Water, Forest and Biodiversity Management

Unit 10

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Introduction

Water resources are sources of water that are useful or potentially useful to humans. Uses of water span agricultural, industrial, household, recreational and environmental activities. All these human activities require fresh water. Life would cease to exist without water.

Salt water constitutes 97% of water on Earth. Two- thirds of the remaining fresh 3% fresh water comprises frozen glaciers and polar ice caps. The residual share of unfrozen freshwater is mainly found as groundwater, with only a small fraction present above the ground or in the air.

Water Management

Though fresh water is a renewable resource, yet the world's supply of clean, fresh water is on a steady decline. With an incidental rise in population there is greater demand for fresh water, which heightens the problem of shortage of fresh water. The demand for water already surpasses its supply in many parts of the world. The awareness of the global importance of preserving water for ecosystem services has only recently emerged. This awareness came only after more than half the world's wetlands were lost along with their valuable environmental services, with industrial development in the 20th century. Biodiversity-rich freshwater ecosystems are currently declining faster than marine or land Ecosystems.

Importance of water management in crop production

Water is one of the most important inputs essential for the production of crops. Life cannot sustain without water. Plants need it in large quantities continuously during their life. It profoundly influences photosynthesis, respiration, absorption, translocation and utilisation of mineral nutrients and cell division besides some other processes. Both its shortage and excess affects the growth and development of plants directly and consequently, its yield and quality. Rainfall is the cheapest source of natural water supply for crop plants. The irrigation system also depends heavily on rainwater, thus creating more draughts and floods whenever rainfall is uneven. Its frequency distribution and amount are not in accordance with the needs of the crops. Artificial water supply through irrigation on one occasion and removal of excess water through drainage on another occasion, therefore, become imperative if the crops are to be raised successfully.

Water affects the performance of crops not only directly but also indirectly by influencing the availability of other nutrients, the timing of cultural operations etc. Water and other production inputs interact with one another. In proper combinations, crop yields can be boosted manifold under irrigated agriculture.

The construction of dams and reservoirs, the conveyance of water from storage points to the fields, the operation and the maintenance of canal systems all involve huge expenses. The misuse of water leads to problems of water logging, salt- imbalance etc., thus rendering agricultural lands unproductive. Hence, a proper understanding (among people from myriad occupations) of the relationship among soils, crops, climate and water-resources for maximum crop production is very important.

The water, flowing on the surface and that seeping into the ground, forms the following two major sources of water for irrigating crops:

- **Surface-Water Resources**

This surface-flowing water needs to be trapped in ponds, tanks, lakes or artificial reservoirs when it is available in abundance so that it can be efficiently used for irrigation during dry periods to facilitate irrigation.

- **Ground-Water Sources**

Substantial supplies are also available from ground-water sources. Large amounts of rainwater seeps into the ground. Of the 800,000 million cubic meters of rainwater that seeps into the ground annually, about 430,000 million cubic meters of it is absorbed by the surface layers of the earth's crust and thus, can be utilised directly by vegetation in the process of evapo-transpiration and growth. The residual 370,000 million cubic metres of rainwater percolates deep into the porous strata of the earth's crust, representing the gross annual enrichment of the underground water. This ground water is tapped by digging or drilling wells and is lifted by using mechanical devices for irrigating the crops. This process is aided by the government to ensure that farmers have sufficient supply of water that meets their irrigation needs and accrue more harvests per year.

Soil -Water System

Availability of water for crop plants

Soil is a heterogeneous mass and consists of three phases, viz. solid phase, liquid phase and gaseous phase. Mineral matter, consisting of sand, silt and clay and organic matter, forms the solid phase, which serves as a framework (matrix) with numerous pores of different shapes and sizes holding air and water in various proportions. Soil is a porous medium and serves as a water reservoir or bank. Water is deposited in this bank by rain or irrigation and plants withdraw it during their growth. The soil quality is important in retention of water. In desert areas, for example, there is no retention of water in the soil and therefore, plants cannot grow there easily. Some varieties of cacti may exist in these regions.

Water is retained by a soil particle in the form of a thin film around it and in the numerous small pores of the soil matrix with forces like surface tension capillarity, cohesion and adhesion. Salts present in soil water accentuate these forces by way of osmotic pressure. Plants, therefore, need to exert at least an equal amount of force for extracting water from the soil mass for their growth.

Immediately after rain or irrigation, water infiltrates into the soil and continues to move downwards into the soil mass to deeper layers. This downward movement is because of the gravitational force. The downward movement of water practically ceases after a certain time (normally after 48 to 72 hours). The water retained in the soil under this situation is termed 'field capacity' which forms the upper limit of the available soil moisture for crop plants. In other words, any further addition of water will not be retained by the soil, but will be lost through deep percolation beyond the roots of a crop, thus making it unavailable for the growth of its plants. After the wetting of the soil, as evaporation and transpiration continue, the soil water goes on diminishing till a point is reached when plants are unable to extract it. The moisture content at this stage is termed 'permanent wilting- point' and this sets the lower limit of the availability of soil water. In other words, any moisture below this point will not support plant growth. The range of soil water between the field capacity and the permanent wilting-point is termed 'available soil water for crop growth'. The available soil water-holding capacity increases mainly with the fineness of texture and the content of organic matter.

Availability of soil water for crop growth

Three classical hypotheses have been put forth for the relative availability of soil water in the available range.

- Water availability and consequently, the crop growth are equal and uniform over the entire range from the field capacity to the permanent wilting-point. This holds good generally, for perennial species such as orchard and tree crops whose dense root mass permeates the soil matrix thoroughly.

- Water availability and crop growth proceed uniformly from the field capacity to a certain critical point beyond which crop growth decreases rapidly until the permanent wilting- point is reached. This view holds good for most of the seasonal field crops maturing up to the seed stage.

Water Management in Developing Countries

The community's current water-related strategies and activities

Water management is considered an inter-sectoral question as it has an important role to play in all areas of development: health, food security, transport, trade etc. Regional cooperation is of particular importance since water is often a trans-boundary resource. Water management is therefore considered one of the most important aspects for the future of the world.

Future guidelines

It is essential to integrate water management into all development policies. With a view to achieving the goals in this field.

Raising the policy profile

More attention must be paid to the fragility of water resources and a more resolute political approach encompassing all the areas linked to water management, such as environmental sustainability, pollution etc., must be adopted. If this is followed through, there will be a rise in scarcity of water and the problem will intensify. Six development priorities of the Community are the overarching framework for these activities. Within these priorities, the Commission identifies three objectives:

- Ensuring supply to every human being, especially the poorest, of sufficient drinking water of good quality and adequate means of waste disposal.
- Sustainable and equitable trans-boundary water resource management
- Cross-sectoral coordination to ensure fair and appropriate distribution of water between users of different kinds

Implementation of an integrated approach to water management

The Commission identifies five activities required to achieve integrated management of water resources, namely:

- Awareness and participation: Users must be aware of the importance of water as a resource and their responsibilities in relation to sound management of this precious resource. Ownership is a key factor in the success of the policies and the participation of actors at all levels is thus essential.
- Institution capacity building: The success of activities is contingent upon capacity, resources and expertise of the institutions concerned. Support must be provided for the institutions responsible for water management.
- Demand-based management: It is not adequate to manage only water distribution; supply must also be managed. The challenge entails reduction of demand while increasing output through initiatives such as reuse of water, protecting water resources etc.

- Expanding knowledge base: Necessary knowledge and information are essential for drawing up effective policies.
- Coordination: Coordination among donors (community, member states, the United Nations, NGOs etc.) must be strengthened.

Water-Related Action for Its Different Uses

This approach must encompass all uses of water. The Commission highlights the priority actions in the following fields:

- Secure water supply and adequate sanitation for all: Emphasis is placed on the importance of sanitation.
- Use of water in agriculture for food and production to ensure food security: The Commission highlights the importance of saving water and promoting healthy agricultural practices to avoid contamination of water sources.
- Protecting and restoring water resources and ecosystems to contribute to the long-term sustainability of water use.
- Water as a source of energy and resource for industry: Rational water use must be ensured and pollution must be reduced and avoided.
- Management of water-related risks and of coastal areas: Risks relating to floods, droughts etc must be prevented through the establishment of warning systems and rapid response capacity systems.

All sources of public and private financing must be mobilised to implement these actions.

Key Global Challenges

The international community must tackle some significant questions that are becoming increasingly critical as water resources become scarce. The three major challenges are:

- Trans-boundary water management for conflict prevention
- Implications of climate change
- The impact of the globalisation of trade on water management

Given that water resources are increasingly limited, the possibilities of conflicts over transboundary water management are on the rise. Support must be provided for measures aimed at improving regional cooperation on the management of transboundary water resources.

Developing countries are particularly vulnerable to the problems linked to climate change such as floods and droughts. Assistance in the form of research and capacity building that enables them to prevent and react to growing problems is necessary. The fact that they lack enough resources to manage with limited infrastructure hampers their efforts to conserve water more efficiently.

With regard to trade, the liberalisation of international trade could have a positive impact on developing countries. Imports of water-intensive food crops may prove to be a practical and cost-effective approach to ensuring food security. However, it is essential not to compromise a country's long-term prospects of overall food security or have a negative impact on farmers who grow food crops in developing countries.

A strategic partnership must be established at the international level in order to achieve objectives and resolve problems. This process should be followed by developing countries and encompass civil society. This will ensure some stability in the system and lesser fights between countries over water.

Water Reservoirs

A reservoir is an artificial lake employed to store water. Reservoirs may be created in river valleys by the construction of a dam or may be built by excavation in the ground or by conventional construction techniques such as brickwork or cast concrete.
The term reservoir may also be used to describe underground reservoirs such as an oil or water well.
A dam is constructed mainly to preserve water for further usage. A dam constructed in a valley relies on the natural topography to afford the basin area of the reservoir. Dams are typically located at a narrow part of a valley downstream of a natural basin. The valley sides act as natural walls with the dam located at the narrowest practical point to provide strength and the lowest practical cost of construction. Building a dam has its own ramifications though. In many reservoir construction projects, people have to be moved and re-located, historical artifacts have to be shifted or rare environments need to be relocated.
Examples include the temples of Abu Simbel (which was moved before the construction of the Aswan Dam to create Lake Nasser from the Nile in Egypt) and the re-location of the village of Capel Celyn during the construction of Llyn Celyn Construction of a reservoir in a valley will usually necessitate the diversion of the river during part of the construction often through a temporary tunnel or by-pass channel.

Uses

Direct water supply: The water stored in dams is utilised for many purposes. Many dam river reservoirs and most bank-side reservoirs are used to provide the raw water feed to a water treatment plant, which delivers drinking water through water mains. The reservoir does not simply hold water until it is needed; it can also be the first part of the water treatment process. The time the water is held for before it is released is known as the retention time. These design features allow particles, silt to settle down and makes time for natural biological treatment using algae, bacteria and zooplankton that naturally live within the water. The stored water essentially contains impurities, which cannot be cleaned naturally.

Natural processes in temperate climate lakes produces temperature stratification in the water body which tends to partition some elements such as manganese and phosphorus into deep, cold anoxic water during the summer months. In autumn and winter, the lake becomes fully mixed again. During drought conditions, it is sometimes necessary to draw down the cold bottom water and such elevated levels of manganese in particular can cause problems in water treatment plants.

Hydroelectricity: Water has many more benefits when it is stored in the dams. One huge Benefit; is its propensity to generate electricity. A reservoir generating hydroelectric power has turbines connected to the retained water body by large-diameter pipes. These generating sets may be at the base of the dam or some distance away. Some reservoirs generating hydro-electricity use pumped re-charge in which a high-level reservoir is filled with water using high performance electric pumps at times when electricity demand is low. They then use this stored water to generate electricity by releasing the stored water into a low-level reservoir when electricity demand is high. Such systems are called pump storage schemes. This benefit is very important as electricity is one of the most important aspects in today's life and many Indian states are losing money as they lack enough electricity to meet their needs.

Controlling watercourses: Reservoirs can be used in a number of ways to control how water flows through downstream waterways.

Downstream water supply: Water may be released from an upland reservoir so that it can be utilised for drinking lower down the system, sometimes hundreds of miles further down downstream

Irrigation: Water in an irrigation reservoir may be released into networks of canals for use in farmlands or secondary water systems. These canals can be open or closed. Irrigation may also be supported by reservoirs, which maintain river flows allowing water to be harvested for irrigation lower down the river.

Flood control: Flood control reservoirs collect water during times of very high rainfall and then release it slowly over the course of the following weeks or months. This is done with meticulous planning and experience. Some of these reservoirs are constructed across the river line with the onward flow controlled by an orifice plate. When river flow exceeds the capacity of the orifice plate, water collects behind the dam, but as soon as the flow rate reduces, the water behind the dam slowly releases until the reservoir is empty again. In some cases, such reservoirs only function a few times in a decade and the land behind the reservoir may be developed as community or recreational land. This primarily transforms in to agricultural land. Such land cannot be employed for industrial use. New generations of balancing dams are being developed to combat the climatic consequences of climate change. They are called 'flood detention reservoirs'. However, they possess a risk of clay core drying out and reduction in structural stability, because these reservoirs remain dry for long periods. Recent developments include the use of composite core fill made from recycled materials as an alternative to clay. Thus, modern technology amplifies the efficiency of water management.

Canals: Where a natural watercourse's water is not available to be diverted into a canal, a reservoir may be built to guarantee the water level in the canal, for example, where a canal climbs to cross a range of hills through locks. The water may be stored here to maintain surplus supply and / or to ensure excess space in case of floods.

Recreation: Water may be released from a reservoir to artificially create or supplement white-water conditions for kayaking and other white-water sports. On salmonid rivers, special releases (in Britain called freshets) are made to encourage natural migration behaviours in fish and to provide a variety of fishing conditions for anglers.

Environmental Impact

Whole life environmental impact: All reservoirs will have a monetary cost/benefit assessment made before construction to see if the project is worth proceeding with. However, such analysis can often omit the environmental impacts of dams and the reservoirs that they contain. Often, the dam wrecks the ecosystem that has formed in that particular region. Some impacts such as greenhouse gas production associated with concrete manufacture are relatively easy to estimate. Other impacts on the natural environment and social and cultural effects can be more difficult to assess and to weigh in the balance but identification and quantification of these issues are now commonly required in major construction projects in the developed world.

Climate change: Depending upon the circumstances, a reservoir built for hydro-electricity generation can either reduce or increase the net production of greenhouse gases. An increase can occur if plant material in the flooded areas decays in an anaerobic environment releasing methane and carbon dioxide. This apparently counter intuitive position arises because much carbon is released as methane, which is approximately eight times more potent as a greenhouse gas than carbon dioxide. This increase can be dangerous for the environment and hence it should be avoided as much as possible.

A study for the National Institute for Research in the Amazon evinced that hydroelectric reservoirs release a large pulse of carbon dioxide from above-water decay of trees left standing in the reservoirs, especially during the first decade after closing. This elevates the global warming impact of the dams to levels much higher than would occur by generating the same power from fossil fuels. According to the World Commission on Dams Report (Dams and Development), when the reservoir is relatively large and no prior clearing of the forest in the flooded area was undertaken, greenhouse gas emissions from the reservoir could be higher than those of a conventional oil-fired thermal generation plant. For instance, in 1990, the impoundment behind the Balbina Dam in Brazil (closed in 1987) had over 20 times the impact on global warming than generating the same power from fossil fuels would, due to the large area flooded per unit of electricity generated.

A decrease can occur if the dam is employed in place of traditional power generation, since electricity produced from hydroelectric generation does not give rise to any fuel gas emissions from fossil fuel combustion (including sulfur dioxide, nitric oxide and carbon monoxide from coal). The Tucurui dam in Brazil (closed in 1984) had only 0.4 times the impact on global warming than would generate the same power from fossil fuels.

Dams and their Role

A dam is a barrier that impounds water or underground streams. Dams generally serve the primary purpose of retaining water, while other structures such as floodgates or levees (also known as dikes) are used to manage or prevent the water's flow into specific land regions.

Types of Dams

a. **By size**: International standards define large dams as higher than 15–20 meters and major dams as over 150–250 meters in height. An auxiliary dam is constructed to confine the reservoir created by a primary dam either to permit a higher water elevation and storage or to limit the extent of a reservoir for increased efficiency.

- **An auxiliary dam**: It is constructed in a low area or saddle through which the reservoir water would otherwise escape. On occasion, a reservoir is contained by a similar structure called a dike to prevent inundation of nearby land. Dikes are commonly used for reclamation of arable land from a shallow lake. This is similar to a levee, which is a wall or embankment built along a river or stream to protect the adjacent land from flooding.
- An overflow dam: It is designed to be over-topped. A weir is a type of small overflow dam that is often used within a river channel to create an impoundment lake for water abstraction purposes and which can also be used for flow measurement.

- Check dam: It is a small dam designed to reduce flow velocity and control soil erosion. Conversely, a wing dam is a structure that only partly restricts a waterway, creating a faster channel that resists the accumulation of sediment.
- Dry dam: It is a dam designed to control flooding. It normally holds back no water and allows the channel to flow freely, except during periods of intense flow that would otherwise cause flooding downstream.
- Diversionary dam: It is a structure designed to divert all or a portion of the flow of a river from its natural course.

By Structure

Based on structure and material used, dams are classified as timber dams, arch dams, gravity dams, embankment dams or masonry dams, with several subtypes.

- **Timber dams**: Timber dams were widely used in the early part of the industrial revolution and in frontier areas due to ease and speed of construction. Rarely built in modern times by humans because of their relatively short lifespan and limited height, timber dams must be constantly kept wet in order to maintain their water retention properties and limit deterioration by rot, similar to a barrel. The locations where timber dams are most economical to build are those where either timber is plentiful and cement is costly or difficult to transport or where a low head diversion dam is required or longevity is not an issue.

- **Arch dams:** An arch dam is a type of dam that is curved and generally built with concrete. The arch dam is a structure that is designed to curve upstream so that the force of the water against it, known as hydrostatic pressure, presses against the arch, compressing and strengthening the structure as it pushes into its foundation or abutments. An arch dam is most suitable for narrow gorges or canyons with steep walls of stable rock to support the structure and stresses. Since they are thinner than any other dam type, they require smaller amounts of construction material, thereby making them economical and practical in remote areas.

Fig. 10.1: Arch-Gravity Hoover Dam

- Gravity dams: A gravity dam is constructed from concrete or masonry or sometimes both. It is called a gravity dam because gravity holds it down to the ground stopping the water in the reservoir pushing it over. Gravity dams use their own weight to resist opposing forces and as such require a hard bedrock foundation. A cross-section (or slice) through a gravity dam will usually look roughly triangular. Gravity dams are suited to sites with either wide or narrow valleys, but they do need to be built on sound rock formation

Fig 10.2 Gravity dam - Dworshak Dam

- **Embankment dams**: These are made from compacted earth and are of two main types, rock-fill and earth-fill dams. Embankment dams rely on their weight to hold back the force of water, similar to gravity dams made from concrete. Rock-fill dams are embankments of compacted free-draining granular earth with an impervious zone. The earth utilised for this often contains a large percentage of large particles, hence we use the term rock-fill. Earth-fill dams, also called earthen, rolled-earth or simply earth dams, are constructed as a simple embankment of well-compacted earth.

Purposes of Dams

Function	Example
Power generation	Hydroelectric power is a major source of electricity in the world. Many countries possess rivers with adequate water flow that can be dammed for power generation purposes. For example, the Itaipu on the Paraná River in South America generated 14 GW and supplied 93% of the energy consumed by Paraguay and 20% of that consumed by Brazil as of 2005.
Water supply	Many urban areas of the world are supplied with water abstracted from rivers that are confined behind low dams or weirs. Examples include London - with water from the River Thames and Chester with water taken from the River Dee. Other major sources include deep upland reservoirs contained by high dams across deep valleys such as the Claerwen series of dams and reservoirs
Stabilise water flow / irrigation	Dams are often used to control and stabilise water flow, often for agricultural purposes and irrigation. Others such as the Berg Strait dam can help to stabilise or restore the water levels of inland lakes and seas e.g. the Aral Sea
Flood prevention	Dams such as the Blackwater dam of Webster, New Hampshire and the Delta Works are created for the purpose of
Land reclamation	Dams (often called dykes or levees in this context) are used to prevent ingress of water to an area that would otherwise be submerged, allowing its reclamation for human use. Example: Hoover Dam, Arizona, USA
Water diversion	A typically small dam is used to divert water for irrigation, power generation or other uses, with usually no other function. Occasionally, these are used to divert water to another drainage or reservoir to increase the flow there and improve water use in that particular area. e.g. the Imperial Dam diverts Colorado River in the southwestern United States.

Navigation	Dams create deep reservoirs and can vary the flow of water downstream. This can in return affect upstream and downstream navigation by altering the river's depth. Deeper water increases or creates freedom of movement for water vessels. Large dams can serve this purpose but most often weirs and locks are used. Example: Bonneville Lock and Dam comprises several run-of-the-river dam structures that together complete a span of the Columbia River between the U.S. states of Oregon and Washington at RiverMile
Recreation and aquatic beauty	Dams built for any of the above purposes may find themselves displaced by time of their original uses. Nevertheless, the local community may have come to enjoy the reservoir for recreational and aesthetic reasons. Often the reservoir will be placid, surrounded by greenery and convey a natural sense of rest and relaxation to visitors. Example: KRS (Krishna Raja Sagara, India) dam is best example of a dam that is an ideal tourist destination

Table 10.1 Purpose of Dams

Forest Management

1. **Forest management** is the branch of forestry concerned with the overall administrative, economic, legal and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection and forest regulation. This includes management for aesthetics, fish, recreation, urban values, water, wilderness, wildlife, wood products, forest-genetic resources and other forest resource values. Management can be based on conservation, economics or a mixture of the two. Techniques include timber extraction, planting and replanting of various species, cutting roads and pathways through forests and preventing fire. Forests give hope of further life. If the forests are depleted, the world will not be able to survive.

2. **Public input and awareness**: There has been increased public awareness of natural resource policy, including forest management. Public concern regarding forest management may have shifted from the extraction of timber to the preservation of additional forest resources including wildlife and old growth forests, protecting biodiversity, watershed management and recreation. Increased environmental awareness may contribute to an increased public mistrust of forest management professionals and will lead to proper management of forests everywhere.

3. **Wildlife considerations**: The abundance and diversity of birds, mammals, amphibians and other wildlife is affected by strategies and the various types of forest management.

Forest Products and their Trade

The forest products sector is estimated to contribute about one percent of the world's gross domestic product and to account for three percent of international merchandise trade. The annual turnover of round wood, sawn wood, panels, pulp and paper exceeds US$200 billion. Although the values of non-wood forest products and the environmental services of forests are difficult to estimate in economic terms, they are critical to the livelihoods of an estimated 600 million people in the developing world alone. The emerging markets for environmental services - including the development of carbon trading under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) - may have a considerable impact on patterns of trade in forest products and on forest management, making forestry more profitable as an environmentally sound and economically viable land-use option.

The total amount of round wood felled globally has declined slightly, since the beginning of the 1990s, as an outcome of decreased production in tropical areas and in the Commonwealth of Independent States (CIS). Approximately 80 percent of wood harvested from tropical forests is consumed as fuel wood, while in temperate and boreal areas fuel wood production has been declining. In Europe, bio-energy is gaining importance. On the other hand, wood is facing stiff competition in some of its key markets such as construction, decking, windows, mouldings or furniture from a wide range of other materials such as steel, plastics or aluminium. International trade flows continue to be geared towards markets in the United States, Canada, Japan and Europe. However, major markets such as China and India play an increasingly important role in the dynamics of world trade.

In the past, the international trade regime, primarily pursued by the World Trade Organisation (WTO) and regional trade agreements, focused its attention on tariffs and other formal trade measures. While those trade measures are generally decreasing in importance worldwide, trade and forest policy makers are increasingly concentrating on non-tariff measures to increase market access for forest products and services and to improve sustainable forest management. This move could backfire though, as it could actually increase the demand of wooden products. As steps to liberalise trade generally continue, the international debate in various regions for a mutually supportive relationship between trade in forest products and services and environment-related social issues will continue to influence patterns of forestry trade worldwide. Consequently, the international and regional trade policy debates, within and outside formal flora and institutions, are increasingly influenced by multilateral environmental agreements such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Convention on Biological Diversity (CBD) and the UN Framework Convention on Climate Change (UNFCCC). These institutions help in maintaining forests around the globe.

Forest Management Certification and product labelling play an important role in accommodating environmental and social concerns in forestry. The increasing demand for certified forest products and the emerging markets for environmental services support further development of international certification schemes and national initiatives in this regard. While forest products certification is a market-based instrument, its relationship with national and international policy-making and policy implementation has become more prominent because of considerable political attention and promotion of this instrument by important institutions and constituencies in the government and civil society. The so-called 'phased approach to forest products certification', currently debated in the International Tropical Timber Council (ITTC) and other flora, shows the strong support of governments in the promotion of certification initiatives to achieve policy targets.

While the debate on international trade in forest products and services and the development and dynamics of the world market draw most of the international attention, domestic trade continues to play the most important role. A relatively small number of analyses focus on the impact and interaction between domestic trade and forest management. This is particularly true in developing countries and in countries with economies in transition. In order to support sustainable forest management, the rehabilitation of degraded forestland and the establishment of forest resources at the community level, environmental and social services of forests need careful consideration. It is the interface between trade and forest management that serves as the indicator for positive or negative influences and dynamics between them.

The contribution of forests towards poverty reduction is often under-estimated. Recent analyses of the contribution of forests to poverty reduction note their broader significance for local livelihoods and estimate that hundreds of millions of people depend on forests for subsistence production and environmental services like watersheds, soil erosion control, microclimate, biodiversity and cultural services. It is estimated that 60 million highly forest-dependent people live in the rainforests of Latin America, Southeast Asia and Africa. An additional 350 million people are directly dependent on forest resources for subsistence or income and 1.2 billion people in developing countries use trees on farms to generate food and cash. Loss of forest resources is believed to affect 90 % of the 1.2 billion people who live in extreme poverty directly.

Against this background, trade in forest products and services is vital for economic growth as well as for safeguarding sustainable livelihoods in rural areas throughout the developing world.

Biodiversity Management

The variety of life on Earth or its biological diversity is commonly alluded to as biodiversity. The number of species of plants, animals and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all part of a biologically diverse Earth. Appropriate conservation and sustainable development strategies attempt to recognise this as being integral to any approach. Almost all cultures have in some way or form recognised the importance that nature and its biological diversity has had upon them and the need to maintain it. Yet, power, greed and politics have affected the precarious balance.

Role of Biodiversity in International Trade

Trade-related work under the Convention on Biological Diversity captures different aspects of the complex relationship between international trade and the objectives and provisions of the convention.

The production of value-added goods and services derived from the biological diverse environment, which are traded in domestic and international markets ('biotrade'), may generate incentives for the conservation and sustainable use of biodiversity. Accordingly, a number of thematic programmes of work under the convention call for increased marketing of products derived from sustainable use. As an outcome of these initiatives, The Secretariat of the Convention on Biological Diversity (SCBD) is cooperating closely with the Biotrade Initiative of the United Nations Conference on Trade and Development (UNCTAD) to advance biotrade promotion.

The Conference of the Parties (COP) is the Convention’s governing body that meets every two years, or as needed, to review progress in the implementation of the Convention, to adopt programmes of work, to achieve its objectives, and provide policy guidance. It adopted a provisional framework of goals and targets to enhance the evaluation of achievements and progress in the implementation of the strategic plan of the convention. Target 4.3 of this framework calls for no species of wild flora and fauna to be endangered by international trade. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is the key partner in implementing this target and both conventions are cooperating closely to implement this target, including a liaison of biodiversity-related conventions.

While the Convention on Biological Diversity does not require measures that are directly related to international trade, there is an intricate relationship between many of its provisions – as well as those of its Biosafety Protocol – and the multilateral rules and provisions of the World Trade Organisation (WTO). For instance, the Parties to the

Convention have emphasised the interrelationship between the convention and the provisions of the WTO's Agreement on Trade-related Aspects of Intellectual Property Rights (TRIPs) and the need to further explore this interrelationship. Similarly, the parties have underlined the relationship between the Biosafety Protocol and the provisions of the WTO Agreements on Technical Barriers to Trade (TBT) and Application of Sanitary and Phytosanitary Measures (SPS)