

## Geography | World Problems and Development | **Forestry**

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### **FORESTRY**

**A forest** is a large tract of land covered extensively by trees.

**Forestry** is a scientific process of planting, exploitation, and conservation of forests. It is concerned with managing forests on a sustainable basis, balancing exploitation and conservation.

In the world there are almost 40 million km<sup>2</sup> of forests with roughly half found in the tropics. Forests once covered about 60% of the earth's surface but have greatly reduced by clearance for settlement and farming or during the exploitation process. About 25% of the earth's surface is today covered with forests and the world demand for timber is increasing leading to over cutting of forests. On the other hand, some people are realizing the need of maintaining timber supplies and have planted forests / established forests farms.

### **MAJOR TYPES OF NATURAL FORESTS IN THE WORLD**

The major forests of the world are found in the more humid temperate and tropical areas. The classification is based on climatic factors and the dominant type of trees / wood they produce. The major types include:

- 1) Tropical hard wood forests
  - (a) Tropical evergreen forests / tropical rain forests /  
Equatorial forests
  - (b) Tropical monsoon forests\*
- 2) Temperate hard wood forests\*
- 3) Coniferous forests/ temperate forests

### **TROPICAL HARDWOOD FORESTS**

These are divided into two:

- Tropical evergreen forests/equatorial forests/ tropical rainforests.
- Tropical monsoon forests

## **TROPICAL EVER-GREEN FORESTS/ TROPICAL RAIN FORESTS/ SELVA FORESTS/ EQUATORIAL FORESTS**

These forests are located astride the equator extending approximately 10°N and 10°S of the equator. The largest expanse of tropical rain forests is in the Amazon basin of Brazil, extending from the Atlantic coast to the foothills of the Andes Mountains. These forests also occur on the Pacific coast of Columbia and in Central America.

In Africa tropical rainforests occupy the Congo basin (former Zaire), low lands of West Africa such as Sierra Leone, Ghana, Cameroon, and Gabon. They also occur on the coastal plain of tropical East Africa.

In South Asia, tropical rainforests are found in Malaysia, Indonesia, Papua New Guinea, and in the coastal low lands of South and South-East Asia countries.

Equatorial forests mainly cover lowlands with heavy rainfall and hot temperatures all the year round, between 24°C and 32°C, which rarely fall below 21°C.

### **Characteristics of tropical rainforests**

1. They are thick forests and with much luxuriant foliage/leaves. This is due to heavy rainfall and hot temperatures.
2. The majority of the trees have broad leaves to release excess water through transpiration.
3. The forests are heterogeneous in nature—the trees do not appear in pure stands of a single species but valuable tree species are widely scattered/mixed up with other trees.
4. The forests have distinct layers called canopies—the top layer, middle layer, and bottom layer.
  - The top layer mainly consists of tall trees (giant trees) with buttress roots—generally over 46m in height.
  - The middle layer mainly consists of clinging plants which cling on strong trees, tree ferns, lianas (thick stemmed creepers) and trees between 19 and 34 m tall.
  - The bottom layer consists of mainly undergrowth of ferns, herbaceous plants (herbs), with trees of up to 17m tall.

5. The forests are dominated by hard wood trees and yield valuable hardwood timber( such as mahogany, rose wood, iron wood, ebony)
6. The tall trees are characterized by buttress roots extending for several metres above the ground (up to 10m) which support them and the trees have long straight trunks ideal for timber.
7. The forests have little or no under growth because the dense canopies shut out sunlight from the lower layers/ floor of the forests. The undergrowth becomes thick only in few areas where some trees have been destroyed.
8. There are a variety of climbers /lianas (*rope-like climbing plants*), creepers, and parasitic plants. Rain forests also have epiphytic plants (plants which grow on other plants but do not actually feed on them such as ferns, orchids, bromeliads).
9. Palm trees exist especially along shores or muddy coasts.
10. The trees are evergreen throughout the year because the areas receive rainfall throughout the year (shed at different times of the year/ never shed off all their leaves—most trees retain their leaves for most of the year so that the forest appears evergreen).
11. The trees have a long gestation/ maturity period; most trees take over 60 years to mature (Mvule takes over 70 years).

Examples of tree species in the tropical rain forests are: Mahogany, Iron wood, Red wood, Red heart, Green heart, Mvule, Ebony, Teak, African cedar among others.

### **TROPICAL MONSOON FORESTS**

These mainly occur in south East Asia and the Indian sub-continent, with the major countries being India, Burma, Thailand and indo-china, northern Cambodia, northern Vietnam and northern Australia.

#### **Characteristics of tropical monsoon forests**

1. The monsoon forests are less luxuriant than equatorial forests because of seasonal drought (trees are not as close as in the evergreen forests).
2. They have thick under growth of shrubs and small trees and dense thickets of bamboo.
3. Forests shed their leaves during the dry season and do not grow new ones until the rains come (most trees are deciduous –shed their leaves seasonally).

4. Trees are not in pure stands (heterogeneous in nature).
5. Mainly hardwood species like iron wood, teak, sandal wood etc.
6. Some trees are associated with buttress roots and have broad leaves which are deciduous.

### **TEMPERATE HARDWOOD FORESTS**

These forests are found between approximately 30° and 50° North and South where temperatures are moderate (but where the seasonality of the climate though marked is not as extreme as in the coniferous forest belt).

The major areas with temperate hardwood forests are: northern China (including Manchuria), Japan; west, south and central Europe; eastern North America. Some temperate hardwoods are also found in southern Australia, especially in Tasmania, and west Australia.

#### **Characteristics of temperate hardwood forests**

1. The trees are mostly deciduous, shedding off their leaves in autumn and remaining leafless throughout winter.
2. The trees yield a variety of hardwoods like oak, beech, camphor etc
3. Like the tropical forests, the temperate hardwood forests have a variety of species scattered irregularly through the forests.
4. The forests also contain many shrubs and small plants. But neither the tall trees nor the undergrowth are as luxuriant as those in the tropics.

**Note:** The hardwood while being very durable and strong is not usually as heavy or as difficult to work as are tropical hard woods. But it is more difficult to extract than softwoods.

The main commercial species are: Oak, Ash, Beech, Poplar, Mongol trees, Camphor, Walnut, and Elm.

### **TEMPERATE (*soft wood*) FORESTS/ BOREAL FORESTS/ CONIFEROUS**

Coniferous forests cover a broad belt of land in both North America and Eurasia (to the north of the temperate hardwood forest belt). They extensively cover the high latitude areas and high altitude areas (uplands and mountains).

Coniferous forests are mainly located in the northern hemisphere in a belt between 50° and 70° N (though there are some conifers in the southern hemisphere)

The major regions with coniferous forests include:

- ❖ Western North America, including northern California, Washington and Oregon in USA; British Columbia in Canada and southwest Alaska.
- ❖ Central and Eastern North America. It extends southwards around the Great lakes and into the Appalachian mountains.
- ❖ Southern USA –from Virginia to Texas.
- ❖ Northern Europe. This includes Scandinavian countries –Norway, Sweden and Finland; northern Russia, many uplands further south such as Britain, Germany, parts of Italy.
- ❖ Asiatic USSR—northern Siberia extending to the pacific coast.

### **Characteristics of coniferous forests**

1. The conifers have tall straight trunks/ stems and they grow to a height of 30m or more depending on soil and climatic conditions.
2. The coniferous forests have evergreen trees (due to high adaptation to severe winter conditions). They do not shed their at once and maintain a green foliage throughout the year.
3. The trees have narrow needle-like leaves with small surfaces to prevent excessive loss of water by transpiration/ to limit transpiration.
4. The leaves of the trees have tough and thick skins/ barks to protect them from winter cold.
5. The trees have a short growing / maturity period (about 14 to 20 years).
6. Most coniferous trees are softwood (like hemlock, firs) and are light in weight which makes them easy to cut and transport.
7. The forests are homogeneous in nature-the trees usually occur in pure stands of a single species (a particular species like spruce occurs in a given area), and hence easily exploited.
8. The trees are cone-shaped and flexible to allow snow to slide off without breaking branches.
9. The forests have no under growth because of frozen ground, and yet the trees grow close together producing a heavy shed.

10. Coniferous forests are moderately dense and they become thinner in colder or drier regions( the most dense , luxuriant coniferous forests are found in western north America).
11. The trees often grow to a height of 30m or more (but do not have the wide buttress roots of tropical rainforests).
12. The trees have wide spread shallow roots to collect water from the top frozen ground.
13. There are no creepers and lianas.
14. Conifers bear and carry their fruits in form of tough cones; hence the name conifers.
15. There are few species unlike the tropical rainforests.
16. Towards the poles the conifers become shorter, more dispersed, stunted and merge with the tundra vegetation.

The major commercial tree species include:

- **The pines**—such as white pine, Scots pine, Lodgepole pine, Norwegian pine, jack pine, pitch pine, slash pine, ponderosa pine.
- **The firs**—such as Douglas fir, Balsam fir, Joint fir, Noble fir, Silver fir.
- **The spruces**—such as Norway spruce, red spruce, Sitka spruce.
- **Cedars**—such as Red cedar, Cedar of Lebanon, Cyprus cedar, Deodar.
  
- ✓ **Hemlock**—such as eastern hemlock( N.E USA and eastern Canada); western hemlock( along pacific coast from Alaska to central California);Japanese hemlock etc.
- ✓ **Larches** – such as American larch (tamarack), subalpine larch, and European larch.
- ✓ **Californian red woods** ( sequoias)

### **General importance of forests**

1. **Provision of industrial raw materials** for example the major product timber which is used to produce many items such as used in the construction and boat making, furniture making, manufacture of synthetic textiles (like rayon), production of cellulose.
2. **Provision of medicine** for certain diseases such as quinine extracted from cinchona tree, cocaine got from the coca shrub, camphor –an oil distilled from the camphor tree and today used in making cosmetics, soaps and ointments.

3. **Forests provide food and fruits** collected from the tropical rain forests such as ivory nuts, Brazil nuts, and betel fruits. Many societies obtain gums from forests—used in the making of chewing gum. Also palm oil like in Brazil for extracting cooking oil and other products. There are also mushrooms and yams.
4. **Water catchment function of forests / protection of water resources** because the canopies break the force of rain making it percolate/infiltrate slowly into the soil causing long run water storage hence development of rivers and rivers. In fact, the world's major rivers are characteristic of forested areas such as Amazon River, and Congo River.
5. **Modification of climate** through the evapo-transpiration process, by recharging atmospheric moisture which condenses into rain. In fact, many dense forests have the heaviest rainfall world over such as Congo and Amazon basins. This supports economic activities such as farming in the surrounding areas.

Rain forests also regulate climate by absorbing carbon dioxide and give off oxygen in the process of photosynthesis; hence lessening the impact of global warming.

6. **Soil conservation** since the forests reduce soil erosion frequency and intensity by facilitating infiltration/ percolation of rain water into the soil and therefore reduced runoff. The rainwater is intercepted by the tree branches and rolls off the trunks into the soil. The plant/tree roots also bind the soil particles together which factor also promotes slope stability.
7. **Habitat for wild life** in form of flora and fauna species. The animals and birds include: elephants, buffalo, chimpanzees, monkeys, gorillas, flamingos, falcons in tropical rain forests. In the temperate forests –bears, deer, gray owl, North American mink, lynx (wild cat), lemmings. There are also various plant and tree species in various forests. Eventually the forests act as laboratory for research and educational studies.
8. **Promotion of the tourism sector** because many forest areas have been gazetted as national parks and game reserves for example Okanda national park in Gabon, Amazonia Park in Brazil, and Galamba Park in Congo to conserve wild life. These act as places for recreation, and other tourist activities such as picnics, forest walking, camping, and viewing forest animals. The tourists bring in valuable foreign exchange and also provide market for the local products and services.

9. **Generates government revenue** through the sale of forest products such as timber, rubber, and medicinal products brings in revenue to government. The government also licenses and taxes the forest exploitation companies, workers, timber exports and other forest-related activities to get revenue that is re-invested in other sectors of the economy such as health and, education.
10. **Generates foreign exchange** through the exportation of forest products such as timber, sawn wood, plywood, fibre boards, rubber, gums, to outside countries. The foreign currency generated is used to settle foreign debts and encourage importation of foreign capital and consumer goods.
11. **Promotes development of urban centres** since the sawmills, pulp and paper industries have attracted a large population as workers and in turn associated infrastructure such as roads, schools, banking, recreation centres—hence development of urban centres/towns.
12. **Provision of many employment** to the people such as lumber jacks, forest guards, fire fighters, supervisors, transporters, industrial workers. These earn incomes which they use to improve their standards of living.
13. **Diversification of the economy** since forestry industry acts as an alternative source of income for the respective countries instead of over depending on a few sectors like mining, agriculture. This expands the economic base and results into increased national income.
14. **Forestry is an economic use of land where other activities are limited** for example areas of little agricultural value –like the steep slopes, areas of thin soils, infertile stony or sandy soils, water logged areas, areas of a short growing season. Also very remote areas are more economically utilized for forests instead of farming.

#### **Negative / shortcomings of forests**

1. **Occupation of land that would be used for other economic activities** such as industry and agriculture. The forests are an obstacle by limiting land for arable farming especially with increased population pressure on land.
2. **Harbor dangerous wild animals** such as black mamba, cobras, python, chimpanzee, lions, buffalo etc which threaten human life and limit economic activities in the surrounding areas.
3. **Forests harbor disease causing vectors** such as mosquitoes and tsetse flies that are dangerous to the people living near them and their livestock,



by causing malaria and sleeping sickness in people or nagana / trypanosomiasis in livestock and hence reduce the quality of life.

4. **Forests hinder development of transport and communication networks.** The vegetation grows so rapidly and associated with heavy rainfall that destroys the road networks. For example the Trans-African highway has problems in DRC due to high costs incurred to construct each kilometer of the road through the forest.
5. Some forests act **as hiding places for rebels** and other criminals, who disrupt peace/ bring about political instabilities and hence destroy social economic infrastructure.
6. Some forests have **few valuable tree species** and thus their exploitation is uneconomical. There are many trees with no present economic value.
7. **Industrial –related problems** such as pollution of the environment by the sawmills, pulp and paper industries due to the disposal of wastes into water sources and emitted gases into the atmosphere. This contributes to the environmental degradation.
8. **Urban-related problems** such as slums, alcoholism, and increased crime in the urban centres that have come up. These reduce the quality of life such as slums on the margins of the urban centres having poor structures and poor hygiene. The eradication of such problems is very to the government.
9. **Forestry leads to regional imbalance in development** especially where areas around processing centres are more developed in terms of infrastructure than the countryside /other areas.
10. Some forests act as **social and economic barriers** between people of the opposite sides. For example, it is difficult to connect the areas via transport routes since people have to move for longer distances outside the forest.

## **FORESTRY IN BRAZIL**

Brazil is located in South America and it is the largest country in terms of area in South America (3.2m km<sup>2</sup>). The largest single area of tropical rain forests is in the Amazon basin. The westward extension of this forest is limited by the Andes Mountains. On the east coast of South America tropical forests extend as far south as 25<sup>o</sup>s.

The tropical rain forests cover almost half of the country's total area mainly in the north and the area is called the Selvas/Amazon region. The forest has over

40,000 tree species such as **Mahogany, Ebony, Rosewood, Green heart, Ironwood, Teak, Palm trees**

The main districts covered by Amazon forests are: **Acre, Mato Grosso, Amazonas, Para, Rondonia, Ceara, and parts of Bahia.**

***A sketch map of Brazil showing the major forested areas***

### **Factors which have hindered the development of the forestry industry in the Amazon basin / Brazil**

Despite the abundance of forest resources in Brazil, the forest industry is still under developed in the Amazon region and this is explained by a number of factors:

1. Heterogeneous nature of forests/ the trees grow in impure stands.
2. Some densely forested areas are impenetrable.
3. Tropical hardwoods are bulky and too heavy to be floated on rivers like Amazon and its tributaries (such as Negro, Tapajos, Madeira)
4. The tropical forest trees have buttress roots
5. The long gestation / maturity period of most valuable tropical trees.
6. The harsh climatic conditions
7. The tropical rain forests harbor dangerous wild animals
8. Limited capital to invest in forest exploitation.
9. Low levels of technology
10. Shortage of labour both skilled and unskilled.
11. Political instability such as the military coup of 1964.
12. Unfavourable government policy
13. The government has also gazetted some areas as forest reserves like Amazonia, Raajon game parks.
14. Limited market for tropical hardwood.
15. Limited research and careless destruction of valuable tree species through charcoal burning, shifting cultivation, hunting and settlement.

## **DEMOCRATIC REPUBLIC OF CONGO**

In Africa, the largest tropical rain forests occupy parts of the (Congo) Zaire basin. Although the forests are not as luxuriant and extensive as those in the Amazon basin, it is one of the worlds thickest. The main tree species include: **Mahogany, Ebony, Iron wood, Rose wood, Mvule, African cedar, Iroko, teak, Limba, Green heart**

The main forested areas are: Kasai area in the south, Equatuer, Bandundu, and Orientale provinces. The main lumbering forests are: **Ituri forests, Great Congo forests, pygmy forests, Stanley forest**. The Coastal region was the major production area at first but after exhaustion lumbering moved to the interior. The simba forests have been replaced by Eucalyptus forests.

***A sketch map of DRC showing the major forested areas***

### **Problems facing the exploitation of forest resources in the Congo basin**

1. **Heterogeneous nature of forests/ the impure stands of the trees** in that, the valuable tree species are widely scattered such as iron wood, mahogany as noted in Ituri forest, pygmy among others. These are mixed up with trees of no present economic value. This makes selection, felling and removal of logs from the forest difficult –hence limiting the exploitation of forest resources.
2. **Some of the most densely forested areas are impenetrable** making accessibility difficult since many trees are entangled by creepers and plants like lianas, saprophytes and epiphytes. Therefore the commercial tree species cannot easily be reached in the Congo basin—hence complicated exploitation.
3. **Tropical hardwoods are bulky and too heavy –to be floated** on rivers like Congo River and its tributaries (like Lomami, Lualaba, Kasai, Uele) from the forested areas to processing centres.
4. **Most tropical trees** (such as mahogany and iron wood) **have buttress roots** extending outwards from the base of the trunk, which also makes the process of felling difficult. It requires working from a platform built around the trunk of the tree (at a height of 3-5 m from the ground) which is tedious and time consuming. affecting lumbering

5. **Long maturity period of tropical hardwood trees** such as Ebony, Green heart, Mvule and Mahogany which affects supply. They mature in a period ranging from 60 to 100 years, which does not match with the available demand. This complicates the process of exploitation and quickens depletion of forest species since the rate of cutting is far more than the rate of growth. It is there fire difficult to maintain production on a sustainable basis.
6. **The harsh climatic conditions/** these tropical rain forests have hot humid weather throughout the year with temperatures ranging between 27 and 32<sup>o</sup>c, which is too hot for the lumbermen. The areas also receive heavy rainfall between 3000 to 4000mm per annum, which makes the ground damp and impassable / transport difficult. These conditions also favour the breeding of mosquitoes causing malaria –which reduces labour supply to exploit the forests.
7. **The tropical rain forests harbor dangerous wild animals** for example lions, chimpanzees, cobras, black mambas, which pose great danger to lumbermen and forest rangers in the forests of Ituri and Stanley among others.
8. **Poor transport routes in the forested areas affecting marketing.** Many areas in the Congo basin with the best timber are not accessible due to lack of good roads and railways. The roads are difficult to construct but still even when built they are difficult to maintain due to rapid re-growth of vegetation. The roads become impassable during heavy rains. The rugged relief in some areas also further limits the setting up of transport networks- hence limiting exploitation of forests.  
  
Besides some rivers/ streams are less navigable due to problems of waterfalls, rapids, shallowness and floating vegetation among others. They are therefore hard to use to float logs.
9. **Inadequate/limited capital to exploit forests/** to invest in the forest sector such as to develop infrastructure, purchase modern machinery and set up processing centres. This has led to continued use of rudimentary tools (like axes handsaws) and dependence of poor infrastructure in many forested areas of the Congo.
10. **Low levels of technology/** Rudimentary tools are still being used in the exploitation of forests in some parts of Ituri, Bunia, Lisala and Stanley forests. This involves the use of handsaws, axes, and pangas among others. These are ineffective, time consuming and wasteful. These lead to low

quantity and quality of timber and other products. Although the use of power driven saws is increasing, it is still on small scale.

11. **Shortage of labour both skilled and unskilled** since the densely forested areas such as Bunia, Ituri, Stanley, Great Congo and pygmy forests are sparsely populated, so that obtaining labour is a problem. The unskilled labour in such areas uses rudimentary tools which are wasteful. The inadequate skilled labor force also implies production of poor quality timber, which cannot compete favourably on the world market.
12. **Political instability in many parts of the Congo forests** for a long time such as a series of civil wars and unrests. For example the Katanga rebels from Angola in the period 1977-78, the Allied Democratic Front of Laurent Kabila in 1997 to overthrow the government and others instabilities caused by invading forces from Rwanda and Uganda, in addition to the current Congo rebels. This has affected forest exploitation by scaring away workers and investors, since the forests are taken as war-zones.
13. **Unfavourable government policy / limited government support** since the government does not give priority to the forestry industry in favour of other important sectors such as mining of copper and gold in the Shaba province, and agriculture. This therefore undermines investment in the forest sector --hence limiting the purchase of modern machinery, developing necessary infrastructure and carrying out research among others.  
**The government has also gazetted some forest areas for wild life conservation** –national parks, such as Galamba national park, Salonga national park, okapi national park, and Maiko national park—hence limiting the area available for forest exploitation.
14. **Limited market for tropical hardwood, both local and foreign.** The local market is limited by the location of the forests in sparsely populated areas/ remote areas of the Congo. Basin. More so tropical hard woods compete with coniferous forests (softwoods) in other parts of the world such as British Columbia (Canada), Sweden, Russia, among other areas—with a variety of uses of economic value. This further limits the market since lower prices are often offered for tropical hardwood; a factor which also discourages exploitation.
15. **Limited research** and careless destruction of valuable tree species through charcoal burning, shifting cultivation, hunting and settlement.
16. **Many accidents occur** during the felling and transportation of timber, leading to death of workers.

17. **Over exploitation of forests** for example the coastal region was the major production area at first but these forests were exhausted and lumbering moved to the interior –hence affecting future supplies. More so many areas cleared of their original forests have been replanted with other fast growing trees such as the simba forests replaced with eucalyptus trees, and this in the long run makes the forests less valuable.
18. Population encroachment on forest areas.
19. Limited power supply
20. Hostile tribes like pygmies
21. Competition from other wood producing countries like Sweden, Norway, Finland, Ghana, Gabon.

## **FORESTRY IN GABON**

Gabon is one country located in the equatorial region of Africa and its economy greatly depends on the exploitation of forests. Gabon is largely covered by dense tropical rain forests (equatorial forests).

The major tree species include: **Okoume** (used for making plywood), **Mahogany, Ebony, Kevazingo, Rose wood, Azobe, Ozigo, Iron wood, Kavaninga, and Green heart.**

The main lumbering areas include: **the coastal strip along the coast of the Atlantic ocean** running from cocoa Beech north of Libreville to Sette-cama in the south, **along Ogooue river, Owendo, Okonja, Moanda, Mekambo, Makokou, Koula -Moutou, and Kango.** The characteristics include; trees have broad leaves, have canopies, grow in impure stands, have hard wood, and long gestation period among others.

In Gabon large companies were given concessions for systematic forest operations. Operations have necessitated the construction of a railway line and a new port at Owendo. There are over 15 saw mills mainly located at the coast. The largest and one of the biggest exporters of plywood in the world lies at Port Gentil.

**Note:** Lumbering especially along the coastal strip is almost ended due to exhaustion of forests and today most lumbering takes place in the interior and along the Ogooue River.

## ***A sketch map showing forest areas in Gabon***

### **Factors which have favoured commercial forest exploitation in Gabon**

1. **The equatorial climate** characterized by heavy rainfall of over 1500mm and which is well distributed throughout the year and hot temperatures of 26°C and above—which conditions have encouraged the growth and maturity of tree species like Okoume, Ebony and Mahogany. This in turn promotes wood production.
2. **Presence of many valuable tree species.** Gabon has a virtual monopoly of Okoume in the world—which provides valuable plywood, and competes favourably with softwood of the temperate forests. Gabon also has valuable hardwood tree species like mahogany, ebony, Ozigo, red wood in the forest areas like parts of the coast, Lambarene, Makokou, Mekambo and Franceville. These provide more valuable timber for construction and furniture making.
3. **The sparse population/ low population density** which has favoured continued existence of forests. The population density is about 6 people per sq km and this means that vast areas of natural forests have not been encroached on by people for settlement, agriculture, fuel wood, and illegal timber harvesting. The country therefore has large reserves of forests especially in the interior and along Ogooue River for commercial exploitation.
4. **Presence of various rivers** like Ogowe/ Ogooue and its tributaries (Como, Nyanga, and Offoe). These have enabled the transportation of light logs using Tug-boats to factories at the coast and inland workshops. This increases the supply of wood and wood products.
5. **The relatively flat nature of the landscape** which facilitated the construction of transport routes particularly road network and railway—which connect lumbering centres to processing centres at the coast. This ensures continuous supply of wood and wood products like timber.
6. **The fairly fertile soils** which have supported the growth of various tree species like Okoume, and Ebony—in turn favouring the supply of wood and thus encouraging lumbering in Gabon.
7. **The presence of hydro-electric power** generated from the rivers which helps to run machines in the saw mills and other factories. This increases

efficiency in the wood processing factories and thus steady supply of wood products.

8. **Availability of large sums of capital for commercial exploitation** provided by large companies from Europe (particularly France), which the government has given concessions/ contracts to exploit tropical wood. These companies compliment government in providing the necessary capital to purchase modern machinery, setting up processing facilities, payment of labour and carrying out research. This increases forestry production.
9. **The use of improved technology in the forest sector** which involves selective felling of trees using powered saws for feeling trees, trimmed and hauled using tractors to collecting centres. The factory technology has also been improved to increase efficiency in the forestry industry.
10. **Presence of skilled labour** / highly skilled and specialized manpower especially the French plus local people –used in tree selection, felling, trimming, hauling and timber processing. There is also division of labour where the forest area is sub-divided and each portion allocated to a team under a supervisor. This ensures that quality and quantity output is realized and thus more investment in the sector.
11. **Cheap labour** provided by the local people from the nearby area to work at certain stages of the forestry industry such as in tree felling, loading and unloading.
12. **The improved transport network** such as the Trans—Gabon railway (from Libreville at the coast to Franceville in the interior), and roads connecting the forested areas to the processing centres. The railway has opened up large areas of the forests previously inaccessible. This also increases the supply of logs to the factories and thus more supply og wood products to the market.
13. **Presence of a large market** for the forest products both local and foreign. The Okoume tree commands a large market in Asia (like china, Japan), Israel, and the Rest of Africa especially Morocco. China is the largest importer of Gabonese timber products today like plywood, furniture, tanning materials. This has encouraged inveseement in the forestry sector so as to satisfy the demand.
14. **Favourable/supportive government policy** towards the forest sector since 1960s to date. It signed concessions with large timber companies to carry out efficient forest exploitation. It constructed the transport infrastructure like the railway lines connecting lumbering areas and



sawmills at the coast. The government has also invested in giant sawmills (such as at Kango). This in turn increases the quality and quantity of wood production.

15. **The development of forest-based industries** such as at port Gentil, Libreville, cocoa beach, Kango-including sawmills, plywood factories, furniture workshops and boat making factories. These add value to forest output and hence provide immediate market. This encourages wood production.

### **Problems facing the forestry industry in Gabon**

1. **Over exploitation leading to exhaustion of forests near the coast.** Mismanagement has led to over exploitation without appropriate conservation efforts. Presently exploitation is further inland and has necessitated construction of a railway line. Besides the revenue from forestry has been declining due to exhaustion of valuable timber at the coast.
2. **Transport problems to the interior/ poorly developed transport routes** making some forest areas inaccessible. The transport network to the interior is not good, although the 320km railway was constructed to Pointre Noire and another 700km railway across the country to Mekambo. It was very expensive since many bridges had to be put up. It is also hard to maintain roads and railway due heavy rainfall, quick re-growth of forest vegetation.
3. **Long maturity period of the hardwood trees** such as Mahogany, Ebony, taking over 60 years to mature. The trees cut down are difficult to replace and this limits sustainable forest exploitation.
4. **The heterogeneous nature of trees species** / the trees do not occur in pure stands of a single species, but scattered and mixed up with other currently useless tree species. This makes selection and removal of valuable species difficult, hence discouraging exploitation.
5. **Accidents occur** during the felling of trees, leading to destruction of equipment and loss of lives of the workers.
6. **The forests harbor dangerous wild animals** such as cobra snakes, black mamba snakes, lions, which scare away the people working in the forestry sector, hence limiting effective commercial forest exploitation.
7. **Pests and diseases** which affect the trees and negatively affect the quality of timber.

8. **Poor methods of exploitation in some parts of the forests / low levels of technology.** The poor tools used waste wood such as pangas, axes, hand saws etc. this limits the production of high quality and quantity timber.
9. **Competition for market from other forest product exporters** mainly West African countries like Ghana, Cameroon, and Nigeria. This limits the market and discourages further investment in the forestry sector.
10. Limited market for hardwoods
11. Price fluctuations and marketing problems.
12. Profit repatriation by foreign –owned companies from Europe.
13. Limited capital affecting exploitation.
14. Limited skilled labour supply.
15. Buttress roots affecting lumbering.
16. Heavy rainfall affecting lumbering and transport.
17. Opposition from environmentalists/ conservation policies

#### **Steps taken to solve the above problems**

1. Exploitation of forests further inland due to exhaustion of forests near the coast.
2. Re-forestation programmes in areas where forests have been depleted/exhausted.
3. Growing fast growing / maturing trees such as eucalyptus which have a gestation of 12--15 years.
4. Diversification of exports by the government and encouraging cash crop production like cocoa, coffee, ground nuts , rice to reduce over dependence on timber exports.  

The government has also emphasized mineral exploitation such as uranium, manganese, and iron ore, to reduce over dependence on timber exports.
5. Construction and rehabilitation of roads and railway lines to increase accessibility to forest/ lumbering areas.
6. Use of protective gear to guard against accidents when felling trees
7. Spraying with chemicals to control pests and diseases.
8. Carrying market research to widen the external market for timber and timber products.

9. Attraction of foreign investors with enough capital and better technology.

## **FORESTRY IN CANADA**

Canada is part of North America and forests cover about 60% of the land area. Canada is dominated by coniferous forests. Newsprint is the major timber product due to predominance of **Spruce** in the eastern forests and the country is also the largest newsprint producer in the world. The dominance of **Douglas fir** in the western forests also makes Canada a leading producer of sawn wood in the world, much of which is exported.

The major forested areas of Canada are:

- Eastern Canada
- Western Canada ( British Columbia)

## **EASTERN CANADA**

The forests stretch from the Rocky mountain slopes to the Atlantic Ocean. The major lumbering areas are in the Maritime Provinces and the St. Lawrence – Greatlakes region. But these forests in the east are not as valuable as those in the west since they are with smaller and less valuable trees due to harsher climate and poor soils. Main tree species are: **Red spruce** (good for pulp and paper), **Balsam fir** and **a variety of pines**.

Eastern Canada produces all types of Paper and also produces Sawn wood, Furniture and other timber products but still the most important is Newsprint. The Pulp industry is the major user of HEP in Canada. The main producing centres include: **Quebec, Montreal and Toronto**. Other are: **Ottawa, Cornwall on st. Lawrence Seaway, st. John, Corner Brook, Nova Scotia, Grand-Falls and Newfoundland**.

Market exits in N.E USA, Britain and the rest of Europe. There is a large British investment in Canadian forest industries. Pulp is also used in the st. Lawrence –Greatlakes industrial belt of Canada, northern USA and New England for making rayon (for textiles).

## **WESTERN CANADA (BRITISH COLUMBIA)**

British Columbia is Canadian province found in the west. Its economy largely depends on the exploitation of natural resources. The province is largely covered by coniferous forests producing mainly softwood timber.

The major tree species in British Columbia include: **Douglas fir** (which is Canada's leading timber by value), **Spruce** (leading timber by volume), **Western hemlock, Balsam fir, Red cedar, Pines**. British Columbia produces Sawn wood, Plywood, Furniture, Pulp and Paper.

The main lumbering and processing centres include: **Vancouver, Prince George, Kitimat, Prince Rupert, Kamloops, New Westminster, Chilliwack, Nelson, Alberni, and Gold River**.

### **Factors responsible for the development of forestry in British Columbia (Canada)**

#### **Physical**

1. **Rugged / mountainous nature of the landscape** consisting of the Coastal ranges and Rocky Mountains—which prevented other land uses like crop growing and settlement. Glaciation is also responsible for this rugged landscape and which removes fertile soils making the land less supportive to crop farming. All this created room for forests as an alternative land use, thus more forest cover and more wood production.
2. **The temperate climate** with warm summers and mild winters which is ideal for the growth of coniferous forests and which allows forestry to go on throughout the year. The heavy rains on the slopes of the Rocky Mountains also facilitate the rapid growth and maturity of the tree species like Sitka Spruce, Western Hemlock, and Douglas fir. This leads to increased production of forest resources.
3. **The infertile and thin soils** which prevent crop growing and are also responsible for the sparse population, and this allowed a large area of the province to be left for forest growth. Only about 3% of the total land area in British Columbia is agricultural land, forcing many people to seek a livelihood from forests resources.

4. **Availability of extensive forestland** with over 60% of the British Columbia forested. This is partly explained by the low population density of about 4 people per square kilometer—which has left large land area to be left for forests. This in turn leads increased lumbering activities.
5. **Presence of many valuable/commercial tree species** commanding high demand on the world market due to a variety of uses. The most important species are **Douglas fir** –for plywood production, **Spruce** for pulp and paper production, **western Hemlock**, **western Red cedar**, **Balsam fir**, **Pines (like Lodge pole pine)**. Softwood is also used to make furniture, paperboards, newsprint, and tiles. All these ensure a constant supply of mainly soft wood, hence encouraging forestry investors.
6. **The homogeneous nature of the forests**( the trees exist in pure stands of a single species) –that is a particular species like Douglas fir exists in a given area. This leads to easier location, selection, felling and hauling the logs out of the forests –hence facilitating easy exploitation of the coniferous forests. This leads to increased development and exploitation of the forests.
7. **The coniferous logs are light in weight** and therefore easy to transport. They are easy to float on water from the lumbering sites to the sawmills on rivers like Fraser, Skeena, Nass, Kootenay, Columbia, and Stikine River. The logs are moved to booming grounds on special boats (barges) on frozen rivers. This ensures ready supply of wood to processing centres and thus continuous production of timber products.
8. **The short gestation / maturity period of the softwood tree species** like Lodge pole pine, spruce, and red cedar which mature in a period of about 14 to 22 years which facilitates planned exploitation of the forests. This has enabled sustainable exploitation of forests in British Columbia( Canada).
9. **Presence of many fast flowing rivers** which help in transporting logs and yet rivers like Peace, Nechako, and Columbia have dams which are also used to generate hydro- electric power—which is used to run machinery in the saw mills, pulp and paper industries. Therefore power increases efficiency and effectiveness of exploitation of forest resources.

### **Human factors**

1. **Availability of adequate capital to invest in forestry sector** and the initial capital was brought in by US and British farmers. They also brought in the technology and lumber jacks- to cut down, to collect and load on the

trucks skillfully. The government and the private individuals also provided capital used in the purchase of power saws, helicopters, payment of labour and carrying out research training –leading to effective and efficient exploitation of forest resources.

2. **Presence of skilled labourforce** which is relevant to modern forestry operations. It is easier and quicker to work with the telescopic observers, water bombers and chain wheeled trucks. There are experienced and specialized lumberjacks who use power saws to fell trees, firefighters use water bombers and helicopters, and professional botanists who research on fast maturing and high yielding timber. This increases the quality and quantity of forest produce especially timber.
3. **Availability of modern technology** which promotes extensive and intensive mechanization of the forestry sector, with use of tractors to haul logs, bull dozers for quick exploitation, power driven saws to fell trees, fire fighters (telescopic observers, binoculars and water bombers), and chain wheeled trucks to move up and down the steep slopes. The technology improves efficiency and reduces wastage when exploiting wood.
4. **Presence of a large market for softwood products both local and foreign.** It supplies Canadian demands for sawn wood and other timber products, and also a ready market in western USA, Britain and the rest of Europe. There is increased demand for paper in printing books, newsprint, magazines, and paper bags. In turn, there is increased investment in forest plantations and their exploitation in order to satisfy the large market.
5. **Well developed transport system by road, railway and water** connecting the forested areas to the sawmills, pulp and paper industries; and also connected to the coastal ports like **Churchill, Vancouver, prince Rupert,** and **Victoria** to facilitate the exportation of forest products. The railway system is largely electrified which increases efficiency in transportation. This leads to ready supply of wood to factories and increase in the volume of wood products exported.
6. **Favourable/Supportive government policy** for example the Forests are under the control of the Canadian government which minimizes careless and wasteful exploitation the forests. The government also facilitates /encourages research, encourages private companies, construction of the required infrastructure (like railway), and opening international markets for timber and timber products. This facilitates further investment in forestry industry.

7. **Intensive research carried out in the forest sector** to develop fast maturing, high yielding and disease resistant tree species. The trees are planted at regular intervals, thinned, protected against pests and diseases, and with regular inspection. This practice ensures high quality and quantity output from the forestry sector, leading to increased production.
8. **Political stability of the country/the continent** for a very long period of time which has enabled long-term investment in the forestry sector . This is by increasing the area under forest cover, setting up modern wood processing facilities, and attracting more investors and professional workers. This explains the continuous forest planting, exploitation and conservation.

### **Problems facing the forestry industry in British Columbia (Canada)**

1. **Fire outbreak** especially during summer destroying large areas of forests. It is caused by holidaymakers and people on picnics who often leave fires burning in the camps or careless smokers who drop cigarettes. *(The fires are also caused by sparks from power saws and saw mills . conifers have a high pitch content and can easily be gutted by fire).*
2. **Over exploitation of forests** such near Alberni Port and Vancouver areas. Trees are cut down without replacement, leading to depletion of forests in such areas. Rapid exploitation of forests has been due to the discovery of new uses of wood products in the recent years, hence reduced forest cover.
3. **Rugged mountainous landscape** which makes large forested areas not easily accessible as they are far beyond the reach of roads and railway. This increases the costs of exploitation.
4. **Pests and diseases** which attack the trees and destroy them, leads to poor quality timber.
5. **Heavy rainfall** which makes the roads muddy and transport complicated since some trucks stick in the mud. This also leads to inefficiency in production.
6. **Fluctuations in labour force.** The available labour is inadequate considering the fact that British Columbia is sparsely populated. During the dry months of the year, the population is engaged in other activities such as tourism-hence limiting the manpower available for the forestry industry. In winter because other sectors are not vibrant, then labour is

easily available. This fluctuation in labour supply affects the supply of logs to saw mills.

7. **Log jamming in rivers due to congestion**, that is at certain points of the rivers the logs get stuck leading to inefficiency in production.
8. **Accidents** occur when felling trees leading to death of workers. The forests are sometimes faced with strong winds also causing accidents of falling trees. This discourages potential workers.
9. **Lumbering is difficult during winter** especially in the higher latitudes where snow is very common. The felling trees is difficult and it is equally difficult to keep the roads open. Likewise the rivers get frozen and movement of logs difficult. This limits winter lumbering.
10. **Competition from other producing areas of timber products** such as Sweden, Finland, Norway, USSR, and Gabon among others. This limits the available market for Canadian wood and wood products.
11. Government conservation policies / opposition from environmentalists.
12. Presence of dangerous wild animals such as bears, snakes, wild fox which scare away workers.
13. Competition from substitute items on the world market such as plastics, metals.

### **Solutions to the problems facing forestry in British Columbia**

1. Forest fires are controlled using:
  - a) Watch towers high above the trees where fireguards are able to see far and detect fire out breaks.
  - b) Regular patrols using helicopters to detect fire outbreaks.
  - c) Use of mobile fire fighters and water bombers which run very fast and spread water to stop fires.
2. Over exploitation is partly solved by forest farming, a long range harvesting programme, re-a forestation, selective cutting etc. This is to ensure sustainable forest exploitation.
3. Introduction of quick/fast maturing and disease-resistant tree species to increase the area under forest cover.
4. The government also restricts the cutting of trees by imposing high taxes on the forest exploiters and complicated licensing process.



5. Spraying with chemicals to control pests and diseases that attack the trees. This is to increase the quality of wood.
6. Use of chain- wheeled trucks which can move up and down the steep slopes which are slippery –these do not stick in the mud. This makes movement of logs to saw mills easier.
7. Intensive and extensive mechanization to minimize the problem of labour shortage.
8. The use of trained men to remove the jam logs across streams /rivers to ensure steady supply of logs to the factories.
9. To avoid accidents, the fellers carry out the work carefully by checking the positions of their colleagues before each tree falls. The workers also use brightly colored steel helmets.
10. To avoid problems of lumbering during winter, they are **using “log high” and “log low” system**. Areas of higher cooler latitudes are logged during summer when forests are free from ice and snow. Winter logging is carried out in the lower latitudes where roads can be kept open.
11. Competition is being controlled by producing high quality products.

***[Note: Pulp—a soft wood used to make paper***

***Plywood –construction material consisting of thin sheets of wood glued together.***

***Sawn wood –wood in planks (long flat pieces of wood) or board from saw mills].***

## **FORESTRY IN SWEDEN**

Sweden is one of the Scandinavian countries together with Finland and Norway. In Sweden about 50% of the total land area is covered by forests especially in **the central-northern parts** of the country. Most of the trees are coniferous and the most important commercial species is **Spruce** (like Norway spruce, Red spruce). Other species are: **Pines (like Scotch pine, Norwegian pine), Larch, Firs, birch** --which can withstand the climatic conditions.

**Silvi-culture** is a practice taken on in Sweden for over 100 years. It involves trees of the same species, age, and quality that are planted, transplanted

easier, sprayed against pests and diseases, thinned and harvested at regular intervals. It also involves regular inspection of the forests.

Today forests are a major source of wealth and make up a large percentage of Sweden's exports. Timber is transported to saw mills by road, railway and rivers (like **Torne, Ume, Oster, Dal, Pite, Angerman, Trysileva, Skellefte, Lule, Ljungan, and Ljusman**). The tree species in Sweden are exploited for the **pulp industry (the most important)**, sawn wood, paper, among others.

The main wood processing centres in Sweden are **Harnosand** and **Sundsvall**. Other important centres include: **Jonkoping** (important for matches), **Orebro** (paper), **Karlstad, Norrkoping**, and **Trollhattan**.

***\*A sketch map of Sweden showing forest distribution\****

### **Factors which have favoured the development of the forestry industry in Sweden**

1. **The rugged nature of relief** partly explained by glaciation which affected the highland interior and the northern parts of the country, making soils thin and infertile, and this limits the land for cultivation—hence forcing people to turn to other land uses especially forestry. In turn, there is a large area under forests, which increases softwood production. The limited arable farming has also released labour to forestry activities.
2. **The cool temperate climate** with rainfall received throughout the year and the heaviest rains in the late summers. The warm summer temperatures (12-22°C) help in the faster growth / maturing of the tree species like pines, and spruce.—hence continuous supply of softwood. The cold winter with frozen ground favours tree felling and hauling of logs on the snow into the rivers to the saw mills.
3. **Presence of many commercial/ valuable tree species** that is coniferous tree species such as spruce (Norway spruce, Red spruce), pines (Scots pine, Norwegian pine), larch, birch. These tree species have a variety of uses such as for plywood, pulp, sawn wood, paper, paperboards, matches, furniture; hence commanding a large market in Europe and other parts of the world. This has encouraged investment in forestry in Sweden.
4. **The homogeneous nature of the forests**, that is, a close nature of valuable single tree species like spruce in a given part of the forest. This makes

exploitation easier and systematic due to easy selection /searching of tree species; yet even removal of logs from the forests is easier since there is clear-cutting in a given area. This favours continuous / sustainable supply of wood and timber products.

5. **The coniferous logs/ wood are light in weight** and this makes them easy to transport by floating on rivers like Oster, Dal, and Angerman. Remember that floatation is the cheapest way of transporting logs to sawmills and pulp factories. This ensures steady supply of wood, which increases production of wood products for both domestic and foreign market.
6. **The short maturity period of softwood tree species** like Scots pine, Norway spruce, firs, birch and larch. These trees take about 14-20 years to mature, and this enables planned/ sustainable exploitation of the forests, since the forest trees are easy to replace once cut down. This encourages forestry investment.
7. **Presence of many fast flowing rivers** for example such as Oster, Dal, Ljungan, Torne, Angerman, Lule, Ume, Pite, Ljusman; which are used as float ways carrying logs to pulp and paper industries or saw mills along the Baltic sea coast. Still many canals (such Gota Canal) have been constructed to link the forests to the processing centres. Sweden has more than 35,000km of public float ways. This leads to continuity in supply of logs and hence more timber and timber product production.

Besides the rivers provide a ready source of hydro –electricity due to the dams constructed such as Angerman, Dal, Trysileva, Ume, and Torne; and the power is used in running machines in the saw mills , pulp and paper industries , ship building , and furniture workshops. This increases the quality and quantity of output.

8. **The sparse population of the country/ availability of extensive forest land** due to the low population density (*of about 22 people per km<sup>2</sup>*) and most people live in the urban areas of the south. In the forested north (Norrland and Lapland) the population density is much lower. There is limited encroachment on forests for settlement, agriculture and infrastructure. Therefore, there is a large area under forest cover and hence increase in the quantity of wood production.
9. **Availability of large sums of capital** invested in the forestry industry provided by the government, private companies and individual forest growers. The capital is invested in purchase of modern machinery, setting

up processing facilities, development of transport infrastructure like railway, carrying out forestry research, and payment of labour. This favours large scale management of forest resources.

10. **Presence of a large market both local and foreign.** For example in the urban areas of Sweden like Stockholm and Goteborg. There is great demand for timber, pulp and paper in the industrialized countries to the south such as Britain, Germany, France, Holland, and Denmark. Sweden produces pulp, plywood, furniture, cellulose, and matches are also exported to USA, and Japan. There is increased production in the forestry sector to satisfy the ready market.
11. **Presence of highly skilled and specialized labourforce** to work in the forest sector such as forest rangers, lumber jacks, fire fighters, industrial workers, transporters, and botanists. The lumberjacks cut trees with less timber wastage and destruction of young trees. The fire fighters work to stop fires from destroying forests, while the botanists carry out research to improve the quality of tree species. This leads to high quality and quantity of forest products.
12. Sweden has one of the most **developed transport system** in Scandinavia including road and railway networks. For example the Swedish railway running from the south to the north which provides accessibility processing centres like sawmills, pulp and paper industries, and to urban markets. This favours continued supply of wood to factories and ready supply of wood products to the markets.
13. **Presence of modern technology** employed in forestry such as the use of power driven saws for felling and logging, fire fighting technology (such as use of helicopters and water bombers), tractors for hauling logs, bulldozers for quick exploitation, industrial processing technology. The botanists also use modern laboratory equipment in experimenting trees species. This increases the quality and quantity of wood and wood products, thus increased investment in the forestry sector.
14. **Highly developed research in the forestry sector** promoted by the government and private companies. **Silvi-culture** is practiced and involves planting trees of the same species and quality, protecting them against pests and diseases, thinning, regular inspection, harvesting at regular intervals, and replanted at regular intervals. this ensures that fast maturing and disease resistant tree species are realized. This ensures high quality

and quantity of forestry output; and ensures sustainable forest development.

15. **Favourable / supportive government policy** such as setting up the necessary infrastructure such the railway network and port facilities to transport wood products, encouraging private companies and individuals to invest in the forest sector since most of the land is not suitable for crop farming and encouraging forestry research to ensure quality output. The government also controls the forest sector to ensure sustainable forest development.
16. **Political stability of the country** for a long period of time which has enabled long-term investment in the forestry industry such as planting large areas of forests, extraction of wood, logging, transportation and setting processing facilities-since security of investments is assured. This has encouraged more investors and thus continued supply of softwood and associated products like pulp.

### **Contribution of forestry to the economy of Sweden**

1. **Promotion of industrial development** by providing raw materials such wood used in sawn wood, pulp and paper, and plywood industries. The pulp industry remains the most important and the main processing centres are Sundsvall, Harnosand, Karlstad and Trollhattan. Paper production is greatly noted at Orebro; and the production of matches is especially at Jonkoping. Remember that Sweden is world's main producer of matches. This increases the national income of Sweden.
2. **Promoted development of urban centres** and ports along the Baltic coast and in the central lakes area. The major urban centres are Karlstad, Trollhattan, Stockholm, Sundsvall, Harnosand, Norrkoping, Jonkoping, Malmo, Uppsala, Linkoping, Orebro, and Halmstad. These are centres of saw mills , pulp and paper industries , furniture workshops which have attracted population concentration as workers and in turn associated infrastructure like banking, schools, health facilities and recreation facilities.
3. **Generation of foreign exchange** through the exportation of forest products such as sawn wood, pulp, paper, plywood, and furniture, cellulose, to other countries like Britain, Germany, Norway, France, Denmark, and USA. The foreign currency generated is used to obtain foreign technology, consumer goods and paying expatriates.

4. **Generation of many employment opportunities** such as lumber jacks /fellers who sort and cut trees, botanists who research on the tree species, forest rangers/ forest officers, engineers in pulp industries, transporters and export handling workers. The forest sector employs a large percentage of the total working population. These people earn incomes which helps to improve their standards of living.
5. **Encouraged development of float ways** to promote transportation of logs to factories. The forest regions are very accessible due to a large number of rivers, lakes and canals which provide float ways. Sweden has about 35,000km of float ways. Besides forestry has led to development of transport networks such as road network and the Swedish railway system. The transport system does not only facilitate forestry, but also several other activities such as industry, agriculture, tourism, trade and commerce— hence facilitating the general economic development.
6. **Forestry promotes Soil conservation** since the forests occur on the steep slopes of central to northern parts of the country. The forests have protected soils against soil erosion and the occurrence of landslides /avalanches by compact the soils together –hence promoting slope stability.
7. **Habitat for wild life and promote development of tourism.** The forests harbor wild animals like Reindeer (*with branching horns*), Roe deer (*without b.h*), Lemmings, Moose, Bears, Lynx (*wild cat*), Wolves; and many wild birds; and yet the pure stands of the trees also attract many tourists. Both flora and fauna act as items for research and educational studies for the tourists. Tourism also generates foreign exchange and provides market for other locally made products like foodstuffs.
8. **Provision of other forest products** for example fruits, nuts, spices, resin, tar, and tannin. Tannin is a substance found in the bark of certain trees used in conversion of raw hides to leather found in trees like hemlock, cedar, and oak. There are also synthetic textiles known as rayon ( from spruce wood), materials for paint making, and making medicines. All these products when made improve the quality of life /standards of living of the people.
9. Promoted international cooperation/ relationship between Sweden and the importing countries.
10. Diversification of the economy.

11. Generation of government revenue.
12. Forests act as catchment areas for rivers.
13. Modification of climate.
14. Forests used for research and educational studies.
15. Utilization of the land that would otherwise be lying idle.—it utilizes areas that would be wastelands.

### **Negative /shortcomings**

1. **Environmental pollution** such as the water ways are polluted with wastes containing bleach, lignin and fibres. Also the processing industries emit gases and toxic substances which pollute the environment. This reduces the quality of life such as by causing deadly diseases.
2. Urban-related problems such as high crime rate and congestion.
3. Forests hinder transport and communication development.
4. Harbor dangerous wild animals such as wild fox, bear.
5. Occupation of land that would be used for other economic activities.
6. **Straining the government budget** due to the heavy investment in the forest sector which has meant that other sectors like agriculture have been largely underdeveloped.
7. Some forests act as social and economic barriers between people of the opposite sides.
8. **\*Results into regional imbalance in development** because the areas where processing centres exist are more developed in terms of infrastructure than the countryside.

### **FORESTRY IN NORWAY**

Norway is a less important lumbering country compared to Sweden and Finland. About 35% of the land area is under forest cover, and as in other Scandinavian countries the forests are owned mostly by farmers. Approximately 80% of the forests are owned by families/farmers who manage

their forests in combination with farming. The rest of the forests are owned by the state, community and private companies.

**Silvi—culture** and forest improvement are important and new species have been introduced from Alaska and British Columbia in a forestation schemes. The major species of commercial value are: **Norway spruce, Scots pine,** and **birch**. Others include: firs, larch, and other pines.

These softwoods have been used to produce soft boards, furniture, pulp, paper, paint, rayon, and cellulose.

The main centres are: **Trondheim**—an exporting centre as well as having timber industries, **Honefoss**—a saw milling centre, **Kristiansand** and **Skien** have pulp and paper mills, **Drammen** has a wide range of timber processing industries. Rivers like Glomma are used for floating logs.

***Note: the factors for forestry development are similar to Sweden.***

## **FORESTRY IN FINLAND**

Finland is also a Scandinavian country. Like Sweden, much of the original forest cover remains and there is a practice of Silvi—culture which has been practiced for over 100 years. Forest production has been enhanced by the introduction of trees from other countries that give a higher yield of timber. Many farmers have been encouraged to turn their land over to forest to increase forest area and therefore boost timber output.

The major commercial tree species include: **Scots pine, Norway spruce, Firs and larch**—which are exploited for Sawn wood, Pulp and Paper, Rayon, Furniture among other products.

The main rivers for floating logs and producing HEP are: Oulu, Kemijoki, Muonio, and Tornio (Torne).

In Finland there are timber industries at the coastal ports of **Vaasa, Oulu, and Pori**—which also export timber and timber products. The main centre is **Tampere**. Sawn wood, pulp, paper, furniture and other wood working industries are all important. In addition Finland has important engineering industry manufacturing wood-processing machinery both for the local and foreign market.



Finland supplies about 4.5% of the world's pulp much of which is exported to Britain and other European countries with small local timber resources. Finland is also a major exporter of sawn wood.

**Note: factors for the development of forestry are similar to Sweden.**

### **Causes of forest depletion in Africa**

Deforestation refers to the gradual removal / destruction of forested lands to be converted into other uses. There is continued decline of forest cover in Africa greatly by clearance for settlement, agriculture or during exploitation process. The causes of forest depletion in Africa include:

1. **Rapid population growth** which increases the need for settlement and cultivation land thereby encroaching on the forests. For example the population growth rate of Nigeria is 3%, Malawi- 2.8%, DRC-3.1%, and Cameroon-2.4%. In effort to divert land to farming, large areas of forests have been destroyed such as parts of Congo forests, southern Ghana and Cameroon where crop plantations have been established.
2. **Increasing demand for timber and timber products** such as making plywood, furniture, construction, boat-building among others. There is also increasing demand for fuel wood and charcoal for smoking fish (like in West Africa), curing tobacco (such as in Zimbabwe), and domestic cooking. This has also led to continued destruction of forests in Africa.
3. **Careless felling of trees/ poor logging methods.** As people cut down trees for timber, charcoal, firewood they cut even the young trees and yet there is limited or no reforestation of the trees. Therefore each time a tree is cut down there is no replacement and where it has been encouraged it is still limited. This in turn has reduced the forest cover.
4. **Poor farming methods** like shifting cultivation practiced by the Bemba in northern Zambia, Azande in the Congo basin forests. Many farmers also carry out bush burning before cultivation-which ends up destroying large areas of forests.
5. **Need for infrastructural development and industrialization** involving roads, railways, schools, hospitals, and recreation centres ,which have been set up after destroying part of the existing forests. More so, the process of infrastructural development and industrialization requires large quantities

of poles, timber and timber products. For example power transmission requires poles and timber—hence quickening forest destruction in Africa.

6. **Effect of mining activities** in large areas of forests which are destroyed to access the mineral ores especially with use of open cast mining such as copper mining in the Shaba province of Congo and the Zambian copper belt, diamond and gold mining in Ghana, and iron ore mining in Gabon. Many trees are destroyed and not replaced.
7. **Low level of power and energy development in Africa/ lack of alternative sources of energy** and this has led to continued cutting down of trees to get firewood and charcoal, since the people have limited or no alternative. This is compounded by the poverty in Africa with many people engaged in selling firewood and charcoal for survival.
8. **Forest/wild fires** especially during the dry season caused by careless smokers, hunters, or cultivators intentionally or accidentally-hence destroying large areas of forests.
9. **Damage by wild animals** such as elephants, giraffe in the national parks and reserves especially where many of such animals exist in a given area. For example in Tsavo park elephants destroyed the vegetation tending to create an “elephant desert”.
10. **Pests and diseases** which also lead to continued destruction of forest trees such as aphids destroying soft wood trees. There is also cutting down of trees in order to control the pests and diseases. This in turn reduces the forest cover.
11. **Political instabilities in many parts of Africa** for example in the Congo basin forests where the rebel activities have existed for long, West African forests (like Nigeria, Togo, Ivory Coast, Liberia) where the forests have been bombed or cut down suspected to be hiding places for rebels. The continued violence makes the natural forests hard to maintain.
12. **Government negligence to conserve forest resources** such as lack of a comprehensive conservation policy and poor law enforcement against forest encroachers. There is also inadequate funding and high degree of corruption in the forest departments. This results into continued destruction of the forests.

13. ***Prolonged drought conditions*** for example the fact that the Sahara desert is extending southwards and thus declining forest cover. The northern parts of the Congo forests are turning into woodlands.

#### **Effects of forest depletion in Africa**

1. **Brings changes in local climate.** Forest depletion brings adverse effects on the climatic conditions by bringing low rainfall which is also irregular due to reduced evapo-transpiration. This leads to desert conditions.
2. **Decline in agricultural productivity** which leads to famine. Because most Africans are farmers they have been affected by increasing poverty due to declining crop and animal performance.
3. **Decrease in timber products** because of the long regeneration/ maturity period and the little reforestation. Therefore, Africa's future survival on timber products is not assured.
4. **Causes severe lack of fuel resources** especially in the areas of increasing populations such as southern Ghana and southern Nigeria. This is increasing difficulty in acquiring wood for fuel.
5. **Destruction of habitats for wild animals and birds** for example monkeys, buffalo, elephants, eagles, cranes—which also limits the tourist potentials in various parts of Africa.
6. **Leads to soil erosion and mass wasting** which affect the people in various areas. This leads to low crop yields due to reduce soil fertility and poverty due to reduced earnings from farming. Mass wasting (landslides) affect especially highland areas where forests have been cleared –leading to loss of life and property.
7. **Leads to increased incidence of economic refugees** since the areas facing environmental degradation are often struck by drought and famine making people to migrate to other areas that are productive. This strains the receiving areas.
8. **Increased government expenditure** due to the need to handle the situation when programs like reforestation and afforestation are put in place. There is also need to import food to feed the affected people, hence straining the government budget.

9. **Decline in revenue in form of foreign exchange** due to importation of forest products, which are some of the direct benefits from the forests. This in turn compromises other government activities like health and education service provision.
10. **Decline in water table because forests would act as bases for water streams and rivers.** The forests would allow water to infiltrate the soil hence increased water table, but the clearance of forests undermines this purpose.

### **Forest conservation**

1. **Afforestation** which involves planting of trees in areas which have not been previously covered with forests. In some countries governments give incentives to farmers who turn their arable land to forest. It mostly involves planting quick maturing trees especially conifers—like pines.
2. **Re-afforestation** which involves replacing the trees which have been cut down. In some countries (such as Germany) every tree cut down must be replaced by law. The new trees may or may not be the same as those removed. Conifers are preferred due to shorter gestation period and more useful such as pines, Cyprus.
3. **Silvi-culture** which is a system where logged areas are planted with more trees and they are properly cared for. It involves planting of trees of the same quality, age, and grade; replanted at regular intervals, protected against pests and diseases, thinned and harvested at regular intervals. It involves planting the trees in line and quick maturing species that readily meet market demand.
4. **Improved tree cutting practices** such as selective cutting of trees, the forests stand a better chance of regeneration and survival. It involves removing the mature trees or the diseased ones.
5. **Forest protection** for both the natural and planted forests from hazards such as pests or fires. This can involve a close system of inspection using towers and air patrols as can be seen in Scandinavia and North America.
6. **Reducing wastage at the industrial level** for example use of pulp which is not suitable for paper to make fibre and particle boards for the building industry. Also the re-use of waste paper in the production of newsprint and other inferior paper products. The greater use of plastics rather than paper

for packaging purposes. It can also involve using trees more intensively to reduce cutting down of more trees.

7. **Gazetting areas into forest reserves** to reduce on the encroachment of people on forests for other activities like farming. There should also be eviction of encroachers by the forest department. This in turn increases the forest cover.
8. **Encouraging use of alternative sources of energy** such as biogas, agricultural wastes(coffee husks, sugarcane husks, banana peelings) , and the use of HEP. This in turn reduces the cutting down of forests.
9. **Use of energy saving stoves** which reduce on the demand for firewood and charcoal; and hence reduction in forest destruction.
10. **Training labour force** as forest rangers, and supervisors to manage the forests in various departments such as fighting against forest encroachers.
11. **Government legislation** against forest encroachment, regulating the issuing of licenses /permits to reduce careless cutting down of trees. It also calls for serious enforcement of the conservation laws.
12. **Emphasizing Population control measures** to reduce the cutting down of forests for settlement and cultivation in various areas.
13. **Ensuring peace and stability** in all areas to reduce forest destruction. This can be through peacetalks and promotion of international relationship with neighboring countries.
14. **Education/sensitization of the masses** about the value of forests and the need to conserve nature.

## **PLANTED/ ARTIFICIAL FORESTS**

These are forests planted by man and not indigenous to an area. They are also called man-made forests. The world's hope in global wood requirements lies in planted forests. They are often of a singletree species.

### **Man -made forests Swaziland**

Swaziland is a small country found in Southern Africa. Most of the forests are man-made / artificial coniferous forests which have been planted since the 1940s. Many years ago, Swaziland had many great forests which were

unfortunately greatly destroyed for fuel and to create more farmland. Over grazing and heavy rainfall of the Drakensburg caused severe soil erosion.

However, since the 1940s much reforestation and afforestation has taken place. Planted forests play a great role in the economy of Swaziland. There are now vast/ large coniferous forests in the hilly and mountainous region.

The major forested areas include:

- a) **Sappi Usutu** (*formerly Great Usutu forest*)—further South near Mbabane exceeding 70,000ha. It is the largest man-made forest and covers about 4% of Swaziland's total area. It is situated at Bhunya near Mbabane, on either side of the great Usutu River. It was started in 1949 when 40,000 hectares were planted with exotic tree species such as *Pinus Patula* from Mexico and *Pinus Taeda* from USA. Today this forest covers over 70,000 hectares. It was financed by the common wealth development corporation.
- b) **Mondi peak** (*formerly Piggs peak forest*)—North West of Swaziland covering about 32,000ha. This is the second major forest area and it is managed by the pigs timber company.
- c) **Shiselweni** (*formerly Nhlanguano forest*)—in the South West (which is the most recent).

## Organization

The country has carefully planned a rotational system of afforestation to ensure that timber is maintained to support the economy. The forests mainly consist of pines, eucalyptus. The forests are scientifically managed with well-maintained access roads crossing from all directions. It has many divisions planted on a rotational basis to ensure steady and regular supply of wood to the processing factories. The trees mature within 15 to 20 years. Trees are cut using mechanical saws and tractors are used to drag the logs to the main service roads where they are loaded on to huge trucks for transport to the sawmills.

Forests such as the Great Usutu and Mondi peak have their own processing factories and saw mills. They produce pulp, sawn timber/wood, pit props, and telegraph poles, telephone poles, tanning materials, plywood, furniture, Paper etc

Many companies are involved in forests such as the Usutu pulp company produces pulp and the spring wood cellulose company does the marketing in Great Usutu. The Piggs timber company manages the Piggs peak forests.

### ***Sketch map showing the major forests of Swaziland***

#### **Advantages of planted forests in Swaziland**

1. They grow and mature very fast, taking about 15 years.
2. The trees occur in pure stands, which makes their exploitation easy.
3. They produce softwood, which has a variety of uses.
4. They lead to effective use of land that otherwise would be lying idle due to being rugged.
5. The forests conserve the environment by controlling soil erosion and protecting water catchment areas.
6. They yield valuable softwood products which have a variety of uses, hence generating revenue.
7. They modify the climate through evapo-transportation which favours rainfall formation.
8. The planted forests are used for research and educational purposes.

#### **Factors/ conditions which have favoured forestry in Swaziland**

1. **The sub-tropical climate** characterized by moderate to heavy rainfall ranging from 1000mm to 2200mm (tropical to sub-tropical climate) for quick maturing of softwood forests. This in turn favours extensive forest cover and thus increased supply of timber and timber products.
2. **Cool temperatures due to high altitude of over 1000m above sea level** which favours the growth of softwood species. This in turn encourages the establishment of more tree plantations and thus increasing the supply of softwood and softwood products in Swaziland.
3. **The mountainous/hilly and rugged nature of the landscape** in the western part of the country which cannot support settlement and crop cultivation, hence availability of extensive areas occupied by forests. This

explains why most of the forests are located in the western parts of the country such as the Great Usutu forests in Bhunya. The extensive forests encourage wood production in Swaziland.

4. **The need to preserve hilly slopes** especially the Drakensburg Mountains from erosion and protect the water catchment areas by planting trees. This has resulted into large areas of forest cover and in therefore sustainable forest exploitation since there is always need to replace the trees cut down to protect the environment.
5. **Presence of valuable/ commercial tree species** which grow and mature very fast in a period of 15—20 years such as pines (*like Pinus Patula , Pinus Taeda*) favouring steady supply of softwood by planting the trees in intervals (rotational system) and hence sustainable forest exploitation. The soft wood trees also have a variety of uses such as furniture, sawn wood, pulp, paperboards, pit props, telegraph poles; which encourages production.
6. **The tree also occur in pure stands** which makes their exploitation/ harvesting easy. A single species exists in a given area making it easy to locate and cut down the trees. Clear cutting is majorly done in which all the trees are removed and replaced at once. Easy exploitation increases the supply of timber and timber products.
7. **Availability of adequate/ large sums of capital** provided by Swaziland government, local and foreign investors (*the Common Wealth Development Corporation*) to invest in the forestry industry such as; establishment of large plantations (*like the Great Usutu and Piggs peak*), financing the pulp mills (*like at Bhunya* ) , constructing transport routes, carrying out forest research to develop more fast maturing and disease resistant trees. This increases the forest area, the production and supply of wood.
8. Presence of skilled labour to work in the forestry industry such as carrying out research on tree species, careful selection and felling trees, transportation of logs to saw mills, timber processing in the factories, grading and exportation of wood products. This in turn increases the quality and quantity of timber production.
9. **Presence of a ready/ large local and foreign market** for the soft wood forest products such as pulp, plywood, sawn wood, and furniture. There is a large demand forest products in united kingdom, Switzerland, south Africa , Botswana, Namibia, Lesotho. This therefore encourages the establishment of more tree plantations to satisfy the large market.



10. **Developed / improved transport network by road, railway and water** linking to processing centres and markets. The planted forests such as the great Usutu have a network of roads linking to the main roads and railway leading to the factories and sawmills which encourages the supply of wood. The railroads are also connected to the ports like Maputo and Durban which increases the exportation of timber products.
11. **Advanced/ Improved technology used in the forestry sector** which has simplified the forestry activities such as in felling trees using mechanical saws, use of tractors to haul logs to the main service roads, also industrial processing machinery which increases the quality and quantity of output. This in turn encourages further investment in the forestry sector.
16. **The development of timber processing factories** such as at Mbabane that produce sawn timber, boards, pit props, furniture, pulp, telegraph poles. These provide immediate market for wood, and add value to forest output which commands high prices and in turn increasing the income from the forest sector.
12. **Favourable / positive government policy of afforestation and reafforestation** to ensure sustainable forest utilization. There was a government policy of attempting to use the land available in the most economical way because of being rugged and hence establishment of large tree plantations, leading increased timber production.
13. **Presence of ready supply of hydro-electric power** which is used in the processing of wood / timber in the factories, and hence encouraging further forestry investment.
14. **Increased scientific research and management of the forests.** The forests have a carefully planned rotation system of reforestation that ensures continued existence of the large forest cover. The introduction of tree species especially pines, *and also wattle, eucalyptus* which have a short maturity period of about 15 –20 years and disease resistant is also based on research in other countries. This ensures steady supply of wood and thus sustainable exploitation.

#### **Problems facing the forestry sector in Swaziland**

1. Fire outbreaks destroying forests and thus limiting production.
2. Pests and diseases which destroy the trees and thus limit production.

3. Poor transport network due to the rugged nature of the landscape which limits accessibility to some forested areas.
4. Competition for market with other soft wood producing countries which limits export earnings.
5. Over dependence on foreign companies which repatriate the profits to their home countries.
6. Limited capital to invest in the forestry industry such as purchasing modern equipment and funding research.
7. Long distance to markets abroad, which increases the costs of production.
8. Shortage of skilled labour due to the small population in most areas which limits production.
9. Price fluctuations on the world market which discourages production/ leads to fluctuation in export earnings.
10. Competition from alternative raw materials in the industrialized countries such as plastics, metals; which reduces the demand for timber.
11. Rapid population increase which creates more land for settlement and farming, hence encroachment on forestland.

### **Guiding questions**

- 1) Assess the role of the forestry sector to the economy of either Canada or Swaziland.
- 2) Examine the economic significance of the forestry industry to either British Columbia or Norway.
- 3) With reference to either British Columbia province of Canada or Gabon
  - (a) Discuss the problems facing the forestry industry.
  - (b) What steps are being taken to solve the above problems?
- 4) Account for the development and importance of the forest sector in either Scandinavia or North America.
- 5) With reference to a specific country in either North America or tropical Africa, discuss the problems involved in the exploitation of the forestry industry.

- 6) Describe the characteristics of tropical rain forests and discuss the problems associated with their exploitation.
- 7) Compare the characteristic features of equatorial forests with those of coniferous forests, and describe the strategies taken to improve the forestry industry in either a developing or a developed country.
- 8) (a) Compare the forests in the higher latitudes with those in the lower latitudes.  
  
(b) How are the forests in the lower latitudes an obstacle to their exploitation?
- 9) Explain the importance of forests to the economy of either Sweden or Ghana.
- 10) Account for the development of forestry in either Gabon or Norway.
- 11) To what extent have physical factors favoured the development of forestry in either Finland or Swaziland?
- 12) The effective utilization of equatorial forests/ tropical evergreen forests has been mainly limited by human factors. Discuss.
- 13) Examine the problems facing the utilization of forest resources in either the Amazon basin or Congo basin.