

# **SOCIAL SCIENCE**

## **GRADE 10**

### **PROJECT 1**

## **FOREST USE AND MANAGEMENT IN PAPUA NEW GUINEA**

**CHAPTER 1 INTRODUCTION TO FOREST IN PAPUA NEW  
GUINEA**

**CHAPTER 2 USE OF FOREST IN PAPUA NEW GUINEA**

**CHAPTER 3 IMPORTANCE OF FOREST TO THE  
ENVIRONMENT**

**CHAPTER 4 CASE STUDY ON TROPICAL RAIN FOREST**

**CHAPTER 5 COMPARING PNG FOREST WITH THE REGION  
AND THE WORLD**

**CHAPTER 6 FOREST MANAGEMENT IN PNG**

## **ACKNOWLEDGEMENT**

We acknowledge the contributions of all Secondary Teachers who in one way or another have helped to develop this Course.

Our profound gratitude goes to the former Principal of FODE, Mr. Demas Tongogo for leading FODE team towards this great achievement. Special thanks to the Staff of the Social Science Department of FODE who played an active role in coordinating writing workshops, outsourcing lesson writing and editing processes, involving selected teachers of Central Province and NCD.

We also acknowledge the professional guidance provided by Curriculum and Development Assessment Division throughout the processes of writing, and the services given by member of the Social Science Review and Academic Committees.

The development of this book was Co-funded by GoPNG and World Bank.

**DIANA TEIT AKIS**

PRINCIPAL

Published in 2017 by the Flexible, Open and Distance Education, Papua New Guinea  
© Copyright 2017, Department of Education, Papua New Guinea

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means electronic, mechanical, photocopying, recording or otherwise without the prior permission of the publisher.

Printed by Flexible, Open and Distance Education.

ISBN: 978 – 9980 – 87 – 748 - 2

National Library Service of Papua New Guinea

**CONTENTS**

	<b>Page</b>	
Title Page	1	
Acknowledgements	2	
Contents	3	
Introduction	4	
<b>PROJECT 4</b>		
<b>Chapter 1</b>	<b>Introduction to forest in PNG</b>	5 - 7
<b>Chapter 2</b>	<b>Use of Forest in PNG</b>	8 - 17
<b>Chapter 3</b>	<b>Importance of Forest to the Environment</b>	18 - 23
<b>Chapter 4</b>	<b>Case Study on Tropical Rainforest</b>	24 - 27
<b>Chapter 5</b>	<b>Comparing PNG Forest with the Region and the World.</b>	28 - 31
<b>Chapter 6</b>	<b>Forest Management Plans in PNG</b>	32 - 40
<b>Answers to Activity Questions</b>		41 - 43
<b>References</b>		44

## **PROJECT            INTRODUCTION**

---

Dear Student,

This is Project 4 of the Grade 10 Social Science course. In this Project you will study the Climate and its effects.

You have partly looked at Forest in Unit 1. This is an extension of what you have already studied. This project will enable you look at forest in more detail.

This project is made up of six topics. They are

**Chapter 1    Introduction to Forest in PNG**

**Chapter 2    Use of Forest in PNG**

**Chapter 3    Importance of Forest to the Environment**

**Chapter 4    Case Study on Tropical Rainforest**

**Chapter 5    Comparing PNG forest with the Region and the World.**

**Chapter 6    Forest Management in PNG**

Each chapter has an activity which you will do after reading through the chapter. Answers to the activities are found at the end of the Project.

We hope you will enjoy this project.

Your teacher

## Chapter 1 Introduction to Forest in Papua New Guinea

---

### 1.1 What is forest?

**Forest refers to a portion of land bigger than half a hectare with trees higher than 5 metres and a tree canopy cover of more than 10 %.**

Total land area in Papua New Guinea is 46.284 million hectares of which the forest covers approximately 29.437 million hectares. The PNG Forest Authority classifies PNG's vegetation into six classes based on their structural formation.

- Forests
- Woodland
- Savanna
- Scrub
- Grassland
- Mangrove

Of the six vegetation types, only the forest will be studied in this booklet. There are three main types of rainforest in Papua New Guinea. They are lowland, montane and swamp forest.

### 1.2 The functions of forest

Forests have been the source of livelihood for Papua New Guineans, both in subsistence and modern living. It is the source of food and shelter. It also brings in millions of Kina into Papua New Guinea from the export of mainly raw logs.

The forest also plays an important role in maintaining its own ecosystem. One of the roles it plays is it traps water and regulates the flow of water. It also maintains the quality of water. Forests also protect and maintain the landforms thus improving the quality of the soil. Because forests trap and store water, they are called catchments. The forest catchment is also the habitat for animals. It is also called a 'carbon sink' because plants, especially trees absorb huge amount of carbon dioxide to make their food through the process of photosynthesis. By regulating or controlling water and carbon dioxide, forest actually control climate. However, today, forests across the world are facing serious threats from especially logging, large scale agriculture, urbanization and population increase.

The forest of Papua New Guinea and West Papua is the largest in the Asia Pacific region and is the third largest in the world. Policies like reforestation and downstream have been introduced to conserve Papua New Guinea forest.

### 1.3 Types of forest in Papua New Guinea

In our introduction, we said that forest is one of the six vegetation classes according to PNG Forest Authority (PNGFA)

Papua New Guinea has various types of forest across its land mass. These rainforest occurs as lowland forest across the coastal plains and foothills up to 1000 meters above sea level, and as Montane forests above the attitude of 1000m throughout the country's main ranges along the central cordillera to the west Papuan border (The State of Forest of Papua New Guinea 1972-2002, 2008: 11).

Below is a table showing the different types of rainforest, the altitude, the proportion of the area covered by each type and where they are found in Papua New Guinea.

Types of PNG Forest	Altitude found (above sea level)	Percentage of total forest area covered	Where mostly found
Lowland rain forest	Less than 1000 meters above sea level	57 %	All lowland
Lower Montane	1000-2 800 meters	27 %	Steep rugged terrain
Upper Montane	Above 2 800 meters	2%	Steep rugged terrain
Swamp Forests	Coastal zone, grows close to water courses	10 %	East Sepik, West Sepik, Western Province and Gulf Province.
Dry Ever Green Forest	Coastline	2 %	Western Province
Mangrove	Grows close to water	2%	All coastal provinces with most found in Gulf and Western Province

#### Summary

- Forest refers to portion of land bigger than half a hectare with trees higher than 5 Meters and a tree canopy cover of more than 10 %.
- Forest covers approximately 29.437 million hectare of the land (i.e estimated 70% of the land)
- The forest plays an important role in the ecosystem.it hosts vide variety of animals and plants.
- It provides food and shelter to both human and animals.
- It regulates climate

- The four main types of forests in Papua New Guinea are (i) lowland rainforest, (ii) montane forest, (iii) swamp forest and (iv) mangrove forest.
- 

**ACTIVITY 1**

1. Define forest in your own words.

---

---

2. How much land area of Papua New Guinea is covered by forest?

---

---

3. List six forest types in Papua New Guinea and describe where they are found?  
(You may draw a table to answer this question)

---

---

---

---

4. Which forest type covers half of the forest area in PNG?

---

---

Check your answers. Answers are at the end of the project.

## **Chapter 2: Uses of Forest in Papua New Guinea**

---

Forest is one of the very useful natural resources any country can ever have. In Papua New Guinea, forest is of enormous importance to its people and its natural environment. Apart from gold, copper and oil that we have, forest is very resourceful in that it has so many uses both to traditional and modern living. In total, there are one thousand species of plants that have been identified that are used for food, medicine, ropes, stimulants, body decoration, art, utensils and canoe (Powel, 2008;17)

### **2.1 Traditional uses of the forest**

Papua New Guinea forest has been attached to its owners or natives for thousands of years through its provision of food, medicines, shelter, spices and its connection to the people spiritually and culturally. Though there are many of uses, we will discuss only four uses of the forest.

#### **2.1.1 Source of Food**

More than five hundred (500) species of plants have been identified as food sources in PNG, the vast majority growing wild in either primary or secondary forests according to Powell (2008; 17). The forest hosts some of the important and basic food such as wild nuts (e.g .pandanus nuts, galip nuts), wild fruits (e.g. locally known as laulau) wild berries, and vegetables (e.g. locally known as fern/kumu grass)

The forest also hosts thousands of animal species, many of which are edible. According to Sekran and Miller (2008), there are 200 000 to 300 000 insect species in Papua New Guinea. In many parts of Papua New Guinea, insects like grasshoppers, crickest and river frogs, and other species of frogs which breed in the rainforest rivers and creeks have been the main source of daily protein in the past. Some mammals like tree kangaroo, cuscus and river and forest rats were also an important part of the protein diet in many parts of the high lands of Papua New Guinea. These plants, insects and animals were eaten as food while some were used as medicines.

#### **2.1.2 Source of Traditional Medicine**

Forests of Papua New Guinea also hold and as yet unassessed value in terms of their potential pharmaceutical uses (The state of Forest of Papua New Guinea, 2008). Many traditional medicines come from the forest. The forest provides medicines in different forms. The medicinal properties are found in leaves, fruits, seeds, bark and roots of trees.



Below are some examples of plants and their medicinal uses. (You could also think of the plants in your forest area that is used as medicine)

Name of the plant	Medicinal value
Moringa plant	Used for medicine
Eagle wood	Used for perfume, medicine
Sandal wood	Used as oil, incense
Pawpaw	Soap, upset stomach, for treatment of malaria

Below is an example of a plant that has medicinal properties.



Moringa leaf



Moringa young tree

Moringa contains proteins, vitamins, and minerals. As an antioxidant, it helps protect cells from being damage. It is not only an important food source but can also cure and reduce symptoms of many diseases including high blood pressure, diabetes, asthma, stomach problems, heart problems, cancers and many more.



Moringa bean pod

### **2.1.3 Source of energy for cooking, heating and preservation**

The forest provides fuel in the form of firewood. Firewood is used for the preservation of food. In the highlands of PNG where temperatures are lower than coastal areas, the energy converted from the burning of firewood serves three purposes:

1. warms up the house;
2. protects seedlings from mould and insects; and
3. the smoke preserves meat and nuts

For example, in the Eastern Highlands where there are pandanus nuts, these are kept in the ceiling above the fire place in the house or in make shift shelters in the rainforest where the nut is collected. The firewood is used to smoke the nuts overtime. In this way the nuts are preserved and eaten up to six months after the nut's season is over.

Seeds that are preserved by heat for future planting include corn, bean, peanut and vegetable seeds.

### **2.1.4 Source of building materials and arts and craft.**

In PNG, the rainforest provides both hardwood and softwood for the construction of houses, fences, bridges, canoes and simple tools like spears, and bows and arrows. Leaves of certain palms are used for roofing and walls.

Some trees such as wild tulip barks are used for weaving bilum (basket/bag), wild cane (bush vine) used for making chairs and baskets, and knitting arrow pointers, used as walking sticks by old man. Some plant leaves, seeds and sap from the plants are used for decoration, painting and perfumes for ceremonial purpose. Bird plumes and animal hides also form part of the traditional dressing.

## **2.2 Uses of forest today**

In modern Papua New Guinea, the use of forest has increased as a result of the increase in knowledge and modern technology which is driven by mainly commercial and educational purposes. It has become one of the main source of export of logging and research centre for education as well as for modern medicine. It is also another source of tourist attraction. Today, the forest is significant for serving three main purposes:

1. generating income through logging;
2. education and research; and
3. tourism

### **2.2.1 Logging**

Logging is the cutting or felling of big trees for commercial purposes. This is usually done with approval of the government.

## Types of logging

- **Clear felling**

Under this, all trees are felled and the land is barren after its operation is complete. All trees whether mature or young and other plants are chopped down for export. Clear felling destroys the natural environment but it is the cheapest logging method. It is convenient for the company to fell every tree and plant that is in its way without taking time to select which tree to fell and which tree not to fell. However, this type of logging exposes the soil to erosion and also causes displacement or extinction of many animal and plant species.



Clear felling in the Amazon Rainforest



Land exposed as a result of clear felling

- **Selective logging**

In this type of logging, only selected trees are felled. One advantage of this type of logging is that not all plants and animals are destroyed or displaced. Only the trees needed are cut down but in the long run, it is likely to suffer catastrophic burning (bush fires) and many of the remaining trees are likely to die.

From 1972-2002, 3.8 million hectares of PNG's forests were degraded or cleared by logging operations and the total declared value of exports was K4.57 million (The State of Forest of Papua New Guinea, 2008)

Tree species are logged for different purposes. Some logs are felled for timber or to manufacture paper, plywood, chairs or furniture. Some are felled for spice and scent for perfume.

Below are few local trees and their purposes.

Name of tree	Purposes (uses)
Eucalyptus trees (tallest tree in the world)	Cough and cold medicine product Skin and face care product Beauty and fragrance product shampoo Oil Soap
Araucaria	used for everything from construction to pencil.
Agathis	soft and used for the production of guitar
Acacia	suitable for wooden bowls, utensils and chopping board.(see the photograph below)



Bowl made of acacia tree

Some common hardwood trees are oak wood, rosewood, sandal wood, and walnut.

**Log Export**

Logs are exported in the form of round wood (raw form), sawn wood, veneer, plywood sheets and wood chips. Of all these forms, about more than 90 percent of the logs exported are round wood (in its raw form). The table below shows the top ten destinations of Papua New Guinea log products in 2015

<b>COUNTRY</b>	<b>%</b>	<b>COUNTRY</b>	<b>%</b>
Korea	1.9	India	11.3
Taipei	1.7	Philippines	0.4
Malaysia	0.5	New Zealand	0.1
Japan	0.8	China	82.3
Australia	0.9	Other	0.1

From the table on the previous page, you will notice that China is by far the most important destination for Papua New Guinea's timber, especially round wood. The other destinations remain important for the exports of processed wood products such as sawn wood.

### **Logging concessions**

The level of logging increased in the 1990s with the development of new concessions on the mainland. At the same time, there were opportunities for new logging concessions in the islands region as the richest accessible forest areas were logged out. The mainland was less economical and less attractive therefore, there was an increased demand for larger concession area in order to gain economies of scale (increase production of logs at low cost by accessing the larger area of logging). The reason for acquiring larger area is that, the mainland forest area has mountainous and steep rugged terrains which makes it difficult for the logging companies.

**Logging concession refers to contract license or permit granted to a logging company to extract logs from a defined area of forest within a given period.**

**An economy of scale is the increasing production of logs at reduced average cost.**

By 2005, a total of 217 commercial logging concessions were acquired and allocated. Thirty three (33) of these concessions were in production and had exported raw logs and they covered a total area of 5.25 million hectares. The logging sector of Papua New Guinea is dominated by Malaysian companies such as Rimbunan Hijau and their primary markets for raw logs are in China Japan and Korea.

#### **2.2.2 Provides Opportunity for Education and Research**

The forest of Papua New Guinea also holds a great potential for research in biodiversity. This research contributes to scientific knowledge as well as pharmaceutical uses.

There are several research centres in Papua New Guinea such as the National Agriculture Research institute (NARI) and Medical Research Institute (MRI). Likewise, existence of forest in Papua New Guinea saw the need for the establishment of the Forest Research Institute (FRI) under the directorate of the PNG Forest Authority.

The research center has made way for the study of different species of plants and animals which has added to the subject or curriculum to enhance skills and knowledge in the education system. The research center also helps Medical Research Institute in finding plants and animals that have the potential for future medicine.

The Forest Research Institute (FRI) works closely with International Organizations such as (JICA) to collaborate on forest related issues such as climate change. FRI has also collaborated with the Joint Research Institute in Germany to undertake studies relating to **biomass** and carbon (Papua New Guinea Forest Outlook by PNGFA, Pg 23)

The Papua New Guinea University of Technology is the only university in the Pacific region that offers tropical forest science degree. It also offers the diploma in forest, tropical forest science at its Bulolo college. It also produces trade certificate in various wood processing

**Biomass refers to the amount of living matter in the given habitat.**

Post graduate studies are usually undertaken abroad in Australia, New Zealand and some in Japan, Europe and in the United States of America.

Therefore, we can conclude that forest in Papua New Guinea provides opportunities for education through research centres and universities and studies under international scholarships abroad.

### **2.2.3 Employment and business opportunities**

Forest provides opportunity for employment. Those who went through formal education system studying forestry are employed as foresters in many different logging companies throughout Papua New Guinea. Some are employed as researchers in the forest research institute for further research in different species of trees.

Logging companies create employment for both skilled and unskilled workers. Some locals are employed as carriers, helpers in the oral survey of the land, drivers, cooks and cleaners. Logging also creates avenues for small businesses like trade stores, catering companies, security firms and transportation. Some of these may have contracts with the logging companies to provide their service. These spins off businesses create further employment. In fact, there are more people employed in logging operations than those employed in other activities such as timber processing, carpentry, supporting workshops or engineering services (PNGFA, 2005)

Some forest –related commercial opportunities exist for butterfly farming, insect farming, orchid production, crocodile hunting, fish and cassowary farming according to Chaterton (2008)

There are certain forest related commodities and forest –related activities that yields income for Papua New Guineans. They are listed below.

- Forest provides nuts and fruits that can be sold for money. For example, from our earlier reading you will remember pandanus nuts and galip nuts which are common nuts that are collected from the forest and sold in the vegetable markets. Even wild vegetables from the forest are also collected and sold in the markets. There is

substantial demand for these commodities especially in urban vegetable markets that go unnoticed.

- Logging companies also provide employment that gives opportunity for regular incomes received by locals and nationals who either work as casuals or professional foresters.
- Even income is paid to landowners in the form of royalty payment.
- Landowner companies also form to give services to logging companies which in return receive payment from them.
- National Parks such as the Variarata National Park in the Central Province also attracts tourists.
- Butterfly projects also have potential for tourist attraction.
- Bird watching also attracts international tourists.
- Forests also have the potential in the filming industry as settings for movies and documentaries.

---

## SUMMARY

- Forest is an important natural resource apart from gold, copper and oil and other natural resources which is extracted for commercial purposes.
- In total, there are more than 1000 species of plants which are useful for food, medicine, body decoration, art, utensils, tools and building materials.
- Forest provides
  - firewood which produces energy for cooking, heating, preservation of food. Seeds are also kept near the fire place for protection from mould and insects.
  - medicinal trees and plants such as Moringa, and Eagle wood (Arga wood) are few of the thousands of plants in the forest that provide medicine, oil and perfume.
  - felled logs for building materials.
  - income earning opportunity from sale of wild nuts, fruits, berries and vegetables.
  - employment from logging companies and forest related activities.
  - education through research centers, colleges, universities and scholarships abroad.
- Logging is defined as cutting or felling of trees for commercial purposes.
- Two types of logging are clear felling and selective felling.
- Clear felling is when every tree in the way is cut down making the area barren while selective logging is when certain trees only are cut leaving the residue trees to grow.
- Most trees are logged for timber, paper, and plywood.

- Forest provides employment as well as income earning opportunity for the locals and Nationals as a whole.
  - Logging concession refers to contract, license or permit granted to a logging company to extract logs from a defined area of operation.
  - Most logging companies are owned by Malaysian Rimbunan Hijau (RH)
  - There were more than 217 commercial logging concessions, 30 of which were active in operation
  - There was an increase in the volume of export from below 500 000 million cubic metres to 1 450 000 million cubic metres each year in the 15 year period from 1972.
  - Most log exports are round woods ( in their raw forms).
  - Main log export destination is China followed by Japan and Korea.
- 

## Activity 2

1. Define logging

---

2. Name the two types of logging.

---

---

3. Differentiate between selective logging and clear felling

---

---

---

4. Name two of the tree species that are currently logged for their multi -purposes.

---

---

---



5. Draw a plant in your own area or research and discuss their medicinal values. Label the part that is used for medicine.

6. Define the word 'logging concession'

---

---

Check your answers at the end of the project.

## **Chapter 3: Importance of the Forest to the natural Environment**

---

### **3.1 Provides vital ecological services, water catchments and coastal protection**

The forest provides a number of vital ecological services as well as other functions such as regulating the water cycle and protecting the shorelines.

#### **3.1.1 Ecological Services**

The forest

- maintains the stability of water and the continuation cycle
- stores of carbon dioxide for photosynthesis and also helps to control and maintain stability in the climate
- controls rodents and insects
- pollinates crops
- maintains fish stocks

#### **3.1.2 Regulation of water catchment and enhancement of water quality.**

- The forest maintains the quality of the river catchments and preserve water supplies and quality by
  - protecting watershed
  - regulating water flows
  - maintaining soil formation and health
  - reducing local flooding and supplying high quality water by filtering silt and pollutants.
- It is responsible for retaining soil and nutrients- The forest keeps the soil from erosion and thus maintains necessary nutrients which maintain quality of soil.
- The forest is also a water catchment. A large amount of water is stored in trees compared to smaller plants and grasses. This water is later released from trees through the process of transpiration. When rain falls water is absorbed by the soil and later taken up by plants through their roots.

**Ecology - the study of relationships between organisms and their environment**

**Ecological - relating to or concerned with the relations of living organisms to one another in their physical surroundings.**

**Service- it is a help given to someone or something for the improvement of life (e.g. improvement of ecosystem hence water and soil quality)**

**Water catchment - an action of catching water or area covered by trapped water.**

**Forest water catchment - action of the forest catching water (all the water trapped in the forest).**

### 3.1.3 Responsible for coastal formation and protection

- Protects the coastline from the effects of waves and tides, for example, mangrove forests
- Papua New Guinea forest filters fresh water and controls sedimentation caused by erosion. This provides the conditions necessary for the development of coral reefs, sea grass beds, estuarine wetlands and lush mangrove forests which are then responsible for protecting shoreline and land from storm and wave damage (Hunt, 2008).

The forest of Papua New Guinea therefore, performs important roles in the formation and stabilization of our natural surroundings. It is reported that these roles played by the forest are unrecognized and underestimated according to the report.(The state of Papua New Guinea Forest,2008)

### 3.2 Home to Diverse Plants and Animals

Papua New Guinea forest harbors more than 6 per cent of the world's biodiversity with some of the world's biologically diverse communities. It contains thousands of varieties of plants, animals and insect species. The Island of New Guinea (PNG mainland and West Papua of Indonesia) is ranked among the world's top ten most ecologically distinct forest according to Olsen and Dinerstein (2008).

There are thousands of animals and insects that are harboured in the forest many of which are being unaccounted for and are still being researched.

#### COMMON FOREST ANIMALS AND THE NUMBER OF SPECIES FOUND

Animals in their class	Number of species accounted	Estimated number that are endemic
Mammals (e.g., tree kangaroo ,cuscus ,wild deer)	191	80% of mammals are endemic
Birds	750	50 %
Reptiles	300	unknown
Amphibians	197	unknown
Fish	3 000	

**Endemic refers to plant and animal species that are native to an area or found only in that area.**

There are more than 1000 species of plants in the forest which are used for various purposes. More than five hundred of these have been identified as food while the rest are used as medicine, ropes, building materials stimulants, body decoration and adornment, art, utensils and canoes.

Many animals and insects form the protein diet of many rural Papua New Guineans. Hunting is still the major activity for rural Papua New Guineans and forms part of the customary practice. This has led to approximately 7.9 vertebrate animals which weigh up to 20.9 million kilograms of biomass, being consumed each year according to recent research (Mac and West, 2005). They would amount to considerable amount of kina when eaten or sold in markets at retail price in place of tinned fish and lamp flaps. This potential animal protein market excluding transport cost to rural market is values at K75 million annually (The State of PNG Forest, 2008).

Therefore, the forest is important to animal and plants which have the potential to contribute to the economy of our country.

### **3.3 PNG Forest regulates climate and weather.**

Tropical rainforests play an important role in stabilizing the global climate. They help to regulate the rainfall, temperature, wind and cloud. Tropical rain forests are one of the planet's greatest reservoirs of carbon. They store an enormous volume of carbon dioxide apart from the ocean which stores the largest amount of carbon dioxide. Because of this, the ocean and the forest are called carbon sinks.

How does the forest store carbon? When plants grow, carbon is removed from the atmosphere and absorbed in wood and leaves during photosynthesis. The forest has the potential to absorb about one tenth of the global **carbon emission** and store them into their **biomass**. Plants take in carbon dioxide and release oxygen through photosynthesis.

**Carbon Emission - release of carbon into the atmosphere.**

**Biomass – amount of living matter in the given habitat.**

**Carbon sinks – large areas in the natural environment where carbon dioxide is absorbed and stored.**

However, the forest's ability to absorb and store carbon is threatened by carbon emissions from the following activities.

- Burning of fossil fuels-the most important source of carbon dioxide.
- Tropical deforestation and decomposition. As the trees are cleared, the amount of carbon stored in this area is released and is responsible for 18 per cent of the total carbon emission.
- Expansion of subsistence agriculture as the population increases and also commercial agriculture due to increase in demand as population increases.

### 3.3.1 Forest and Global Warming

**Global warming is the gradual increase of the Earth's average temperature.**

Enhanced global warming is caused by greenhouse gases such as carbon dioxide, methane, water vapour, nitrous oxide and other man-made gases. Greenhouse effect is a naturally occurring and life sustaining process that has been in existence for millions of years which is necessary for life to exist on earth.

#### Major effect of global warming on climate in Papua New Guinea

- Papua New Guinea is likely to have increased humidity. This is now proven by the presence of certain insects (e.g. mosquito-that lives only in humid coastal areas is now found in the highlands. Fruit like mangoes, coconuts and bettlenut that once grew only in the coastal region of the country is now grown in parts of the highlands of Papua New Guinea.
- Coastal inundation –temporary and permanent flooding of a portion of land within the coastal zone.
- Salt water intrusion of ground water system (those who come from the coast of PNG may experience that ground water near their homes taste like salty.
- Storm surges -is a coastal flood like phenomenon of rising water commonly associated with low pressure weather systems such as tropical cyclones and cyclone.

---

#### Summary

- The forest is important because.
  - it provided ecological services through crop pollination, maintaining stability of water cycle, stores carbon dioxide which helps maintain the climate system.
  - it is responsible for water catchment and maintains water quality.
  - it is responsible for coastal formation and protection.

-it is home to diverse plants and animals, many of which are uncoun-  
ted and are still being researched on.

- The animal protein in the forest is estimated at K75 million annually.
  - Forest regulates climate and weather by storing and emitting carbon dioxide.
  - Carbon emission is the release of carbon into the atmosphere.
  - The forest has the potential to absorb one tenth of the global carbon emission into its biomass and soil.
  - Threats to the reduction in the amount of forest come from burning fuel, logging, and commercial agriculture and subsistence as population increases
  - As more forest is cleared and left to decompose, there is an increase in carbon emission.
  - Global warming occurs when there is more carbon emission released into the atmosphere. This is known as Enhance Global Warming.
  - Global warming is a gradual increase in the earth's surface temperature
  - Some direct effect of global warming on climate in PNG are signaled by
    - general increase in humidity,
    - salt water intrusion of ground water system and
    - coastal flooding
    - extreme weather pattern
- 

Now that you have come to the end of chapter 3, do activity 3 below.

### Activity 3

1. List three ecological services that the forest provides.

---

---

---

2. What is a water catchment?

---

---

3. How does the forest maintain the quality of river catchment and preserve the water supply?

---

---

---

4. Explain how the forest is responsible for the formation and protection of the coastal area,

---

---

---

5. Name some plants, fruits and nuts in your area that are sold in the market.

---

---

---

6. Define global warming.

---

---

7. Explain how the forest stabilizes the global climate.

---

---

---

---

8. Give an example of the ecological changes in your area that are obvious showing that there is a change of climate in Papua New Guinea.

(One, example is the existence of mosquitoes in the highlands of PNG which never existed in the past,)

---

---

---

Check your answers at the end of the project.

## CHAPTER 4: Logging Companies in PNG and the Case Study

This chapter is made up of a case study and the list of logging companies in Papua New Guinea.

### 4.1 Case Study on Tropical Rain Forest-PNG.

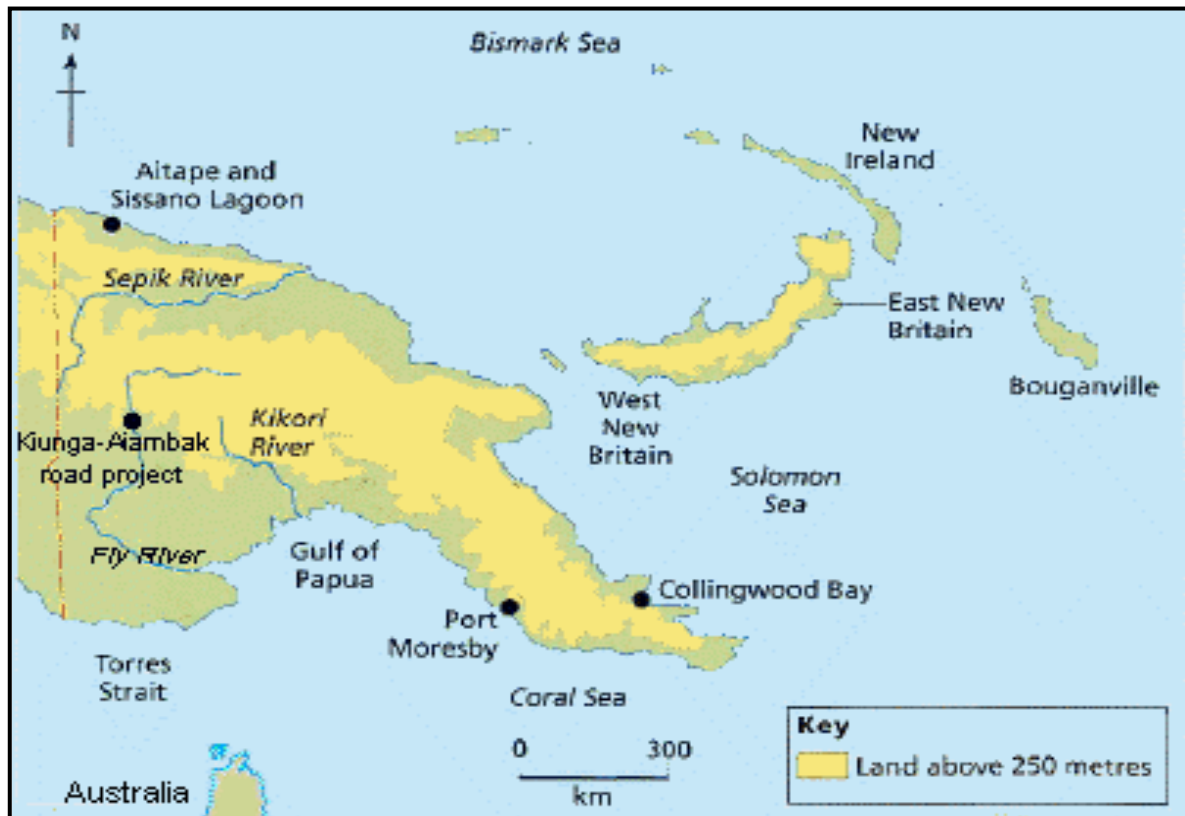
**Conservation – to protect the environment from the harmful effects of man-made and natural hazards and harmful substances.**

**Exploitation – using the environment in such a way that it is destroyed and will be of no use to future generation.**

**Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.**

The map below shows the location of the areas in this case study.

#### MAP SHOWING KIUNGA- AIAMBAK AND OILPALM PLANTATION AT AITAPE





### Rainforest Exploitation

Papua New Guinea (PNG) possesses one of the planet's largest remaining tropical rainforest. At least seventy-five percent of its original forest cover is still standing, occupying vast, biologically rich tracts over 100,000 square miles in all. Its forests provide the habitat for about 200 species of mammals, 20,000 species of plants, 1,500 species of trees and 750 species of birds, half of which are endemic to the island. It has been estimated that between 5 and 7% of the known species in the world live in PNG. Rare plants and animals like the largest orchid, the largest butterfly, the longest lizard, the largest pigeon and the smallest parrot ever registered live in these forests.

The forests also constitute the home of the indigenous peoples, the Maisin. For the Maisin, forests provide everything from food and medicinal plants, to materials for houses, canoes and tools. Under the Papua New Guinea constitution, the Maisin are the legal owners of their traditional lands. But these forests and forest peoples are under threat due to large-scale logging activities and oil palm plantations. Oil palm plantations are not aimed at the production of edible oil for the local population and almost the entire production is export-oriented.

Resource Exploited	Problems Created	Groups For	Groups Against
<p><b>Timber extraction</b> e.g. Kiunga-Aiambak road project located in previously intact rainforests in Papua New Guinea's remote Western Province.</p> <p><b>Oil palm plantation</b> at Aitape</p>	<p><b>Soil erosion</b></p> <p><b>Loss of biodiversity</b></p> <p><b>Diseases</b> spread amongst indigenous <i>Maisin</i> population through contact with the timber cutters</p> <p><b>Increase in viral diseases and malaria</b>, because of the ecological changes deforestation causes</p> <p><b>Loss of game animals</b></p> <p><b>Loss of clean water supply</b> through sedimentation</p> <p><b>Sedimentation</b> and</p>	<p><b>PNG Government:</b> who sold logging rights and helped finance the project</p> <p><b>Transnationals and their shareholders:</b> Malaysian company bought logging rights</p> <p><b>Consumers in MEDCs</b> who want cheap plywood and furniture</p> <p><b>Indigenous population</b> who obtain work with the logging company</p> <p><b>PNG Government:</b> offers tax incentives in the oil palm sector</p>	<p><b>Landowners:</b> not consulted and paid very little in compensation for the loss of their cocoa smallholdings.</p> <p><b>Environmental groups:</b> e.g. Greenpeace</p> <p><b>Australian Government:</b> Australia lies too close to Papua New Guinea to be isolated from its social problems</p> <p><b>Indigenous population</b> who object to the logging companies illegally taking over their land and the cultural, social and financial problems that followed.</p> <p><b>Indigenous people</b></p>

	<p><b>Eutrophication</b> caused through soil erosion (after forest clearance) and use of fertilisers would kill the nearby coral reef in Sissano Lagoon</p> <p><b>Prawn and sea fishing industry destroyed in Sissano Lagoon</b> through use of fertilisers and pesticides</p>	<p>designed to encourage growth and boost production</p> <p><b>Transnational oil palm companies and their shareholders</b></p> <p><b>Plantation workers</b> have jobs</p> <p><b>Fertiliser and pesticide company</b> have more sales</p>	<p>who claim legal rights to the land seized from them</p> <p><b>Local fishermen</b> who would lose their livelihoods</p> <p><b>Tour companies</b> and workers: the coral reef attracts tourists and divers</p> <p><b>Tourists</b> who prefer to see unspoilt coral reefs</p>
--	--	--	---

#### 4. 2 Logging companies in Papua New Guinea.

##### Export Market Share in 2004

Company	Origin	Volume harvested ( m <sup>3</sup> )	Market share
Rimbuna Hijau	Malaysia	649 000	32.5 %
Caraka Alam		234 000	11.5%
Innovission		199 000	10 %
VTK Realty		176 000	9.0%
Kera wara		175 000	8.5%
SBLC		140 000	7.0%
Turama For.Industry		133 000	6.5%

Source: SGS Log Export Monitoring Report: 2004

## Summary

- The case study of different logging location showed the negative impact of logging in Papua New Guinea.
  - According to the report of 2004 by SGS group (PNGFA appointed group whose purpose is to monitor log export), log export companies (logging companies are dominated by Malaysian interests).
  - The log export market share was dominated by Rimbunan Hijau in 2004.
- 

Now do the activity below.

### Activity 4

1. Define the following terms.

a. Conservation

---

---

b. Exploitation

---

---

c. Sustainable development

---

---

2. Which timber company dominated the log export market share in 2004?

---

3. Which group in this case study benefited the most in these projects?

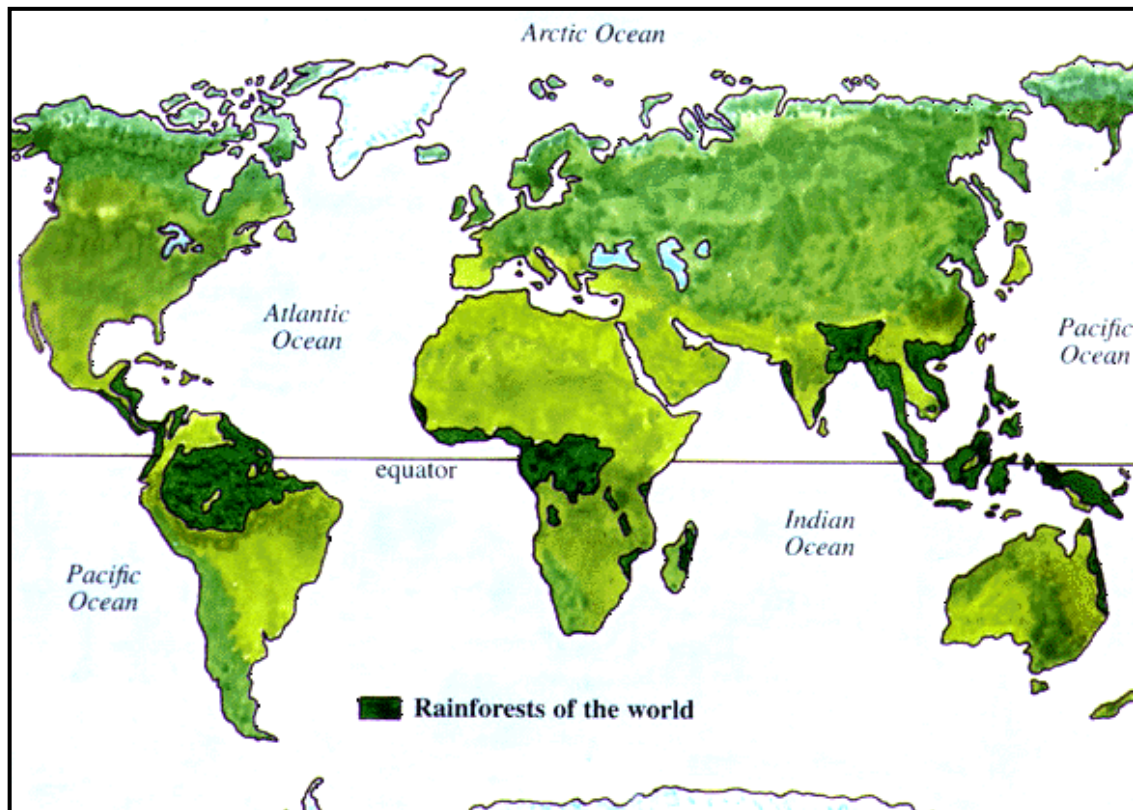
Check your answer at the end of the project.

## Chapter 5: Comparing PNG forest to the region and the world and its importance in the world

---

Rainforest system in Papua New Guinea ranges from mangrove to montane and from seasonal to savannah to continuously wet cloud forest .This forms one of the most diverse blocks of tropical rainforest in the world. Its importance has gained international recognition and has attracted attention for conservation.

### MAP SHOWING LOCATION OF TROPICAL RAIN FOREST IN THE WORLD



### Compare the area of forest in Papua New Guinea to Southeast Asia/Pacific region

- Papua New Guinea has the greatest area of tropical rainforest in the Oceania Region. It has twice the size of the remainder of the region combined.
- It also has 37 % of the montane forests in the Asia- Pacific Region
- The Island of New Guinea (that is combining mainland PNG and West Papua) has the third largest tropical rainforest in the world after the Amazon and the Congo (Brook et al, 2008).

### AREA OF PNG MANGROVE FORESTS COMPARED TO THE WORLD

Country	Mangrove area (ha)
Indonesia	2,930,000
West Papua	1, 249 052
<b>PNG</b>	<b>574,867</b>
New Guinea (Combining PNG & West Papua)	1,823,919
Brazil	1, 010 000
Nigeria	997, 000
Australia	95,5 000
Bangladesh	62,2 600
Malaysia	572, 100
Cuba	529, 000

Source: The State of Forest of Papua New Guinea, 2008

- PNG has 37% of swamp forest in the region
- PNG has 14 % of the regions mangrove
- Papua New Guinea Mangrove forests are the sixth extensive in the world

Recently there has been increased recognition that forests play a substantial role in fixing atmospheric carbon dioxide and serve as a massive carbon sink (Lewis,2008). Recent **post-Kyoto discussion** acknowledged that the clearance and degradation of forest results in significant emissions of carbon according to Stern (2008). This has raised the prospect of countries like Papua New Guinea receiving external assistance in return for re-afforestation efforts or reduction in rates of deforestation and degradation. PNG forest therefore is of highest importance to the global conservation.

Read part of the speech by Hilary Rotham Clinton in the Editorial below which shows that the developed countries are committed to protecting and improving Papua New Guinea forest.

Secretary Clinton said the United States made a commitment at Copenhagen to work with others to combat climate change. "As part of our commitment, the United States has pledged to reduce our own carbon footprint and we want to help countries like Papua New Guinea to be able to adapt to climate change and to prevent its effects." She said the U.S. is already working through the Coral Triangle Initiative to protect marine biodiversity and improve Papua New Guinea's capacity to manage coastal areas. The U.S. Government is promoting innovations in the country's agriculture and has asked the U.S. Congress to approve more than \$100 million in climate-related funding to small island development states, of which \$20 million will be targeted specifically for Pacific island nations, including Papua New Guinea.

Source: Editorial November 3 2010

Another example which shows PNG forest is important to the world is shown in the extract below.

Eagle wood known as Argawood is the most harvested tree species for its oil and incense by locals.

Increasing demand for the tree's oil, however, has led to local landowners overharvesting its timber, hence reducing the chances of natural regeneration and causing commercial extinction in some areas.

World wildlife Federation (WWF) is collaborating with local authorities and other non-government organizations (NGOs) to provide education and training to local communities about the importance of eaglewood as a resource, and encouraging sustainable management of the industry. These training workshops come under a project funded by the United Nations Food and Agriculture Organization.

---

## Summary

- Rainforest in Papua New Guinea ranges from mangrove to montane and from seasonal savanna to continuously wet forest.
- It is of world significance for global conservation
- Island of New Guinea (combined mainland PNG and West Papua) has the largest forest in Oceania and the third largest in the world.
- PNG has 37% of the Asia Pacific/Oceania swamp forest
- PNG has 14% of the regions mangrove
- PNG Mangrove forest is the sixth largest in the world.
- The prospect of PNG forest receiving external assistance in return for re-forestation effort has been raised at the recent Post -Kyoto discussion
- Developed countries like USA is donating millions of dollar for reforestation in PNG
- Eaglewood is one of the tree species that has the world's attention in PNG to protect it from being exploited and it comes under a project funded by United Nations Food and Agriculture Organization (FAO).

Now do the activity on the next page.

**Activity 5**

1. What is the composition of rainforest on the Island of New Guinea (PNG mainland and West Papua Forest) with respect to the:

a. Asia-Pacific Region?

---

b. world?

---

2. How much of the montane forest of the Asia Pacific Region is found in PNG?

---

3. What percentage of the swamp forest of the Asia Pacific does PNG have?

---

4. Why would PNG forest receive external assistance?

---

5. Name one country that is committed to assisting reforestation in PNG (Give the answer from the article in this chapter)

---

Check your answer at the end of the project.

## Chapter 6: Forest Management Plan in Papua New Guinea

---

In this chapter we will look at how forest in Papua New Guinea is managed.

The Papua New Guinea Government and those interested parties like Non-Government Organisations (NGOs), Research Centers or government agencies like PNGFA assist in several ways to manage our forest. Some of these include:

- Re-forestry program
- Encouraging more downstream processing
- Wild life conservation
- Formation of groups to create awareness at landowner/land group level
- Secondary forest management
- Reduction of impact in logging areas

Before, you continue to look at each of them, let's look at a few facts about our forest.

### 6. 1 Production forest and reserve forest.

- Papua New Guinea's land area is covered by about 29 million hectare (60% of the land) of forest.
- About 14 million hectares (48 % of the forest cover) out of the total forest covered is classified as **reserve forests**. But more than half (15 million hectares) of PNG forest cover is on production.

**Reserve Forest- refers to forest area not being touched or exploited by any human activity.**

**Production forest- refers either to forest area being logged or covered by logging concessions.**

- About 15 million hectares is production forest.
- About 12 million hectares of the 15 million hectares is acquired ( 3 million is still available)
- About 10 million of the 12 million acquired is for timber permit.
- 7.2 million of the 10 million hectares of timber permit is sustainable, however, only 3.5 million hectares is in production.



## 6.2 Forest management plans

Management refers to organizing, coordinating and controlling of any operation or activity or things in order to achieve ones objective.

In this topic, we will look at some of those management plans set in place by our government through its agencies and other organisations.

### 6.2.1 Re-forestry program

Re-forestry refers to replanting of trees in areas that have been deforested with the objective of re-foresting the area.

The government has already started re-forestation projects. New trees have been planted in 13 provinces. About 40,000 hectares of land had been cleared in those provinces in total. Some of these provinces are Eastern Highlands province, Simbu and Enga Province.

Unlike, natural forests, only 1 or 2 tree types are planted and they must be tended carefully. One example of NGO re-forestry project is the Tubusereia Lavadai Mangrove reforestation project in the Central Province managed by the Clinton.

### 6.2.2 Encouraging more downstream processing

Downstream processing refers to production of raw logs into processed wood timber, plywood and other by-products such as books and pencils.

Downstream processing has been one of the conditions when granting timber permits. It is the responsibility of all the parties involved in forestry. There is no export tax on processed timber export. This is done to at least encourage downstream processing in the country. However, downstream processing is large, capital intensive and unattractive.

**Capital Intensive – more use of machine than labour in the production process**

Let us look at the articles by two different governments of PNG on downstream processing. One is the Somare government and the other is the O'Neil government.

#### Article 1

Papua New Guinea's Government says it will soon announce a downstream processing policy for the forestry sector.

The Post Courier reports that Prime Minister Sir Michael Somare made the announcement at the 42<sup>nd</sup> International Tropical Timber Congress in Port Moresby.

Sir Michael said downstream processing will allow further processing and export of value added forest products.

During the past five years, a total of 236,000 cubic metres of processed products were exported, earning PNG 190 million US dollars.

But the Prime Minister has voiced concern that global campaigns by local and international NGOs are beginning to strangle lucrative overseas markets for PNG timber exports.

Sir Michael said the campaigns were forcing developed economies to impose non-tariff barriers, in contravention of World Trade Organisation obligations.

It's estimated that almost 90 percent of logging in PNG is illegal.

However, Sir Michael says many of the allegations of illegality in the tropical wood trade are unfounded and come from activists and countries remote from the realities of developing economies.

Source: Post Courier 9 May 2007

## Article 2

Prime Minister Hon. Peter O'Neill says Papua New Guinea will be looking to a wave of new resource projects to help the country develop an all-important value-added downstream processing industry.

In an interview with global publishing, research and consultancy firm Oxford Business Group (OBG), Prime Minister Hon. Peter O'Neill said that key projects, led by the Total-Inter Oil Joint Venture which will see the Elk-Antelope gas field developed represented an "exciting" follow-on from the "outstanding success" of the liquefied natural gas (LNG) initiative.

"This project is even larger on paper than the first PNG LNG project and could provide the basis for a thriving petrochemical industry in the future as the country diversifies its economic base in the attempt to create new jobs for Papua New Guineans," he said.

Source: PNG Facts

From the two articles read, we can conclude that the government has been serious about downstream processing.

However, downstream processing policy has to be targeted in a strategic manner. Larger and more capital intensive operations are not necessarily attractive according to Goodwill Tony (2011).

### 6.2.3 Wild life conservation

Wild life conservation refers to keeping aside (protecting) wildlife from being exploited. Some areas of the PNG forest are conserved for research purposes as well as for wildlife protection.

Below are some examples of wildlife conservation in Papua New Guinea.

- MT GAHAVISUKA in Goroka

Mt Gahavisuka was Established as a National Park for the conservation of montane species of mountain orchids and rhododendrons in the natural habitat. There are walking tracks to the summit of the mountain.

- McADAM, WAIF in Bulolo/Lae

This conservation area was established for the protection of the last virgin stand of Arancarta forest. Hoop and Klinki Pine varieties still remain in Bulolo/Wau areas. Used for education and research. There is an outdoor recreation area and scenic walking tracks.

- Baiyer Rriver Sanctuary in Mt Hagen

Biayer River Sanctuary was established in 1968 for the protection in captivity of endangered species of wildlife fauna and to encourage breeding whilst in captivity. Used for research and education.

- Talele island in Kimbe

This area was established in 1973 as a nature reserve for the conservation of land and marine habitat.

- The rainforest habitat in Lae

The rugged mountains near Lae are covered in a tangle of rainforest which is home to an assortment of tropical birdlife, butterflies, orchids and creatures which crawl, fly and jump.

The dark and steamy atmosphere of this impenetrable rainforest jungle is recreated at the Rainforest Habitat only nine kilometres from the centre of Lae.

Forest trees, local bananas, tree ferns, flowering orchids and ginger are amongst the 15,000 native and exotic plants found spreading upwards to form a natural protective canopy for the diversity of animals and birdlife below.

Forest wallabies, flying foxes, lizards, green frogs, butterflies and crocodiles add to the large variety of wildlife. The "raunwara" (waterhole) in the centre of the Habitat has species of native fish and turtles and adjoins a swamp where ducks and other water birds live.



Bird Sanctuary at Lae Habitat

### 6.2.3 Creating awareness at land group and land owner level through workshops

PNGFA had come up with the initiative to form groups at land owner/land group level to create awareness on preserving and protecting the most threatened trees in their area.

Eaglewood, also called agarwood, gaharu or aloeswood is known around the world for its highly valuable perfume and incense, and Papua New Guinea (PNG) is one of the last remaining frontiers for natural areas of these trees. There is an increase in demand for this particular tree product. It is observed by concerned authorities that locals have been overharvesting the tree due to an increase in the demand for its oil.

This particular tree species is the most **aromatic** tree, therefore, is one of the endangered trees around the world. One of the few last places to be found is in Papua New Guinea. The survival of this tree species depends on landowners and landowner groups.



Eaglewood Tree



Eaglewood trunk showing the darker inner part that is used in making perfume

According to the project, there are some sites already selected for research and conservation.

Sites selected	Province
Hunstein range and Karawari	East Sepik
Vailala	Gulf
Cape Rodney	Central
Maramuni	Enga

Managing Eaglewood in a sustainable manner will greatly benefit rural communities across the island of New Guinea, by improving the quality of life in villages,” said WWF-PNG’s Sustainable Resource Use Trainer, Leo Sunari. (Project Profile: Eagle wood Management in Papua New Guinea, as posted on the internet: March 2005)

**6.3 Some innovative approaches and activities taken by PNGFA to implement REDD+ Pilots.**

**REDD stands for Reducing Emissions from Deforestation and forest Degradation**

Some responsibilities of PNGFA includes

- Monitoring and controlling of forest operation
- PNGFA has appointed a group to monitor log export shipment since 1994 on its behalf.
- PNGFA continues to monitor all processed forest product exports.

Below are some activities and their objective for pilot areas (Sandaun, West New Britain, E.H.P, Milne Bay).The areas were set up to test new policies and plans related to forest conservation and protection.

<b>Activity</b>	<b>Objective</b>
Reduce Logging Impact (RIL)	Reduce collateral damage and forest degradation by 50 %
Secondary forest management	Enhance re-growth rate of secondary forest
Afforestation and reforestation	Enhance carbon stocks
Forest conservation	Protect forest to maintain Biodiversity and provide environmental services

To conclude this chapter, we could say that the government of Papua New Guinea through the PNGFA is serious in protecting our forest through many different ways. The least we can do as resource owners is to be responsible users of our own forest.

**It takes 5 minutes to cut down a tree but takes decades to be that old.**

---

## Summary

- The forest covers 29 million hectares of Papua New Guinea's land.
- About 14 million hectares (48 % of the forest cover) out of the total forest covered is classified as reserve forests. But more than half (15 million hectares) of PNG forest cover is on production.
- Forest management refers to organizing, coordinating and controlling of the forest to achieve its objective.
- It is the responsibility of the government through PNGFA to
  - monitor and control operation of the forest
  - monitor all raw and processed log exports
- There are so many ways to manage and protect our forest. Some of them are, through re-forestry, wild life conservation, formation of land owner groups to run workshops for awareness.
- Some innovative approaches taken by PNGFA to implement REDD+ pilots were to test effectiveness of new policies and plans related to forest conservation and Protection. Four pilot sites selected are Sandaun, West New Britain, E.H.P and Milne Bay).
- Eaglewood is one of the tree species that is now under protection. Five sites have been identified. They are in East Sepik, Gulf, Central and Enga Province.
- Downstream processing is a condition for granting timber permit.

- To encourage downstream processing, there is no tax levied on export (Known as export duty).
  - However, large downstream processing is capital intensive and is not necessarily attractive.
- 

You have now come to the end of chapter 6. Now do the activity below.

### Activity 6

1. What is forest management?

---

---

2. List 3 ways in which PNG forest is managed.

---

---

---

---

3. Explain conservation with relation to forest in your own words.

---

---

---

4. Name the sites selected by PNGFA for the REDD+ pilot study.

---

---

---

5. What is the general objective of PNGFA REDD+ pilot project?

---

---

6. What is the purpose of establishing Mt Gahavisuka wildlife conservation in E.H.P?

---

---

---

7. Explain the objective of establishing Conservation Park in Talele Island in Kimbe?

---



---

8. Explain how eaglewood tree is protected?

---



---

## ANSWERS TO ACTIVITY QUESTIONS

### ACTIVITY 1

1. Portion of land bigger than half a hectare with trees higher than 5 meters and a tree canopy cover of more than 10%.
2. More than 60 per cent or 29.4 Million hectare of the land is covered by forest
3. (the answer does not necessarily have to be in the table)

Types of PNG Forest	Where mostly found
Low land rain forest	All lowland
Lower Montane	Steep rugged terrain
Upper Montane	Steep rugged terrain
Swamp Forests	East Sepik, West Sepik, Western Province and Gulf Province.
Dry Ever Green Forest	Western Province
Mangrove	All coastal provinces with most found in Gulf and Western Province

4. Lowland rain forest

### ACTIVITY 2

1. Cutting or felling of big trees mainly for commercial purposes
2. Clear logging and selective logging
3. Clear felling is when every tree in the way is cut down making the area barren while selective logging is when certain trees needed only are cut leaving the residue trees still growing.
4. Eucalyptus, Araucaria, Agathis and acacia,(Any of the two, Also accept answers such as rosewood, oak wood, sandal wood)



5. (Answers to this will vary, this question was intended to make students research and identify traditional medicines used in their area)
6. Logging concession refers to contract, licence or permit granted to a logging company to extract logs from a defined area of forest within a given period.

### ACTIVITY 3

1. (Any answers from 3. 1a,b and c)
  - Maintains stability of water cycle
  - Absorbs and stores carbon dioxide for photosynthesis while helping to control and maintain stability in climate
  - regulating water flows
  - pollinates crop
2. Area covered by trapped water
3. The forest maintains the integrity and health of the river catchments and preserve water supplies and quality by
  - protecting water shed
  - regulating water flows
  - maintaining soil formation and health
  - reducing local flooding and supply high quality water by filtering silt and pollutants.
4. The forest filters fresh water and controls sedimentation and erosion. It also regulates the flow w of water hence reduce flooding.
5. (Answer may vary, but some common wild fruits and nuts are
  - Pandanus nuts,galip nuts, rattle seeds.and drupe seeds
6. Gradual increase in the earth surface temperature.
7. The forest absorbs the carbon emission into its biomass hence it stabilizes the climate.
8. (Answers may vary. Some sample answers are
  - Mangoes have been recently bearing fruit in the highlands apart from the existence of mosquito in the recent past.
  - Level of water in the highlands is going down
  - The air in the highlands is warmer now than before.

### ACTIVITY 4

1. a) to manage the environment in such a way that it will be protected from change.

b. when the environment is used in such a way that it is destroyed and will be of no use to future generations.

c. the development of an area using techniques and approaches that will help to protect the environment for the future.

2. Rumbunan Hijau

3. The company

### ACTIVITY 5

1.
  - a. the largest forest in the region
  - b. the third largest (next to Brazil and Congo)
2. 37 %
3. 37%
4. To encourage re-forestation and conservation of forest
5. USA (through Clinton foundation)

### ACTIVITY 6

1. Organising, coordinating and control of forest to conserve and protect it from exploitation from being over used.
2.
  - Wild life/forest conservation
  - downstream processing
  - formation of land groups to make awareness
3. Manage the environment in such a way that it will be protected from change
4. Sandaun, West New Britain, Eastern Highland and Milne bay Province.
5. Test effectiveness of new policies and land related to forest conservation and protection.
6. Established as National Park to conserve montane species of mountain orchids and rhododendrons in the natural habitat.
7. Established to conserve land and marine habitat
8. Through land group formation and awareness the advice received from WWF (Worlds Wildlife Federation)

---

<p><b>YOU HAVE COME TO THE END OF THE PROJECT. NOW TURN TO YOUR ASSIGNMENT BOOK AND COMPLETE ALL THE QUESTIONS ON EACH TOPIC TEST. SEND THE COMPLETED ASSIGNMENT BOOK TO YOUR PROVINCIAL COORDINATOR FOR MARKING.</b></p>
---

**Referrences**

The State of the Forests of Papua New Guinea 1972-2002, University of Papua New Guinea,2008

Illegal Logging in Papua New Guinea, Sam Lawson,2014

Constan Bigol & Bruno Kuroh,REDD+ Readiness Activity by PNGFA,Feb 2012

Goodwill Tony, 2011. Safe Guard the Resource Base: State of Papua New Guinea Forest and Land.

Papua New Guinea Forestry Authority,2009,Papua New Guinea Forestry Outlook Study. Working paper No. APFSOS II/WP/2009/19

[Http://www.fiapng.com/forestryindustry01.html](http://www.fiapng.com/forestryindustry01.html)

<HTTP://WWW.forestry.gov.pg/site/page.php?id=27>

<HTTP://WWW.forestry.gov.pg/site/page.php?id=50>

<http://www.bing.com/search?q=wwf+endangered+species+list&qs=AS&pq=wwf+&sk=AS7&sc=8-4&sp=8&cvid=1C6BB2E442CD4D85AFF74CE5D52FF05D&FORM=QBRE>