities that will form the basis of the strategy. The strategy should explore ways to cope with stakeholders' concerns as well as with the uncertainty and change involved in ABS. It should identify policies and partnerships that can support national competitiveness, as well as conservation and development priorities. The strategy can set out priorities for strengthening and changing the country's knowledge base, technologies, institutions and laws.

Source: Ten Kate & Wells (no date), *A national strategy on access to genetic resources and benefit-sharing: a pilot study*.

4.5.2 Topic: Sustainable use of biological resources and access to biological resources	Grade 11: Environmental Studies
Learning Area: Life Sciences	Integration:
Learning Outcomes: LO 2: Construction and Application of life Sciences Knowledge	
Assessment Standards: AS 2.1.1: Use various methods and sources to access information. AS 2.2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships. AS 2.2.2: Evaluate concepts, principles, laws, theories and models.	Prior Learning: Understand biodiversity and have an understanding of policy-making processes.
Assessment Possibilities: Assessment method: Teacher assessment. Group assessment. Assessment tool: Rubric.	
Resources: Section 4. CBD information. Any additional readings on the topic.	
Teacher Activity: Provide information on the policies and laws pertaining to the CBD. Introduce information on business ventures.	

Activity 2

Divide the class into groups consisting of four members. Groups must choose a business venture that may require access to biological resources. Each group is required to research and evaluate the extent of a potential business venture on the economic upliftment of a local community. They must also investigate and describe the implication of one of the biodiversity problems that may result from the proposed business venture and how they will address this.

Each group must prepare a presentation and present their findings to the class.

4.5.3 Topic: Sustainable use of biological resources and access to biological resources	Grade 11: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.1.1: Use various methods and sources to access information. AS 2.2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships. AS 2.2.2: Evaluate concepts, principles, laws, theories and models. AS 3.2.1: Compare different ways in which resources are used in the development of biotechnological products, and analyse the impacts on the environment and society.	Integration: Prior Learning: Understand the importance of biodiversity.
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Rubric.	
Resources: Section 4. Case study. Any additional readings on the topic.	
Teacher Activity: Introduce GMOs. Provide guidance on how to conduct the research.	

Activity 3

Ask learners to conduct research on genetically modified organisms (GMOs). The research should address the following key questions and must be presented in a research report:

1. What are GMOs?
2. Is there a need for GMOs?
3. What does the CBD state about GMOs?
4. How do GMOs impact on biological diversity?
5. What are the consequences for biological diversity if there are no restricting measures to control the GMO industry?
6. Why is the CBD such an important document for GMO issues?

Case Study 13. Genetically modified organisms: Biodiversity Bill does not protect us

There are more than 122 59 plants and animals threatened with extinction according to the latest Red List published by the International Union for the Conservation of Nature. This is 10 more species than last year and also more than the number of new species identified. Included on the list are the South African riverine rabbit and cycads.

Hence we are on a downward spiral and if our legislation meant to protect biodiversity is not effective, our response to this looming crisis amounts to nothing; our support for the UN Convention on Biological Diversity, the Cartagena Protocol and the WSSD Declaration mere words and empty promises. These protocols and conven-



tions require countries to commit themselves to protecting their biodiversity, protecting themselves from the harm of foreign produce and not inflicting harm on other nations.

While biotechnology is regarded as the phenomenon of the 21st century, it has been practised for millennia. It is the use of life forms in technology, and even bread-baking using yeast spores is a form of biotechnology. Biodiversity is the variety of life forms that enables species to respond to stress and to evolve. Its importance has been recognised since we gained a better understanding of evolution and ecology. Ecology is simply the flow of energy through all living and non-living matter, towards a state of balance. Our bodies are ecosystems, as is the earth. If we lack water, we thirst, we drink and achieve balance. If we don't get the water, we die. If ecosystems on earth are deprived of essential sustenance, such as water or oxygen, they lose species and eventually collapse.

Modern biotechnology refers usually to the use of genes, a field that gives humans a far greater capacity to create and to destroy, and it is no wonder that genetically modified foods are surrounded by public debate and concern. At a conference convened in South Africa, the International Food Policy Research Institute and the Food, Agriculture and Natural Resources Policy Network met to try to reach consensus on the likely impact of GM (genetically modified) foods in Africa. An overview of the pros and cons of GMOs (GM organisms) came up with the following points.

Arguments FOR the use of GMOs were:

- ☛ That they produce seeds better able to resist stress.
- ☛ They produce more nutritious staple foods.
- ☛ They will make farm animals more productive.
- ☛ They will produce more food from less land.
- ☛ They can reduce the need for certain chemicals.
- ☛ They can produce seeds that grow in infertile land.
- ☛ Foods will have longer shelf lives.
- ☛ We may be able to identify diseases more easily using genetic fingerprinting
- ☛ Development of vaccines.
- ☛ Identification of allergenic genes.

The arguments AGAINST GMOs were:

- ☛ That genes may jump from one species to another such as from a plant that resists weed killer to weeds, rendering them resistant too. Once released, they cannot be recalled.
- ☛ That inserted genes may cause harmful mutations.
- ☛ That sleeper genes could be accidentally switched on and active genes switched off. Genes behave rather like an orchestra, producing certain effects when switched on by stimuli that activate groups of genes to work together. New genes could change the behaviour patterns inherent in natural functions.

GM crops could replace normal crop varieties or compete with wild plants and replace them with the GM version. GM crops could create resistant insect species and have a harmful effect on the environment.

The GMO Act, which regulates the research, production, importation and sale of GMOs, is inadequate as a protection from GMO fallout. The Act requires that the Registrar of the GMO Council MAY require a risk assessment, a field trial and an environmental impact assessment (EIA) of any product involving GMOs. In South Africa at least 200 permits have been applied for to work with GMOs. All of them have had risk assessments and field trials, which usually involve paper work submitted by the company requesting the permit. The risk assessment can only look for what we know to be risky such as allergenic particles or known side effects in animals. The field trials are mostly to assess commercial factors such as yield, durability and size. Three products have been licensed for commercial farming (Bt cotton, Bt maize and Ready Roundup Soya), which form 80%, 20% and 11% of the market respectively, but no research has been done to assess the impact these crops have on the environment. Recent research in Britain has resulted in a Europe-wide ban on GM sugar beet and rapeseed, after it was demonstrated that they significantly reduce butterfly, bee and bird populations. In South Africa there has been no EIA on any product and if harm to the environment does occur, there is no way of knowing it or correcting it until it is too late.

The Biotechnology Bill adopted in parliament recently has the same flaws as the GMO Act and allows that the Minister MAY call for an EIA if he thinks there may be harm to the environment. But without such an assessment, why

should he expect such harm? Ironically, the National Environmental Management Act states that every activity requiring a permit also requires an EIA, which must be advertised to the community. But, between the words and the action, falls the shadow. Our laws are not effectively enacted. This may be of nuisance value with regard to smoking, but it has serious consequences when it comes to the impact of GMOs on biodiversity and human health.

We need an urgent re-appraisal of the GMO Act making it mandatory that all GM crops have EIAs. There must be a paper trail from seed to stomach for all GM foods so that if something does go wrong, it can be stopped and prevented in future. We also need unimpeded transparency concerning who has applied for and been given permits to do what, where and why. Only then can we keep a wary eye on humans tinkering with nature's genes and give meaning to our alleged desire to protect our magnificent variety of plants and animals for future generations.

Source: Article by Dr Ruth Rabinowitz (2004).

4.6 Grade 12: Lesson plans and activities

4.6.1 Topic: Local environmental issues—access	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.1.1: Use various methods and sources to access relevant information from a variety of contexts. AS 3.3.1: Critically evaluate and take a justifiable position on beliefs, attitudes and values that influence developed scientific and technological knowledge and their application in society.	Integration: Prior Learning: Understanding benefit-sharing and access. Understanding community structures. Familiar with the biological resources in the community. Understanding of how to develop a strategy.
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 4. Information on biodiversity. Case study.	
Teacher Activity: Discuss the role of stakeholders in managing and conserving our environment. Explain how a strategy should be developed. Mention possible communication methods and tools.	

Activity 1

Ask learners to read Case Study 14 and answer the following questions:

1. Who are the main role-players in this article?
2. Who do you think stands to benefit from this levy and why?
3. What is your opinion of the levy that has been instituted? Is it right?
4. Do you consider the cost for entry into the park as fair? Why?
5. Which statement in the CBD best supports the establishment of protected areas?

Case Study 14. Notice to inform the public of the imposition of a Natal Parks Board Community Levy

With effect from 1 February 1998, visitors will be required to pay a community levy when entering certain protected areas administered by the Natal Parks Board. The levy will apply to those reserves where an entry fee is payable and where hut accommodation or camping is offered. The levy will be used to assist neighbouring communities with capacity-building and development of their surrounds. It will be a once-off payment per camp per reserve, i.e. the levy will be applicable at each Natal Parks Board reserve where an entry fee is paid. The levy will be:

- R10 per person per camp for hut accommodation.
- R5 per person per camp for camping.
- R1 per person per entrance gate for gate entry.

Children under the age of three years will not be subject to the levy. Education groups visiting protected areas will not be subject to the levy. A community levy will also be payable for the following Natal Parks Board facilities:

- | | |
|------------------------------|--------------------------|
| • Crocodile Centre, St Lucia | R1 per person per entry. |
| • Santa Lucia, St Lucia | R1 per person per entry. |
| • Giant's Cup Trail | R5 per person. |
| • Overnight hiking | R5 per person. |
| • Aircraft entry | R1 per person. |
| • Aircraft entry (overnight) | R10 per person. |

Background information

South Africa's protected areas are vital to the ongoing success of this country's world-renowned wildlife conservation programmes. In economic terms, our protected areas are our greatest tourism assets. They attract ever-growing numbers of both foreign and local visitors for the unique experience of life in the wilds. As members of the world's conservation community, we must safeguard these protected areas. They are a priceless heritage that can benefit us all.

Our protected areas can thrive only if they have the support of our people. This includes disadvantaged communities who live around these areas. The Natal Parks Board recognises the needs of these communities and has thus committed itself to their development and upliftment through one of the largest conservation social responsibility programmes in Africa. However, direct cash injection from tourism into these communities is also sorely needed. The community levy would go directly towards fulfilling this need.

Activity 2

The Parks Board has collected sufficient funds from the levies to start the capacity-building programme for the local community. They are, however, experiencing problems with getting the local community involved in the capacity-building programme.

You and your team have been contracted as the communication experts to develop a strategy that will inform them of the programme, indicate the importance of it and encourage them to participate.

Divide the class into groups of five. Each group is expected to develop a communication strategy which should clearly indicate the following information:

- The community groups that will be targeted.
- How they intend to convince people to participate in the programme.
- The information they intend to share with the community.
- The communication methods and tools that will be used.

The groups must present their strategy in class.

4.6.2 Topic: Local environmental issue—GMOs	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO2: Construction and Application of Life Sciences Knowledge LO3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.1: Use various methods and sources to access relevant information from a variety of contexts. AS 3.2.1: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment.	Integration:
	Prior Learning: Understanding benefit-sharing and access. Understanding of GMOs.
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Rubric.	
Resources: Section 4. Information on biodiversity, resources, genetically modified organisms. Case study (<i>Balancing the risks against the promises of gene-altered rice</i>).	
Teacher Activity: Discuss the concept of GMOs.	

Activity 3

1. Prepare the learners for a debate by asking them to read Case Study 15.
2. Divide the class into two teams, one for and the other against GMOs.
3. Give the two groups an opportunity to discuss how they are going to prepare for the debate.
4. The learners are given two weeks to prepare for the debate. All the planning for the debate will be done during learners' own time. During the two-week period the teacher must regularly obtain progress reports from the two groups.
5. Each team must choose three learners to be their debating team.
6. The debate can take place during an interval or after school so that the other learners can be invited.
7. Ask a language teacher to be the adjudicator of the debate.

Case Study 15. Balancing the risks against the promises of gene-altered rice

Watson, Missouri.—Like an expectant father, Jason Garst stood in calf-deep water and studied the rice plants growing in a flooded field here. It was a curious sight in northwest Missouri, a landlocked state in the Midwest, where the growing season is considered too short for rice. Mr Garst hopes at least one of the 12 varieties on his test plot will sprout this fall. If one does, he will start growing rice genetically engineered to produce proteins found in human milk, saliva and tears. Converted into a powder, the proteins would be used in granola bars and drinks to help infants in developing countries avoid death from diarrhoea. 'I know in my heart that this will be better than anything else we are doing,' said Mr Garst, 35, who also farms soybeans and potatoes. The rice project is backed by a private company called Ventria Bioscience and has the support of the state and a local university, which hope



to reverse the long decline in the area's farm economy. But it has run into opposition from environmental groups and even the beer giant Anheuser-Busch amid fears about the health effects of genetically engineered crops, making Mr Garst's little rice paddy a piece of a larger battlefield.

The arguments echo those heard in similar disputes in Europe and, increasingly, in the United States. Critics of Ventria's plans are concerned that gene-altered rice could contaminate regular crops and pose a health risk to consumers. But for Missouri's farm economy, the risk of growing pharmaceutical rice is high. More than half of Missouri's rice is sent abroad, to the European Union and Caribbean countries that are especially sensitive about genetically modified products. Carl Brothers, the vice president for marketing at Riceland Foods, which markets more than half of Missouri's rice said: 'We are still having to make statements to our customers that the rice we export is not genetically modified.' He added: 'We are concerned longer term that if Ventria and others get involved that will get harder to say.'

Ventria and its academic partner in the project, Northwest Missouri State University, say they can control potential contamination. And they say the risks are minimal when balanced against the potential for the special rice to help cut the costs of drugs and save lives. The debate highlights the challenge facing much of the Farm Belt's economy: finding new products that will reduce farmers' reliance on commodity crops. As equipment has become more efficient and foreign competition has stiffened, farms have consolidated and profit margins have shrunk. The genetic engineering work that Ventria and other companies are doing can add value to products like rice, offering farmers a more stable income that does not rely on steep government subsidies.

Source: Article by Alexei Barrionuevo, in *The New York Times*, 4 September 2005.

Activity 4

Investigation

1. Ask learners to conduct a survey in their community to find out how much people know about GMOs and the CBD.
2. Learners should design five of their own survey questions that will enable them to assess the community's knowledge about GMOs and their impacts.
3. Learners must analyse and present their findings in a bar graph.
4. Learners must write an essay on their findings and suggest ways in which public awareness and access to information on the matter can be increased.

Activity 5

Scenario

The findings of a research project suggest a solution to increasing the ability of chickens to lay eggs. If the growth enhancing powder is put into the fodder of the chickens, they can produce up to 25% more eggs than usual. This also means that the eggs will be sold much cheaper to clients. You are a young entrepreneur farming with chickens and service the poor communities in your area with chicken and eggs.

Ask learners to read the scenario and to respond to the following:

The research company has requested a response from you in which you must state whether you will accept or decline the option to use the powder for your business.

- ☛ Refer to the information in the scenario and write a business letter to the research company in which you indicate your decision to either accept or reject their offer. Phrase your response to include a socio-economic and ethical perspective as well.

Learners have to submit their letters. Select two of the letters written, one accepting the offer and one rejecting it, and ask learners to read it in class.

4.6.3 Topic: Local environmental issues—access and benefit-sharing in the CBD	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 2.1.1: Use various methods and sources to access relevant information from a variety of contexts. AS 2.2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts. AS 2.3.1: Evaluate and present an application of Life Sciences knowledge.	Integration: Prior Learning: Understanding benefit-sharing and access. Understanding of stakeholder roles. Understanding biological diversity.
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Rubric.	
Resources: Section 4. Information on biodiversity. Case study.	
Teacher Activity: Discuss the scenario and unpack the article, making sure that learners know what to do. Discuss the role of stakeholders in managing and conserving our environment. Explain the tasks.	

Activity 6

In groups of two's, ask learners to draw up a table in which they list: the main role-players, their contributions to the project and the benefits that they will derive from the project in Case Study 16.

Case Study 16. Conservation in the community: the Edith Stephens Wetland Park

The Edith Stephens Wetland Park was originally a 3 hectare wetland that had to be connected to the two adjacent land parcels (one privately owned and the second owned by the City) to become ecologically viable. In June 2000 the City purchased the privately owned land and amalgamated the three land parcels into the Edith Stephens Wetland Park. The steering committee for the park includes partners as diverse as the previously disadvantaged communities, the National Botanical Institute, now called the South African National Biodiversity Institute (SANBI), the BotSoc and the Table Mountain Fund. The project aims to establish a community park that creates jobs (through invasive alien plant removal) and to provide a recreational centre and a reserve that integrates the various communities. The Table Mountain Fund, with financing from the GEF, facilitated the first stakeholder workshop which led local community leaders to support the project.

To date, the City has spent more than R2 million on establishing this park. The National Botanical Institute has also enthusiastically sourced funding of over R400 000 from the Working for Water Programme for the removal of invasive alien vegetation to rehabilitate the park's natural wetlands, using labour sourced from local communities. The park's success demonstrates the linkages between poverty, environment and development. The Edith Stephens Wetland Park initiative demonstrates how core conservation sites can indeed work to deliver cross-sectoral benefits in urban settings.

Source: Maze *et al.* (2002), *Conserving an embattled flora: mainstreaming biodiversity issues in urban Cape Town*.

Activity 7

Scenario

Three different communities surround the reserve. The donors of a R400 000.00 grant have requested a proposal from the reserve manager indicating how they will spend the money ensuring that people from all the communities benefit from the project. To ensure inclusivity, the manager decided to request input from the four groups.

1. Divide learners into groups of four, one group representing the reserve conservationist and management, the other three groups representing communities 1, 2 and 3 and ask them to read the scenario.

Group 1 represents inhabitants of informal settlement.

Group 2 represents the farming community.

Group 3 represents the residents of the surrounding sub-economic housing areas.

The groups are expected to develop short proposals on how they will:

👤 Investigate the conservation priorities in the reserve.

👤 Spend the money (budget).

👤 Make sure that all three communities benefit from the funds.

👤 Ensure the protection of the biological diversity in the reserve.

2. Each group should present their proposals in class. The groups listening are expected to evaluate the proposals and give the presenting groups feedback on the strengths and weaknesses of the their proposals. Ensure that a person in the group writes the comments.
3. Once all groups have presented, learners should develop a combined proposal drawing on the strengths of the four proposals.

4.6.4 Topic: Local environmental issue—policies that influence access and benefit-sharing in biodiversity	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge Assessment Standards: AS 2.3.1: Evaluate and present an application of Life Sciences knowledge.	Integration:
	Prior Learning: Aware of the policies and laws in the CBD. Civic responsibilities. Understanding of biological diversity.
Assessment Possibilities: Assessment method: Teacher assessment. Assessment tool: Observation sheet. Rubric.	
Resources: Section 4. Information on biodiversity. Resources on stakeholders and policies and laws.	
Teacher Activity: Discuss the policies and laws pertaining to access and benefit-sharing.	

Activity 8

Develop a poster that depicts the role of the individual in supporting the various CBD policies and how these actions will conserve the biodiversity of the local area.

Information Box 1: Legislation and Policies

South African legislation on Access and Benefit-sharing (ABS)

ABS in South Africa is addressed in the White Paper on Conservation and Sustainable Use of Biological Diversity (1997) and the National Environmental Management Biodiversity Act 10 of 2004, known as the NEMBA (2004). In November 1997 South Africa ratified the Convention on Biological Diversity (CBD).

White Paper on Conservation and Sustainable Use of Biodiversity (1997)

ABS is one of the goals of the White Paper on Conservation and Sustainable Use of Biological Diversity (1997), which was drafted in accordance with the objectives of the CBD. One of the policy objectives stated in the White Paper is to 'control access to South Africa's indigenous genetic resources through the introduction of appropriate legislation and establishment of institutional structures'. In fact, the overarching objective is to 'ensure that benefits from the use and development of South Africa's genetic resources serve the national interest'. To achieve this objective, the White Paper stipulates that an 'efficient permitting system whereby authorisation is required for the collection of any biological or genetic resources to be used for research, trade or commercial purposes' be developed and implemented.

National Environmental Management Biodiversity Act (2004) NEMBA

Regulations pertaining to the institutional framework regarding bioprospecting, access and benefit-sharing in South Africa have been outlined in the Biodiversity Chapter 6 of the National Environmental Management Biodiversity Act 2004, best known as the NEMBA (2004), and can be found at the national Department of Environmental Affairs and Tourism (DEAT), under the Biodiversity Management Directorate.

Implementation regulations

The objective of the ABS part of the legislation is 'to regulate access to biological resources and knowledge, practices and innovations associated with such resources and to ensure the fair and equitable sharing of environmental, economic and social benefits arising from their use'. The ABS regulations apply to indigenous biological resources (wild, domesticated, *in situ* or *ex situ*), land, knowledge, innovation and practices associated with biological resources and *ex situ* collections assembled before and after the CBD. ABS regulations do not apply to biochemical or genetic material of human origin, the exchange of biological resources among local communities, or associated knowledge and innovations resulting from non-profit-making practices, uses or customs.

Access to biological resources and/or knowledge associated with such resources for academic research or commercial purposes is prohibited unless a permit has been obtained. The procedure and associated channels that must be followed to obtain such a permit are outlined below. The applicant can be requested to submit additional information.

- ☛ Compliance with the provisions of the NEMBA.
- ☛ The extent of the threat faced by the species concerned.
- ☛ The benefit to be derived from the use of that species.
- ☛ Applicable international laws.

The applicant is required to conduct an environmental impact assessment where the proposed activity may have a potentially negative impact on the environment, socio-economic conditions and cultural heritage. A permit is sought for commercial purposes. The access permit stipulates:

- ☛ The species for which the permit is granted.
- ☛ The activity for which the permit is granted.

Activity 9

Debate

Divide the class into four groups: Community, Conservation Agencies, Government and Industry. Ask learners to debate the role and responsibility of each stakeholder in making sure that everyone abides by the policies and laws in Information Box 1.

5. Fair and equitable sharing of benefits arising from use of genetic resources

5.1 What is meant by fair and equitable benefit-sharing?

Benefit-sharing means the sharing of benefits that come out of the use of biological resources. This can be both monetary and non-monetary.

Word bank

'North': Refers to the 'developed' First World countries such as Europe and the United States situated in the northern hemisphere.

'South': Refers to the developing Third World countries such as South Africa situated in the southern hemisphere.

Case Study 17. A note on terminology: What is 'access and benefit-sharing'?

Throughout the world, biodiversity is found in inverse proportion to technological and industrial wealth, and therefore the biologically rich 'South' has argued that in order to allow companies access to its biodiversity, the technologically rich 'North' must transfer technology and share benefits from commercialisation. This is considered especially crucial given the historical accrual by colonial powers and Northern companies of benefits derived from the commercialisation of resources from the South. These sentiments underpin the Convention on Biological Diversity and the treaty's third objective—to share equitably benefits arising from use of genetic resources.

Growing out of the Convention on Biological Diversity is the basis for a new way of treating trade in genetic resources and for regulating bioprospecting. It is commonly referred to as 'access and benefit-sharing' (or ABS for short) because in order to gain access to resources, a user must provide benefits, and in order to receive benefits, a provider must facilitate access to resources.

This means that as of December 1993, when the Convention entered into force, companies and signatory countries have an obligation:

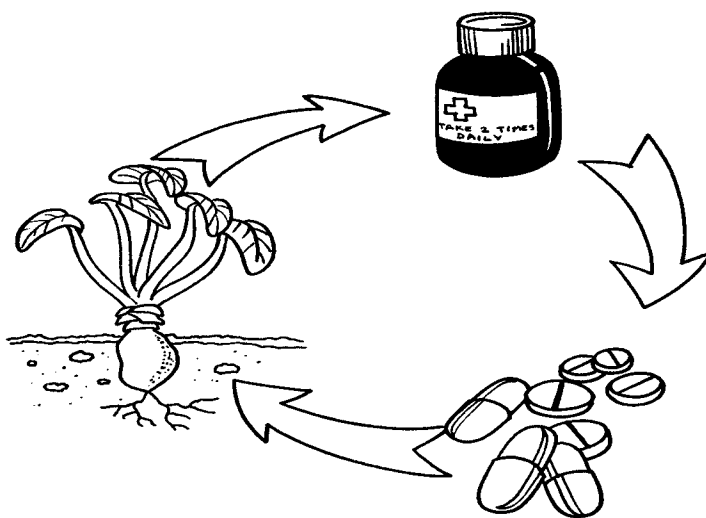
- ☛ To get permission before they collect resources and knowledge ('prior informed consent').
- ☛ To agree on the terms for exchange ('mutually agreed terms').
- ☛ To share benefits fairly with local providers and countries ('fair and equitable benefit-sharing').

In South Africa, we tend to use the terms 'access and benefit-sharing' in a much broader way, referring to the political context from which we have come—where people were denied access to natural resources—and to the fact that the rewards from use of biodiversity were inequitably spread. These are crucial issues that deserve priority attention but the **focus of this paper is on the narrower interpretation of 'access and benefit-sharing'**, within the context of trade in genetic resources, and implementation of the CBD, the International Treaty on Plant Genetic Resources for Food and Agriculture and other international policies and laws. It therefore does **not** look at the broader issues of communities, for example, needing access to biodiversity for a variety of purposes, such as medicines, foods or building material, or at ways in which tourism, for example, can enhance the livelihoods of rural communities.

Source: Wynberg (2004a), *Bioprospecting and access and benefit-sharing in South Africa: towards a strategic assessment*.

Monetary benefits may include:

- ☛ **Fees per sample:** These can be samples that are taken from biological natural resources for the purpose of testing in laboratories.
- ☛ **Grants to cover agreed research programmes:** If research has to be conducted within a specific area, money often has to be made available for the payment of those who assist the researcher or for buying equipment (technological equipment), etc.
- ☛ **Profit-sharing:** After research has been completed by a specific research organisation, the organisation would often sell its knowledge of a particular plant to a pharmaceutical company who would then use it for commercial purposes. However, the profits that are made by these sales have to be shared with the local community, indigenous group and the local research institution according to the laws of the specific country or in compliance with the Convention on Biodiversity.
- ☛ **Joint ventures:** Often research cannot be conducted without the help of local communities, especially if the research is done within the community. More often than not, it should be a combined effort.
- ☛ **Royalties:** Given to those who deserve it, for instance indigenous communities.
- ☛ **Prospect of local employment:** Communities where natural resources are most prevalent, are often very poor. The research can be helpful in employing locals.



Non-monetary benefits may include:

- ☛ **Sharing of research results:** Sharing of information can be important for local communities, because it creates a sense of openness and transparency.
- ☛ **Participation in research:** Asking locals to participate in research can create a sense of collaboration, so

that no one feels excluded from the process, particularly if research is done in local areas that involve communities living within the space of the research.

- ☛ *Technology transfer*: Some research organisations or even companies sending out researchers, are very well equipped with high technology. In this sense it is essential that those in the local environment acquire knowledge of how to use these instruments and techniques when it comes to research.
- ☛ *Training*: However, it is no use having the technology and not the training. It is therefore important that members within local communities be trained for long-term sustainability.
- ☛ *Capacity-building*: Another aspect linked to training is capacity-building. People have to be knowledgeable about their surroundings.
- ☛ *Medical assistance*: It is important to have medical assistance available in the case of an emergency such as the intake of a poisonous substance or a poisonous snakebite.
- ☛ *Investment in local infrastructure*: Monies that are raised through research done by pharmaceutical companies or research organisations have to be ploughed back into local communities for the upgrade of local infrastructure such as roads, schools, health centres, etc.
- ☛ *Support for conservation projects*: A fundamental issue is not only the protection of our national parks or ecological systems, but also support for conservation so that these benefits can be passed onto the next generation and others can learn from the environment.

Case Study 18. Rooting out malaria

Medicinal plants are used by millions of South Africans. Taking their cue, scientists are now studying indigenous plants in an effort to find simple, affordable anti-malarial medicines.

Malaria is, like tuberculosis and HIV/AIDS, one of the killer diseases ravaging the African continent. Current estimates put the clinical case load at between 300 and 500 million people annually—and 90% of them are in sub-Saharan Africa. According to the World Health Organisation, malaria causes 2–3 million deaths each year, most of them occurring in Africa. Many of the victims are children. Malaria is caused by *Plasmodium falciparum*, which is responsible for 25% of deaths in children under five years of age.

Malaria has a massive economic impact—in Africa direct and indirect costs exceed US \$2 billion per year. In addition, drug resistance developed by the malaria parasite is a major problem—the cheapest and safest anti-malarial drug (choloquine) is ineffective in much of Africa and its usual replacement (sulphadoxine-pyrimethamine) is rapidly going the same way.

Many victims, especially in the rural areas, never have access to 'Western' medicine and turn to traditional healers to cure the disease. These healers use a variety of medicinal plants to cure the fever and researchers are now taking a leaf from their book. A consortium led by the MRC is conducting a study into the traditional medicines used by communities for the self-treatment of fevers.

Project leader, Prof. Peter Folb of the MRC's Traditional Medicines Research Unit and Professor of Pharmacology at the University of Cape Town, says they are going to determine scientifically whether the use of traditional medicines has a valid basis. 'The important outcome of this work is to discover active compounds from plants used traditionally for the effective treatment of malaria,' he says.

The idea is then to find a lead molecule that can be developed into anti-malarial medicine. Prof. Folb stresses that, in the first instance, this project is about helping communities. 'We are not looking to provide prestige medicines to rich pharmaceutical companies—we are looking to find simple and affordable ways to treat and prevent malaria in countries where sophisticated medicines are not available,' he says.

The consortium, which is comprised of the MRC, the University of Cape Town, the University of Pretoria, the CSIR and the South African National Biodiversity Institute (SANBI), obtained a three-year grant from the Department of Arts, Culture, Science and Technology (DACST). Prof. Folb describes the pooling of the consortium partners'

knowledge and expertise as 'very exciting'. 'That's the way science should be done, especially in countries like South Africa which are smaller, scientifically speaking,' he says.

Prof. Folb describes the research programme as disciplined and comprehensive. 'We will look at activity, extraction techniques, chemical characterisation and mechanisms of action.' Gilbert Motlalepula Matsabisa, a researcher, adds that the anti-malarial medicine will have any one of four properties: prophylactic, curative, insecticide or able to offer reversal of resistance to available anti-malarials.

Finding an active compound will be only one of the results of the project. 'Another, equally important result is to create the infrastructure and resources to attract young people to do science and to become significant scientists. I believe the development and welfare of a country depend on good science,' says Prof. Folb.

Dr Nireesh Bhagwandin of the MRC's Strategic Market Development Division, agrees that the emphasis will be on capacity development. 'We want to develop a cadre of capable people,' he says.

Another important result will be the benefits brought back to communities. 'The original information comes from the community and this is where the benefits must return. If there were to be financial gains, and we're not working for that in the first instance, those financial gains must go to the communities and into research. We would not be prescriptive about how the communities are to use these benefits,' Prof. Folb says.

Ms Sibongile Pefile, Indigenous Knowledge Systems Manager at the MRC, says the consortium is determined to deal with issues of benefit-sharing and use of information in a proper manner. 'The consortium members are fully aware and in agreement about issues including benefit-sharing, intellectual property rights and acknowledgements,' she says.

Prof. Folb says their work could set a trend. 'If we do this right over the next three years, we will have set up a template—a way of doing things, that could work for other drugs as well. But we will fail if we don't achieve the understanding, support, participation and enthusiasm of the communities.'

Word bank

CSIR: South African Council for Scientific and Industrial Research.

5.2 Access to indigenous knowledge systems (IKSs) and sharing its benefits

To understand indigenous knowledge, let us first look at the dictionary explanation of the words:

Indigenous = born in or natural to a country; growing or originating in a particular country.

Knowledge = knowing, all that a person knows; learning.

Another explanation of indigenous knowledge (IK), particularly within the research discipline, can be described as 'the **information**, **insights** and **techniques** that are passed down and improved from one generation to the next' and covers topics such as:

- 🐾 Medicine.
- 🐾 Animal breeding and production.
- 🐾 Water management.
- 🐾 Soil conservation.
- 🐾 Pest management.

Traditional knowledge is a body of knowledge and beliefs that are passed on through oral tradition and first-hand observation. It includes a system of classification, first-hand observation about the local environment and a system of self-management that governs resource use. According to the Convention on Biological Diversity (CBD) context, traditional knowledge refers to knowledge, innovations and practices of indigenous and local communities deriving from customary uses of biological resources and associated cultural practices and traditions.

According to the CBD, traditional knowledge and its innovative practices, requires that those who are contracted to do research or other parties should respect, preserve and maintain the knowledge and practices of such communities embodying traditional life styles, which guarantee the use of biodiversity in a sustainable manner.

However, such indigenous knowledge cannot be protected only by broader environmental groupings or organisations. It is also the responsibility of governments in co-operation with local communities to protect and educate its own population about the conservation and protection of and respect for the environment and indigenous knowledge.

Indigenous knowledge has been around for centuries. Some of the first people or aboriginal people (First Nations) who were the original inhabitants of the lands made their livelihoods from what they found in their surroundings.

We have to protect indigenous knowledge for the simple reason that companies can patent what they find in plants and animals. Another reason why it is important to protect indigenous knowledge is that these companies can use local indigenous plants to make profits and use whatever they find without the consent of the locals.



Balancing sustainability of our biodiversity in a country burdened with an unemployment rate of approximately 40% and with high levels of poverty, is obviously not an easy task. South Africa has therefore contextualised the CBD for its biodiversity conditions, but in line with the international stipulations. South Africa has a long history of conservation as can be noticed in the historical and indigenous management systems that indigenous African people such as the San, Khoi and Nguni practised. These practices were negatively affected with the colonisation of the country, which brought with it guns that influenced hunting practices, ranching of cattle, sheep and goats, deforestation and introduction of foreign plants and animals.

Colonisation also resulted in indigenous people being forcefully removed from and dispossessed of their native lands. Today, we are faced with many requests from historically dispossessed communities for reallocation of their land, 'the Land Redistribution process'. The challenge facing government is to find the balance between re-allocating land back to the rightful owners while ensuring that it is not at the expense of the country's biodiversity. **Article 10** of the CBD states that government will as far as possible and as appropriate integrate consideration of the conservation and sustainable use of biological resources into national decision-making. Government is therefore in constant negotiations with dispossessed claimants to either suggest alternative land or to support the communities by assisting with the management and conservation of sensitive biodiversity areas. This is underpinned by the principles of informed and transparent decision-making and the fair and equitable distribution of benefits, recognising that, within the limitations of sustainable use, the socio-economic upliftment of disadvantaged communities is an important criterion upon which decisions will be based.

Article 10 of the CBD also states that government will protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with the requirements of conservation or sustainable use.

Case Study 19. Tribal Leaders save African Treasures

South African female traditional leaders are implementing a groundbreaking approach to promote rural livelihoods. A project is being implemented that will help manage indigenous knowledge systems and the sustainable exploitation of natural resources that have nutritional and medicinal values.

The project was prompted by the increasing commercialisation of indigenous plants in South Africa, which was initially set in place to alleviate poverty and to promote job creation. Without clear conservation strategies, however, the project was running the risk of leading to over-harvesting of the country's natural resources. Already urban dwellers are flocking to rural areas looking for herbs with medicinal and nutritional properties that suppress the impact of HIV/AIDS-related illnesses. South African female traditional leaders cite the over-harvesting of the African potato by urban dwellers as a good case in point to demonstrate the threat that South Africa's indigenous plants are facing.

The traditional leaders said that indigenous plants are an important part of their daily lifestyles. The plants are used to heal wounds and to cure diarrhoea, skin rash, rheumatism and arthritis, coughs and headaches. Other medicinal derivatives of these plants are used as laxatives at birth. They are also important as a food source.

Just as the nutritional and medicinal values of indigenous plants are critical for the general upkeep of rural residents, they also have a huge potential to lift local communities out of poverty through their sustainable commercial exploitation.

A project with potential

To achieve the sustainable utilisation of indigenous plants, the female traditional leaders said their Management of Indigenous Knowledge Systems Project should link traditional and modern conservation methods.

South Africa's Council for Scientific and Industrial Research (CSIR) and Resource Africa, a conservation agency based in South Africa, went into partnership in July 2004. Their aim was to jointly implement the Management of Indigenous Knowledge Systems Project using funds from the European Union and the Kellogg Foundation.

The Management of Indigenous Knowledge Systems Project seeks to assist rural communities in protecting their rich indigenous knowledge systems from being illegally acquired and patented by Western pharmaceutical and food companies, a practice which commonly results in preventing benefits from flowing to the local communities. To ensure sustainability and better management of the indigenous plants, the project will focus on the female traditional leaders' role in the management of the harvesting and exploitation of the plants. Awareness on best practices in managing and sustaining indigenous knowledge will be created through traditional fairs, workshops and media publicity.

Apart from protecting indigenous knowledge systems from being illegally acquired and exploited by outsiders without benefiting the real owners, the traditional leaders said that there was an urgent need to ensure that this knowledge was documented rather than simply passed on orally from one generation to the next. At present, this knowledge is in the keeping of the local elderly.

Source: Emmanuel Koro, www.islam-online.net/English/Science/2005/06/article13.shtml



Lesson plans and activities

5.3 Grade 10: Lesson plans and activities

5.3.1 Topic: Threats to biodiversity and historical developments: indigenous knowledge systems	Grade 10: Diversity, Change and Continuity
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Life Orientation LO 2: Citizenship Education Assessment Standards: Life Sciences AS 2.1.1: Use a prescribed method to access information. AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. AS 3.2.1: Describe different ways in which resources are used and applied to the development of products, and report on their impact on the environment and society. Life Orientation AS 2.1: Identify social and environmental issues, and participate in a group project to address a contemporary social and environmental issue.	Integration: Life Orientation
	Prior Learning: Knowledge of biological diversity. Understanding or access and benefit-sharing. Understanding of how to deliver a presentation and how to conduct research.
Assessment Possibilities: Assessment method: Group assessment. Peer assessment. Assessment tool: Memorandum. Rubric.	
Resources: Section 5. Example of a presentation.	
Teacher Activity: Explain the introduction on benefit-sharing, history of the sharing of biological resources in South Africa. Provide guidance on how to prepare the presentation. Provide an introduction to the concept of benefit-sharing.	

Activity 1

Learners should explain in a collage what benefit-sharing means.

Activity 2

In groups, ask learners to develop a presentation that they have to present to a panel consisting of government departments, the medical board and organisations concerned with protecting indigenous knowledge and community practices.

You are the research team and would like to request funding to conduct research on an inexpensive anti-malaria tablet. Your presentation will have to mention the following information:

- 🧐 Why it is important to develop the drug.
- 🧐 Who will benefit from it.
- 🧐 How you will get the information to develop the tablet.



- ☛ The consultation process you will follow.
- ☛ How you will ensure that the traditional healers and communities will share in the benefits.
- ☛ The CBD statement you will use to support your information.

5.3.2 Topic: The importance of the CBD for protecting indigenous knowledge systems and ensuring benefit-sharing	Grade 10: Environmental Studies
Learning Area: Life Sciences	Integration: Life Orientation
Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Life Orientation LO 2: Citizenship Education Assessment Standards: Life Sciences AS 2.1.1: Use a prescribed method to access information. AS 2.3.1: Organise, analyse and interpret concepts, principles, laws, theories and models of Life Sciences in the context of everyday life. Life Orientation AS 2.1: Identify social and environmental issues and participate in a group project to address a contemporary social and environmental issue.	Prior Learning: Understanding the CBD, access and benefit-sharing. Concept of indigenous knowledge. How to conduct research.
Assessment Possibilities: Assessment method: Group assessment. Assessment tool: Memorandum. Rubric.	
Resources: Section 5. Case study. Example of a press release.	
Teacher Activity: Provide some information on the Convention on Biological Diversity. Refresh on information of access and benefit-sharing. Explain indigenous knowledge.	

Activity 3

Ask learners to supply the missing information in Table 9.

The table below represents a summary of the provisions in the Convention on Biological Diversity on access to biological resources and on the knowledge, practices and innovations of local and indigenous communities. Fill in the missing information on the given sheet. Information can be obtained from the Convention on Biological Diversity of 1992.

Table 9. Articles of the Convention on Biodiversity

Article 8(j)	
Article 15.1	Sovereign rights of states over their natural resources; the authority of national governments to determine access to genetic resources.
Article 15.2	
Article 15.3	Articles 15, 16 and 19 only apply to genetic resources acquired 'in accordance with this Convention': i.e. not to those obtained prior to its entry into force or from non-parties.
Article 15.4	Access, where granted, to be on mutually agreed terms and subject to the provisions of Article 15.
Article 15.5	Access to genetic resources to be subject to prior informed consent of the Contracting Parties providing such resources, unless otherwise determined by that Party.
Article 15.6	
Article 15.7	
Article 16.3	
Article 19.1	Effective participation by providers of genetic resources in biotechnological research on the genetic resources they provide.
Article 19.2	
Need for prior informed consent	
Use of written agreements	Biological resources and derivatives should be acquired and supplied by using written agreements, setting out the terms and conditions under which the biological resources may be acquired, used and supplied and how the resulting benefits will be shared. These are called Material Transfer Agreements (MTAs).
Types of agreements	
Benefit-sharing	
Monetary benefits	
Non-monetary benefits	These may include: sharing of research results, participation in research, technology transfer, training, capacity-building, medical assistance, investment in local infrastructure, support for conservation projects.

Activity 4

Learners should read Case Study 20: Commercialisation of *Hoodia* based on San traditional knowledge, Tables 9 and 10 and complete the following tasks:

- 🐿 Using the information in the case study, how would you explain indigenous knowledge?
- 🐿 Do you think that the San community's rights were respected and protected? Explain your answer.
- 🐿 Explain how the CBD policy was used to assist the San community in their case.
- 🐿 In a table form, list the main role-players, their roles and responsibilities and their interest in the *Hoodia*.
- 🐿 Develop a poster that will explain the chronological development of *Hoodia* in picture form. Only select the events which you think are important for people to know. The information can be displayed in any form on the poster.

Case Study 20. Commercialisation of *Hoodia* based on San traditional knowledge

For thousands of years, the San of the Kalahari, numbering some 100 000 across South Africa, Botswana, Namibia and Angola, have used species of the succulent *Hoodia* genus (of the family Asclepiadaceae) to stave off hunger and thirst. In the 1960s, as part of wider research into the use of local species as food, the South African Council for Scientific and Industrial Research (CSIR) collected and began investigating *Hoodia*. At the time of the collections, the CSIR did not sign an agreement with the San. Nor did it do so in 1977 after CSIR had patented an appetite suppressing compound known as P57 from the plant and signed a licensing agreement with Phytopharm plc, a small UK research-based pharmaceutical company. Soon after, Phytopharm sold the rights to an exclusive global licence for P57 to Pfizer, a US pharmaceutical company better equipped to take promising leads through the development phase. Although the CSIR received benefits in the form of laboratory facilities and milestone payments, and will receive royalties if the product is successful, no arrangements were in place to benefit the San for their traditional knowledge.

The San were unaware of these developments, but through lobbying from Biowatch and other NGOs, the case became a high-profile story in the media. As a result, the San publicly spoke out against the commercial use of their knowledge without their consent and hired a lawyer to defend their rights to benefit from the use of their knowledge.

They entered into a Memorandum of Understanding with the CSIR, which acknowledges the need to provide benefits for the use of their traditional knowledge should a commercial product be developed, but does not include specific details of this benefit-sharing package. The MOU acted as a basis for future negotiation and most importantly recognised the San as the originators and custodians of traditional knowledge associated with the *Hoodia*.

In March 2003, agreement was finally reached on the financial benefit-sharing agreement, which—if the product is successful—will see the San receiving 6% of all royalties received by the CSIR and 8% of the CSIR's milestone income received when certain targets are reached. Money will be paid into a Trust set up by the CSIR and the South African San Council to uplift the standard of living and well-being of the San peoples of southern Africa.

The case is extremely important because of the precedent it sets for other holders of traditional knowledge. However, even though the San may receive many millions of rands, it would amount to less than 0.003% of net sales of the product and most money will go to Pfizer and Phytopharm.

Source: Laird & Wynberg (2003), *Bioprospecting & access and benefit-sharing: an introductory primer*.

Table 10. Chronology of the commercial development of *Hoodia*

Date	Event
Circa 25 000 BP–Present	Use of wild plants by the San in a hunting and gathering economy.
1796	Use of <i>Hoodia</i> species by 'the Hottentots' is first recorded by the botanist Francis Masson.
1936	First recorded use of <i>Hoodia</i> species for suppressing appetite, based on San knowledge.
1963	CSIR includes <i>Hoodia</i> species in a project on edible wild plants, based on ethnobotany of the San.
1968	Project placed on hold owing to the death of leading scientist and technical problems.
1983–1986	Acquisition of high-field nuclear magnetic resonance spectroscopy allows for the relevant molecular structures of <i>Hoodia</i> to be elucidated.
1986–1995	Confidential work continues on the development of <i>Hoodia</i> species.
1995	A patent application is filed in South Africa by the CSIR for use of active components of <i>Hoodia</i> species responsible for suppressing appetite.
August 1998	A licence agreement is signed between CSIR and Phytopharm for further development and commercialisation of 'P57'.

1998	International patents are granted to the CSIR in some territories. Phytopharm sub-licenses Pfizer to complete clinical development, obtain regulatory approval and commercialise. CSIR publishes its Bioprospecting Policy, declaring its commitment to sharing benefits with holders of traditional knowledge. However, in practice, this commitment is not implemented in the P57 project until 2003.
1999	CSIR signs a Memorandum of Understanding with a group of South African traditional healers and begins implementing a system to document the use of traditional knowledge based on biodiversity.
2001	Phase IIa / third stage 'proof of principle' clinical trials for P57 reported to be successfully completed.
June 2001	<i>The Observer</i> reports commercial development of <i>Hoodia</i> without involvement of the San. The San establish that a patent has been registered based on <i>Hoodia</i> use and that the CSIR has granted Phytopharm a licence to exploit the patent. Negotiations between the CSIR and the San commence in the same month.
1 February 2002	Memorandum of Understanding signed between the CSIR and the South African San Council, recognising the San as originators of knowledge about <i>Hoodia</i> and including a commitment to benefit-sharing.
Feb.–Mar. 2003	Negotiations continue between the CSIR and the South African San Council.
March 2003	CSIR and the South African San Council sign a benefit-sharing agreement.
July 2003	Pfizer withdraws from commercial development of P57.
2001–2004	In parallel to the CSIR/Phytopharm initiative, a growing herbal market develops for <i>Hoodia</i> , using knowledge of the San to promote products. Some products are later revealed to be fakes, with no <i>Hoodia</i> content.
2004	Phytopharm announces its intention to develop P57 as a food supplement.
May 2004	Proposal is tabled to list <i>Hoodia</i> as a CITES Appendix II plant, to allow for controlled commercial trade.
June 2004	Namibia announces its intentions to commercialise <i>Hoodia</i> .
August 2004	San apply for registration of the San <i>Hoodia</i> Benefit-Sharing Trust.
September 2004	Biodiversity Act 10 of 2004 is enacted in South Africa, requiring a benefit-sharing agreement to be developed with holders of traditional knowledge where their knowledge is used for bioprospecting.
October 2004	Proposal to list <i>Hoodia</i> as a CITES Appendix II plant is adopted by the 13th Conference of the Parties to CITES. The CSIR announces the initiation of a broader bioprospecting project with the San.

Source: <http://www.biowatch.org.za/pubs/wjip.html>.

Activity 5

Divide the class into three groups and indicate that each group will have to prepare for a court hearing.

Group 1: Judges of the constitutional court.

Group 2: The legal team for the San community.

Group 3: The legal team for CSIR / Phytopharm / Pfizer.

Give the learners a day to prepare for the hearing that will take place in the constitutional court where the San community's rights will be argued and the opposition will state their case. (Assist Groups 2 and 3 with pointers of how to prepare their arguments/presentations and the judges with criteria the constitutional court must use to make their judgements.)

Case Study 21. Access to biological resources and benefit-sharing legislation in South Africa

Background

South Africa is rich in biodiversity and is regarded as the third most biologically diverse country in the world. South Africa has a relatively sound knowledge of its resources, adequate scientific capacity and infrastructure, and managed protected areas. As a result, there have been a number of bilateral agreements between multinational corporations and South Africa's research institutions regarding access to its indigenous species. These agreements have been reached in the absence of a legislative framework on access and benefit-sharing (ABS). However, South Africa is now drafting legislation that will fill this vacuum. Although much has been written on how benefit-sharing should work, most countries lack the scientific expertise to determine limits for the sustainable use of their resources. In 1998, the World Wildlife Fund for Nature (WWF) examined the experiences of ten countries and discovered that many of them were experiencing problems in developing and/or implementing a legislative framework for access to genetic resources and benefit-sharing. South Africa is no exception.

South African legislation on ABS

ABS in South Africa is addressed in the White Paper on Conservation and Sustainable Use of Biological Diversity (1997) and in the National Environmental Management Biodiversity Act 10 of 2004, known as the NEMBA (2004). In November 1997, South Africa ratified the Convention on Biological Diversity (CBD).

White Paper on Conservation and Sustainable Use of Biodiversity (1997)

ABS is one of the goals of the White Paper on Conservation and Sustainable Use of Biological Diversity (1997), which was drafted in accordance with the objectives of the CBD. One of the policy objectives stated in the White Paper is to 'control access to South Africa's indigenous genetic resources through the introduction of appropriate legislation and establishment of institutional structures'. In fact, the overarching objective is to 'ensure that benefits from the use and development of South Africa's genetic resources serve the national interest'. To achieve this objective, the White Paper stipulates that an 'efficient permitting system whereby authorisation is required for the collection of any biological or genetic resources to be used for research, trade or commercial purposes' be developed and implemented.

National Environmental Management Biodiversity Act (2004) NEMBA

Regulations pertaining to the institutional framework regarding bioprospecting, access and benefit-sharing in South Africa have been outlined in the Biodiversity Chapter 6 of the National Environmental Management Biodiversity Act, best known as the NEMBA (2004), and can be found at the National Department of Environmental Affairs and Tourism (DEAT), under the Biodiversity Management Directorate.

Implementation regulations

The objective of the ABS part of the legislation is 'to regulate access to biological resources and knowledge, practices and innovations associated with such resources and to ensure the fair and equitable sharing of environmental, economic and social benefits arising from their use'. The ABS regulations apply to indigenous biological resources (wild, domesticated, *in situ* or *ex situ*), land, knowledge, innovation and practices associated with biological resources and *ex situ* collections assembled before and after the CBD. ABS regulations do not apply to biochemical or genetic material of human origin, the exchange of biological resources among local communities, or associated knowledge and innovations resulting from non-profit-making practices, uses or customs.

Source: Ellen M. Mahlase (2001).

5.4.2 Topic: Sustaining our environment—investigating a local environmental issue: the importance of the CBD for protecting indigenous knowledge systems	Grade 11: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.1.1: Use various methods and sources to access information. AS 2.2.1: Identify, describe and explain concepts, principles, laws, theories and models by illustrating relationships. AS 2.2.2: Evaluate concepts, principles, laws, theories and models. AS 2.3.1: Analyse and evaluate the costs and benefits of applied Life Sciences knowledge. AS 3.2.1: Compare different ways in which resources are used in the development of biotechnological products, and analyse the impacts on the environment and society.	Integration: Prior Learning: Understanding the CBD, access and benefit-sharing. Concept of indigenous knowledge. How to conduct research. Understanding of how parliament conducts sessions.
Assessment Possibilities: Assessment method: Teacher assessment. Group assessment. Assessment tool: Rubric.	
Resources: Section 5. Other sections in the resource. Guidelines on how parliament conducts sessions.	
Teacher Activity: Provide some information on the policies that support the Convention on Biological Diversity. Explain the parliamentary procedure.	

Activity 2

Divide the class into two groups representing members of parliament. The one represents the interests of a community whose indigenous knowledge has been patented and the other represents the interests of a multi-national corporation who patented a plant used by the community for thousands of years to cure coughs and chest-related illnesses. Each group must prepare a speech to be presented to parliament (class) stating their opinions on the issue. After the two speeches have been presented to parliament, the members of the parliament will debate the issue. The teacher will play the role of speaker of parliament to facilitate the role-play. Issues that could be part of the speeches and/or debate are:

- Community concerns regarding the use of the plants.
- Community requirements and expectations.
- The tendency of international organisations to derive wealth and profits without giving recognition to the indigenous owners of the knowledge and biological resources.

Use the Convention on Biological Diversity to strengthen the discussions.

5.4.3 Topic: Sustaining our environment—historical developments in indigenous knowledge systems, biotechnology, environment, legislation, social behaviour and ethics	Grade 11: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 1: Scientific Inquiry and Problem-solving Skills LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 1.2.1: Systematically and accurately collect data using selected instruments and/or techniques. AS 1.3.1: Compare data and construct meaning to explain findings. AS 2.2.2: Evaluate concepts, principles, laws, theories and models. AS 3.2.1: Compare different ways in which resources are used in the development of biotechnological products, and analyse the impacts on the environment and society.	Integration:
	Prior Learning: Understanding the CBD, access and benefit-sharing. Concept of indigenous knowledge. How to conduct research.
Assessment Possibilities: Assessment method: Teacher assessment. Group assessment. Assessment tool: Rubric.	
Resources: Section 5. Other sections in the resource. Case Study 22.	
Teacher Activity: Provide some information on the policies that support the Convention on Biological Diversity. Discuss research procedure.	

Activity 3

Survey

1. Ask learners to conduct a survey in their community to find out about the indigenous knowledge that exists around the use of biological resources for medicinal purposes. How extensive is the use of this indigenous knowledge and the associated practices? Is there a possibility of commercialising this knowledge? How old is this knowledge with its associated practices?
2. They should find one example of a local indigenous knowledge medicine that uses a biological resource. The learners have to show and describe how the local medicine is used to the rest of the class. Compare this indigenous knowledge with a modern medicine remedy for the illness.

They must also discuss how the CBD helps to protect indigenous knowledge and resources.



Case Study 22. What is traditional knowledge?

Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language and agricultural practices, including the development of plant species and animal breeds. Traditional knowledge is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture and forestry.

Today there is a growing appreciation of the value of traditional knowledge. This knowledge is valuable not only to those who depend on it in their daily lives, but to modern industry and agriculture as well. Many widely used products, such as plant-based medicines and cosmetics, are derived from traditional knowledge. Other valuable products based on traditional knowledge include agricultural and non-wood forest products as well as handicraft. Traditional knowledge can make a significant contribution to sustainable development. Most indigenous and local communities are situated in areas where the vast majority of the world's plant genetic resources are found. Many of them have cultivated and used biological diversity in a sustainable way for thousands of years. However, the contribution of indigenous and local communities to the conservation and sustainable use of biological diversity goes far beyond their role as natural resource managers. Their skills and techniques provide valuable information to the global community and a useful model for biodiversity policies. Furthermore, as on-site communities with extensive knowledge of local environments, indigenous and local communities are most directly involved with conservation and sustainable use.

Source: Article 8 (j) *Traditional Knowledge and the Convention on Biological Diversity*.

5.4.4 Topic: Sustaining our environment—historical developments in indigenous knowledge systems, biotechnology, environment, legislation, social behaviour, ethics and land issues	Grade 11: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Assessment Standards: AS 2.2.2: Evaluate concepts, principles, laws, theories and models. AS 2.3.1: Analyse and evaluate the costs and benefits of applied Life Sciences knowledge.	Integration:
	Prior Learning: Understanding the CBD, access and benefit-sharing. Concept of indigenous knowledge. How to conduct research. How to prepare for a debate.
Assessment Possibilities: Assessment method: Teacher assessment. Group assessment. Assessment tool: Rubric.	
Resources: Section 5. Other sections in the resource. Scenario 1.	
Teacher Activity: Provide some information on the policies that support the Convention on Biological Diversity. Discuss research and debate procedure. Provide guidance on the development plan.	

Activity 4

Scenario

Your town is surrounded by 50 000 hectares of unprotected land. The land does not have proper fencing. The area is close to a National Park. This land has been distributed to the local community as part of land distribution. The land thus belongs to the local community. It was a series of semi-protected areas, with no real conservation done on the land.

The area is 80 km away from the nearest town centre and is connected with a suitable road. The area holds a mountain range with a water catchment area. It has two natural dams with two flowing rivers around it. Part of the land was used for forestry. The open plains hold numerous indigenous trees as well as 50 endemic plants. Alien invasive plants and trees threaten a small part of the area.

There are small local economic development projects in the area and a few tourist attractions. The area has major tourist attraction potential, but limited overnight facilities are available. The villages are still traditional and use the land in a sustainable manner. The area is surrounded by three villages and has two towns around them. These villages practice subsistence farming and are dependent on the land around them. The towns have light industries and there is a sawmill in one of the towns. The towns also had a big influx of people due to local housing agencies building on some of this land. These new communities are not from the area.

The following are some of the statistics that were compiled by an outside agency:

	2001/2002	2003/2004
Mammals	1 300 species	1 100 species
Birds	250 species	200 species
Freshwater fish	10 species	9 species, 1 alien species noticed
Trees	150 species	150 species, 6 are alien species
Plants	2 000	1 880 species
Insects	1 000 species	970 species
Reptiles	30 species	30 species
Tourism	12 000 visitors	20 000 visitors
Local economic development	15	19
Industry	6	12
Population growth	25 000	40 000
Water catchment	80%	65%
Foreign visitors	3 666	6 000

To note:

In 2003/2004 the area had a water shortage. There are no fences and people from the local towns have access into these areas. Community expansion is due to new economic development in the area. These industries use a lot of water and do pollute the air with their smog. One of the industries is an open mine for coal. Visitors enjoy the tranquillity of the area as it is still mostly undeveloped, with just access roads and a few rustic overnight facilities. Local hunting associations have the right to hunt some game in this area, but they do not have the consent of the local community. People from outside the town manage most of the local tourism industry. People are bussed in by the town centre's tour operators.

The population growth is 2 000 a year and two new developments have started that will house 300 workers. A new housing development for 200 families is on the cards, but an Environmental Impact Assessment must be conducted before approval of the new development. There is no real conservation agency in place and the National Park will do the environmental assessment.

Local villages have strong traditional links to the earth and are using 400 plants for local needs. The plants are used for food, medicinal purposes, fuelwood and hunting instruments even though younger people now use snares and other traps. The villages also use the area for livestock grazing, but have also seen an increase in poaching.

1. Divide the class into groups of five or six learners. Ask learners to form working teams who have to prepare and present a development plan to the local community. The team must focus on the environmental conservation of the area and develop a plan to make sure that all members of the community can have access to and share in the benefit of the natural resources of the area. The plan should include strategies to conserve the biodiversity of the area and to monitor industrial development and problems arising from it.

Each working team should present their development plan to the class.

2. Evaluate and debate as a class which development plan best incorporates the responsibilities as set out by the CBD:
 - Monitoring and identifying biodiversity; environmental impact assessments.
 - Developing national strategies, plans or programmes to conserve and use the components of biological diversity sustainably.
 - Integrating biodiversity into relevant sectoral and cross-sectoral plans, programmes and policies.

5.5 Grade 12: Lesson plans and activities

5.5.1 Topic: Local environmental issue—the role of indigenous knowledge in sustainability of biodiversity	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 1: Scientific Inquiry and Problem-solving Skills LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society History LO 1: Historical Enquiry (Practical Competence) LO 3: Knowledge Construction and Communication (Reflexive Competence) Assessment Standards: Life Sciences AS 1.3.1: Critically analyse, reflect on and evaluate the findings. AS 1.3.2: Explain patterns in the data in terms of knowledge. AS 2.1.1: Use various methods and sources to access information from a variety of contexts. AS 2.2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts. AS 3.2.1: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment. AS 3.3.1: Critically evaluate and take a justifiable position on beliefs, attitudes and values that influence developed scientific and technological knowledge and their application in society. History AS 1.1: Formulate questions to analyse concepts for investigation within the context of what is being studied. AS 3.2: Synthesise information to construct an original argument, using evidence from sources provided and independently accessed in order to support the argument.	Integration: History
	Prior Learning: Understanding benefit-sharing and access, biological diversity, civic responsibility, indigenous knowledge concepts. Knowledge on how to do research.
Assessment Possibilities: Assessment method: Group assessment. Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 5. Case study.	
Teacher Activity: Discuss the role of stakeholders in managing and conserving our environment. Guidance on how to develop the questions and source the information.	

Activity 1

Each learner must develop a collage depicting his or her understanding of the main events of Case Study 23. They may use own drawings, pictures from magazines, books or other resources to develop the A3-size collage, which should be annotated.

Case Study 23. *Hoodia gordonii* (South Africa)

The *Hoodia* plant, native to South Africa, has recently come to the fore of the debate surrounding bioprospecting and intellectual property rights. The *Hoodia*, native to the Kalahari Desert, has been used for centuries by the hunter-gatherer San-speaking tribes of the region. The San peoples have long recognised the appetite suppressant qualities of *Hoodia* and have traditionally chewed the stem to stave off hunger and thirst during long hunting expeditions in the desert. Scientists of the South African Council for Scientific and Industrial Research (CSIR) learned of the *Hoodia*'s properties and began to study the plant. In scientific tests, animals given the plant lost weight rapidly without any apparent negative side effects. According to scientists of the South African CSIR, the *Hoodia* works by 'mimicking the effect glucose has on the nerve cells in the brain, in effect telling us we're full ... thus curbing the appetite'. Scientists at the CSIR dubbed the appetite suppressant molecule in the *Hoodia* 'P57'. Recognising the enormous potential market for the *Hoodia* outside South Africa, CSIR placed a patent on P57 and sold the licensing rights to an English biopharmaceutical firm, Phytopharm, in 1997. Phytopharm then sold the licence to American pharmaceutical giant Pfizer for 25 million dollars. Throughout the whole process, however, the San peoples were completely unaware of what was happening. In fact, they became aware of it only after the excessive media coverage of Phytopharm's sale of licensing rights to Pfizer.

The Chief Executive Officer of Phytopharm, Richard Dixey, claimed that CSIR had led him to believe that 'the tribes using the *Hoodia* were extinct'. He went on to say, 'I honestly believed that these Bushmen had died out and am sorry to hear they feel hard done by'. San expert Sandy Gall maintains, 'these ancient peoples have been exploited for years and it is disgraceful that it is still happening ... they have been displaced and dispersed, but for someone to claim they thought the Bushmen no longer existed is either naïve or deceitful.'

The CSIR, however, assert that they had every intention of informing the San peoples after clinical trials had been completed and that they are fully committed to benefit-sharing with proprietors of traditional knowledge. Yet, according to Alex Wijeratna, of the development charity ActionAid, 'this is a major case of biopiracy. Corporations are scouring the globe looking to rip off traditional knowledge from some of the poorest communities in the world. Consent or compensation is rarely given.'

In 2001, leaders from various San communities met with prominent lawyer and San advocate Roger Chennels to 'plan their strategy against this injustice.' Speaking on behalf of the San peoples, Chennels informed the media that, 'they are very concerned ... they do not object to anybody using their knowledge to produce a medicine, but they would have liked the drug companies to have spoken to them first and come to an agreement.' Shortly after, the San tribes (as represented by Chennels) threatened the CSIR with litigation. Hoping to avoid international scrutiny and bad press, CSIR consented to entering into talks with the San peoples. Lee Gillespie-White and Eric Garduno of the International Intellectual Property Institute contend that, 'a dialogue between the CSIR and the San tribes was opened and on 9 April 2002, the San tribes and the CSIR announced that they had concluded a Memorandum of Understanding (MOU), which would serve as the basis for benefit-sharing negotiations' (Gillespie-White & Garduno 2002: 1). The terms of the MOU state that if P57 enters the market (Pfizer predicts that the drug will be ready by 2007), the San peoples will receive 6% of the royalties generated. Gillespie-White & Garduno state, 'the MOU between the San tribes and the CSIR presents a middle of the road option that may prove to be the most effective course of action for the protection of TK. Under the MOU, the CSIR recognised the San as custodians of TK associated with the uses of a large variety of plant materials, including the *Hoodia* plant. The San, in turn, acknowledge that it was necessary for the CSIR to protect the work that had been done in isolating the active ingredient in the plant and that the CSIR had a right to patent it.'

In March 2003, agreement was finally reached on a financial benefit-sharing agreement, which—if the product is successful—will see the San receiving 6% of all royalties received by the CSIR, and 8% of the CSIR's milestone income received when certain targets are reached. Money will be paid into a trust set up by the CSIR and the South African San Council to uplift the standard of living and well-being of the San people of southern Africa.

The case is extremely important because of the precedent it sets for other holders of traditional knowledge. However, even though the San may receive many millions of rands, this would amount to less than 0.003% of net sales of the product, and most money will go to Pfizer and Phytopharm.

There is currently no legislation to guide such agreements—an important way to ensure that any future commercialisation benefits local groups—but the current development of a Biodiversity Bill and Indigenous Knowledge Systems Bill will help address these concerns.

Activity 2

Conduct an investigation

Divide learners into pairs and ask them to conduct the following research:

- Learners have to research two other case studies from around the world that describe how local communities were exploited in divulging their traditional knowledge for the gain of corporates and other role-players. The information can be sourced from newspapers, books, magazines, the library or the internet (www.google.com).
- They should develop a list of six questions that they will use to analyse the case studies for similarities and differences.
- The information must be captured in a table and supported by a report on the findings. The report should also suggest how the guidelines in the CBD could be used to support indigenous communities against exploitation.
- In a class, ask a few of the groups to present their reports.
- Using the different case studies collected, ask learners to design and develop a reference resource on indigenous knowledge case studies that can be put in the school library.

5.5.2 Topic: Local environmental issue—rights to indigenous knowledge and benefit-sharing	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Science Knowledge LO 3: Life Sciences, Technology, Environment and Society History LO 3: Knowledge Construction and Communication (Reflexive Competence) Assessment Standards: Life Sciences AS 2.1.1: Use various methods and sources to access relevant information from a variety of contexts. AS 3.2.1: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment. History AS 3.2: Synthesise information to construct an original argument, using evidence from sources provided and independently accessed in order to support the argument. AS 3.4: Communicate knowledge and understanding in a variety of ways including discussion (written and oral), debate, creating a piece of historical writing using a variety of genres, research assignments, graphics and oral presentation.	Integration: History Prior Learning: Understanding benefit-sharing and access, biological diversity, civic responsibility.
Assessment Possibilities: Assessment method: Group assessment. Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 5. Case study. List of additional sources.	
Teacher Activity: Discuss the case study in class. Provide guidance on the assignment.	

Activity 3

Ask learners to write a five-page assignment on the impact of unregulated access to genetic resources on biological diversity and traditional knowledge systems in South Africa. Case Study 24, *Protecting the genetic heritage of SA's plants*, should be used as one of the resources. Information can be sourced from the local library, local office of the Department of Environmental Affairs and Tourism (Biodiversity Management Section), the South African National Biodiversity Institute (SANBI) and the internet (www.google.com) where they can enter the key words (e.g. biodiversity, traditional knowledge, case studies).

Case Study 24. Protecting the genetic heritage of SA's plants

It is a well known fact that since the arrival of colonial settlers in southern Africa, South Africa's indigenous plant material has been taken to First World countries where it has been—and continues to be—propagated and commercially exploited with inadequate compensation to South Africa.

According to UCT environmental lawyer and lecturer Professor Jan Glazewski, one of the most common examples is *Pelargonium* (geranium, as it is popularly known), which now widely adorns the flower boxes of European homes. Other well known endemic species that feature prominently on the international scene are clivias, freesias and gladioli.

Glazewski and UCT law faculty researcher Emma Witbooi, in collaboration with botanists, horticulturists and biotechnologists, are pooling their research efforts to address the challenges of adequate legal protection via recent contributions to the Draft Biodiversity Bill of the Department of Environmental Affairs and Tourism.

The Bill is being compiled in response to South Africa's adoption of the 1992 United Nations Convention on Biodiversity, the main objectives of which are the conservation and sustainable use of biodiversity and the 'fair and equitable sharing of benefits' arising from the exploitation thereof.

Useful information for the drafting of the Bill was also obtained from a study by Witbooi in 2000, funded by the National Research Foundation, entitled: *Biodiversity and the law: legal issues arising from the implementation of the Convention on Biological Diversity into South African law*.

One chapter of the Draft Bill aims to regulate the phenomenon of 'bioprospecting' (the search for wild species, genes and their products with actual and potential use to humans) by introducing legal mechanisms to both regulate the exportation of flora and fauna as well as the exploitation of associated indigenous knowledge.

As part of their submissions to the Draft Biodiversity Bill, the UCT team is examining orthodox intellectual property instruments, such as patent law, as well as alternative legal mechanisms, such as benefit-sharing agreements, in an attempt to meet the needs of developing countries.

Glazewski says that valuable lessons have also been learnt from a research and licence agreement entered into between the National Botanical Institute of South Africa (NBI) and US company Ball Horticulture, in August 1999.

In terms of the five-year agreement, Ball gets access to '25 plant items' of indigenous plant material at any one time. Exactly what Ball gains access to, is subject to a complex legal definition.

In 2001, a press furore erupted in which it was alleged that South Africa's plant heritage had been sold without adequate and ongoing gain to South Africa.

The Chairman of the Board of the NBI appointed a task team to investigate the agreement, headed by Glazewski as the legal expert, working alongside horticulturists and scientists.

The team found that while the press reports were exaggerated, it could be argued that there were insufficient non-monetary benefits from the agreement. Negotiations with Ball were subsequently re-opened and the initial agreement seems likely to be amended soon to make it more beneficial for South Africa.

Source: http://www.pase.uct.ac.za/studydetail.php?s_id=7.

5.5.3 Topic: Local environmental issue—the use of biological resources and its sustainability	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society Physical Sciences LO 3: The Nature of Science and its Relationships to Technology, Society and the Environment Assessment Standards: Life Sciences AS 2.1.1: Use various methods and sources to access relevant information from a variety of contexts. AS 2.2.1: Interpret, organise, analyse, compare and evaluate concepts, principles, laws, theories and models and their application in a variety of contexts. AS 3.2.1: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment. Physical Sciences AS 3.2.1: Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications.	Integration: Physical Sciences
	Prior Learning: Understanding benefit-sharing and access, biological diversity. Concept of indigenous knowledge.
Assessment Possibilities: Assessment method: Group assessment. Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 5. Case Study 25.	
Teacher Activity: Discuss the role of traditional healers and other stakeholders in managing and conserving our environment. Guidance on how to prepare a debate and to conduct the research.	

Activity 4

Learners must read Case Study 25 and complete the instructions.

1. In summary form, highlight the main issues in the case study.
2. Divide learners into groups and ask them to develop a strategy that will suggest the following:
 - ☛ A plan on raising awareness among the Gondwanaland communities about the impact of over-utilisation on medicinal plants.
 - ☛ A rehabilitation plan to ensure the survival and sustainable use of medicinal resources.
3. The strategies must be presented in class.

Case Study 25. Sinking of medicinal plants into the hole of extinction

I first became a sangoma in 1937 and in those days there were healing plants, which were plentiful all over Natal and other parts of South Africa. I could list well over 50 different kinds of plants, which we used in the healing of sickness amongst our people as traditional healers. But many of these plants have vanished, never to return, because extinction has now become an accelerating and ongoing process. And as the extinction of valuable plants goes on in South Africa, our people suffer horribly. As a direct result of this, traditional, safe, herbal medicines vanish and more and more people are forced to seek refuge in highly dangerous chemical substances in their battle against sickness. I have tried in vain to fight against this thing, against these alien, un-African chemicals, but my fight has repeatedly failed.

One of the things that brings about the extinction of medicinal plants in South Africa is the fact that since the late 1920s, there has existed what are called 'muti-shops', shops run by Indian, white as well as African businessmen. These shops have sold literally tons of herbal plants and bark of trees all over the main cities of our country. It is this huge 'muti' industry, not the traditional healers, that is responsible for the depletion of many precious herbal medicines. Anyone who blames traditional healers for this extinction should ask himself: 'Is it traditional healers who are exporting tons of herbal plants and other natural resources to nations in the Far East?' Tons of African plants are being ripped out of the soil and exported to the Far East and no traditional healers are involved, but businessmen who do not care about the extinction of our country's precious plant life. Those who export African herbs to the Far East are unscrupulous, merciless people who blind themselves to their responsibility as human beings, in the glare of gold and greed.

I strongly believe that the continued extinction of animal as well as plant species is behind the deterioration in health amongst all human beings. Because all things are interlinked and the destruction of one is the destruction of all. I sometimes suspect that AIDS resulted from the continuous extinction of living things—an extinction that has thrown the entire girdle of nature out of balance.

The prevention of Gondwanaland's demise must not be made into something that belongs only to scientists; it must be the national duty of every one of us, no matter how high or low on the ladder of modern life one happens to be standing. The preservation of our plants is our duty and no politician or whoever should stand in our way in the performance of this important duty. If conservation has any meaning whatsoever, it should be restored back to the hearts and minds of people at grassroots level. Our people did not see humanity as beings apart from the rest of nature, our people did not see humankind as a race of 'uber Menschen', supermen over other living things; our people were fully aware of the slavish dependence that man had on nature. They knew if nature was destroyed, man would die.

Source: Taken from extract in *The Enviropaedia* (Hoogervorst *et al.* 2002).

Activity 5

Debate

In two groups, debate the role of indigenous medicines versus commercially developed 'over-the-counter' medicines. One group should support the use of indigenous knowledge medicines while the other group should prefer the use of commercially prepared medicines. Learners should critically argue their positions using the information from the CBD to support the arguments. Information to support the debates can be taken from this educational resource, case studies, the internet, local library and own experiences.

If possible, ask outside people from both sides of the debate to come and give a talk to the class prior to the debate.

5.5.4 Topic: Local environmental issue—role of communities and indigenous knowledge in management of biological diversity	Grade 12: Environmental Studies
Learning Area: Life Sciences Learning Outcomes: Life Sciences LO 2: Construction and Application of Life Sciences Knowledge LO 3: Life Sciences, Technology, Environment and Society History LO 3: Knowledge Construction and Communication (Reflexive Competence) Assessment Standards: Life Sciences AS 2.1.1: Use various methods and sources to access relevant information from a variety of contexts. AS 3.1.1: Critically evaluate scientific ideas and indigenous knowledge of past and present cultures. AS 3.2.1: Analyse and evaluate different ways in which resources are used in the development of biotechnological products, and make informed decisions about their use and management in society for a healthy, sustainable environment. History AS 3.4: Communicate knowledge and understanding in a variety of ways including discussion (written and oral), debate, creating a piece of historical writing using a variety of genres, research, assignments, graphics and oral presentation.	Integration: History
	Prior Learning: Understanding benefit-sharing and access, biological diversity. Concept of indigenous knowledge.
Assessment Possibilities: Assessment method: Group assessment. Teacher assessment. Assessment tool: Marking grid.	
Resources: Section 5. Information boxes below.	
Teacher Activity: Discuss the role of stakeholders in managing and conserving our environment. Guidance on how to prepare an article, guidance on how to conduct the research. Instructions on how to prepare the display.	

Activity 6

Information Box 2: Indigenous knowledge

Identification of approaches to involvement of stakeholders in access to genetic resources and benefit-sharing processes

Some of these approaches to the involvement of stakeholders in access to genetic resources and benefit-sharing processes, would include the following:

- Use of customary laws and practices found in local and indigenous communities to establish community protocols that will then be used as part of the processes used to determine access to genetic resources.
- Localisation of access regulations at the local government level that will aid in the enforcement of national access regulations.

- (c) Greater representation of local and indigenous communities in bodies and processes created by national governments that will make decisions on access and benefit-sharing questions.

The complementary options to address access and benefit-sharing in the framework of the Convention:

- (a) Criminalisation of biopiracy.
- (b) Greater co-ordination and sharing of information between national governments and professional societies to enforce professional codes of conduct and ethical standards to punish erring international and local scientists and researchers who do not adhere to the objectives of the Convention.
- (c) Intensified support and funding for awareness-raising efforts to secure the support of the general public in these endeavours.
- (d) Documentation and development of community-based mechanisms for the protection of traditional knowledge which may be deemed part of any *sui generis* mechanisms that may be institutionalised by Contracting Parties to the Convention.

Information Box 3: What Article 8(j) states

Each Contracting Party shall, as far as possible and as appropriate:

Subject to national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge innovations and practices.

What is traditional knowledge?

Traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language and agricultural practices, including the development of plant species and animal breeds. Traditional knowledge is mainly of a practical nature, particularly in such fields as agriculture, fisheries, health, horticulture and forestry.

The Convention on Biological Diversity recognises the role of indigenous people and communities and the knowledge that they have and can provide for future use.

- 🐾 Ask learners to collect information from community members about local plants that are used for traditional medicinal purposes, local medicinal remedies, traditional stories and myths relating the resources, traditional methods used to protect the resources, samples of plants and history (old photographs) of the community and its surroundings, and to arrange an exhibition in the school hall or local library to showcase the knowledge that local communities have about our natural resources.

- 🐾 Take photographs of the exhibition and write an article for the local newspaper.

Additional ideas

- 🐾 Learners can invite a journalist from the local newspaper to the exhibition.
- 🐾 Set up the exhibition during an environmental calendar day and invite other schools and the local community.

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