

# **“FOREST ACCOUNTING OF GOA”**

**Report Submitted to  
Forest Department - Government of Goa**

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Research on forest accounting is the need of time, especially for forest rich states like Goa. The present research study is an outcome of a research study sponsored and supported by the forest department, Govt of Goa. I would like to acknowledge the support of Shri Rajiv Kumar Gupta, Principal Chief Conservator of Forest, Shri Keshav Kumar IFS, Chief Conservator of Forests, Shri Saurabh Kumar IFS, Chief Conservator of Forests, Shri Dr Dinesh Kannan IFS, Conservator of Forests and Smt Yasodha, Deputy Conservator of Forests Margao, Goa, Mr Teckchand Sonawane, Debasis Patnaik, Dr Kailas Bavale, Dr Shrikishna Mahajan.

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## **Executive Summary**

Present research explores forest accounting of Goa. It is a theoretical and practical analysis of entire forest accounting of Goa with detailed research investigation. It consists of various components of forest accounting. Goa forest has very strong potential of carbon sequestration that can provide economic benefits. As per the ISFR report, Goa has 25.3 million tons of carbon stock in its forests. The estimated value of carbon credit of Goa Forest is approximately 17 cores dollar. The valuation of carbon credit may increase in future. Forests play an important role in mitigation and adaptation to climate change. Forests are considered as a reservoir, sink and sources of carbon. The Department of Forest can take initiative or build a carbon credit project.

The stock of forest was in 2017 was 2229 sq. km & in 2019 forest stock was 2237 sq. km, it means forest stock has been increased by 8 sq. km. It shows department of forest has taken various steps to increase the forest by which biodiversity may increase in the forest area. The timber production is more in private forest as compare to govt forest. Over the years timber production from govt forest is reduced and timber production from private forest has been increased.

The firewood production is more in private forest as compare to govt forest. It also shows that the over the years firewood production from govt forest as well as in private forest has been increased. Goa has suitable conditions for bamboo production. The data reveals that there is no significant bamboo production both in private as well as in govt forest in the last couple of years.

The combine value of firewood, timber and bamboo both in private as well as in govt forest is 484 lakhs. The cane production value is not available hence it is not included in total value. The revenue of the forest department has increased substantially from 293.39 to 370.46 lakhs. It indicates effective forest management as well as increase in the value of forest products.

Non-wood products such as Cashew, bay leaf, Hirda, Honey, Shikakai, Bamboo and Amsole, Jackfruit etc are available in Goa Forest in large quantities. These products are sources of food, fodder, medicines, gums, resins, and construction materials. It is raw material to various forest based industries such as forest honey industry, cashew industry, fodder industry, furniture industry, pharmaceuticals, and food processing industry, etc. It plays significant role in life of rural people.

There are four major sources of forest revenue i.e. Timber, Firewood, other minor forest products and some other receipts. Firewood and timber are significantly contributing to revenue as compared to other sources. Goa forest has scope for various agro forestry-based businesses such as honey, bay leaf, cashew, bamboo, furniture, fodder, wild spices, Jackfruit etc.

Goa Forest Department may promote forest products-based startups to unleash the potential of forest products and generate employment at local area. The forest resources degradation can be curtailed by adopting green accounting and its institutionalization. Reduction in forest degradation will promote sustainable development.

Accounting of forest sector of Goa increases the prospects in terms of more investment in forest sector, reducing the risk of disaster, more business opportunities, curbing biodiversity loss, biodiversity conservation, ensuring food and ecological balance, etc. As Goa is a forest rich country forest accounting is essential as it has a great facilitating role to play in influencing all other economic activities and needs to have a place in the calculations of Gross Domestic Product. This work will help to Goa policy makers, financial institutions, researchers, students, environmentalists, general public and the overall country as a whole.

**Dr. Parashram Jakappa Patil**

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## Abbreviations

G.D.P.	Gross Domestic Products
GNP	Gross National Products
GNH	Gross National Happiness
SNA	System of National Account
CO2	Carbon dioxide
DCF	Discounted cash flow
NPV	Net Present Value
IRR	Internal Rate of Return
ROA	Real Option pricing method
FR	Forest Ranges
FD	Forest Division
FD	Forest Division
NWFP	Non Wood Forest Product
SEEA	System of Environmental Economic Account
IFRS	International Financial Reporting Standards
AS	Accounting Standard
SDCF	Scholastic Discounted Cash Flow
NRA	Natural Resources Accounting
INRA	Integrated National Resources Accounting
FDA	Forest Degradation Accounting
SQI	Soil Quality Index
EA	Enumeration Areas
CAPM	Capital Assets Pricing Model
ROPM	Real Option Pricing Model
FMC	Forest Management Cost
SFM	Sustainable Forest Management
RF	Reserve Forest

UF	Unreserved Forest
PF	Protected Forest

# Chapter 1

## Introduction & Research Methodology

- **Introduction:** The forests provide different basic inputs to global economic and ecological system in a multi-dimensional way. It provides timber, fuel wood, pulpwood, fodder, fiber grass and non-wood forest produce & support industrial & commercial activities. They also maintain the ecological balance & life-support systems which is essential for food production, health as well as overall development of human kind. Forests control the wealth of adjoining land use system. They also improve the wealth of urban areas. However, there is no proper accounting and valuation system available to tap this very important resource. Forests of Goa form the part of Western Ghats, the region which have been internationally recognized as Biodiversity Hotspot of the world owing to its rich flora and fauna. Most of the Goan forests are located in the eastern region of the state. The forests of Goa are known for their grandeur and majesty. Goa's total tree-cover is around 60 per cent, which makes it the fifth ranking state in terms of forest cover and first among the coastal states.
  
- **Problem Statement:** Goa state is one of the few states in India having 58.24% of the geographical area as forest including mangroves with high eco-tourism value. Of the total geographic area of 3702 km<sup>2</sup>; the area under forest is 2,156 km<sup>2</sup>. Out of the total forest area 1255 km<sup>2</sup> is moderately dense forest and 901 km<sup>2</sup> is open forest. The state has five different types of forests. The economic contribution of forest is in various ways. It is a source of timber with market values, regional climate balance, soil protections, and forest value added products etc. The sustainability of forest resources is being challenged as it ignores the consumption of natural capital (depletion) that occurs when forests are harvested. The depletion cost is considered as extraction cost in national accounting and it records the potential loss in forest wealth as other changes in assets that have no effect on Gross Domestic Product (GDP). Therefore, the question arises what is the real contribution of forest in calculating GDP. There has been no proper or scientific way of accounting for forest areas that has created many problems in management of forest resources. This calls the researcher's attention to conduct study on this issue and hence the title of this study is formulated as "**FOREST ACCOUNTING OF GOA**".

- Objectives of the study:** This study deals with economic and environmental accounting of forests, by and large in accordance with the UN System of Economic and Environmental Accounting, (SEEA 2003). It provides a methodological framework to construct asset accounts and flow accounts of goods and services from the forests. Consequently, the analytical study has endeavored to generate primary level data regarding values of household consumption of goods and services provided by forests and land in the study area, especially those which are non-marketed. Efforts have been made to quantify value of forest amenities flowing to the economy. The primary effort has been to capture the change in resource usage and values and quantity/quality changes (degradation/ up-gradation) since last ten years. The main objective of the study is to construct asset and flow accounts for the forest assets based on framework provided by Verma (2005) and Haripriya et. al (2005). More specifically, the major output of the study comprises of various resource accounting tables and values of various functions rendered by the forests of Goa.
- Significance of the study:** In India forest sector is the second largest land used after agricultural sector. The forest helps in maintaining of the ecological balance in environment. Natural resource accounting is helpful and important for conservation and maintenance of natural resources in forest in an optimum way. It is also helpful to conduct monetary accounting of natural resources. This research is important to the management of forest area and understanding the availability of natural assets and income earned from this asset. It will show importance of natural economics and different method of valuation of natural resources. This study is also helpful to the Government to decide policies regarding forest area. Government can understand and record the actual biodiversity in forest area. According to that information Government can take precautionary action for preservation of natural assets. This study is also helpful to people of the societies and industries dependent on forest produce. They can understand and be aware about the natural resources they use for their own purpose. The forest is beneficial to agricultural system and plays an important role as foster mother in promoting agro industrial economy. Forests make a significant contribution to Indian economy and to the state domestic production. The following are the specific importance of forest accounting that will be explored by the present research work.

- To reduce loss of biodiversity.
- To mitigate inflated economic production figures.
- To enable value chain and supply chain accounting starting with net forest produce.
- To enable Gross National Happiness -GNH calculation that is dependent on forest living and environmental standards.
- To enable balanced economic growth keeping in mind future economic concerns.
- To enable balance in regional economic diversity.
- To safeguard biodiversity (both plant and animal).
- To assess tradeoff between agriculture and environment preservation exercises.
- To assess nature of food safety networks based on area specific nutrition availability and bringing economic measures for balanced nutrition in regions.
- To cause rational international economic and diplomacy dialogues based on hard data.
- To measure economic sustainability.
  
- **Limitations of the study:** The following are the specific limitations of the study.
- The present study is limited only to forest area in Goa and study only a selected range of forest area.
- The study is limited to only natural resources in forest area and do not study any other natural resources.
- The present study is limited to the analysis of economic /actual accounts of forest area by using specific parameters. It does not cover other methods of natural resource accounting.
- The present study mainly depends on the primary and secondary sources of data, which having its own limitation.
  
- **Scope of the study:** The scope of the present research work has been divided in following parts.
- Topical Scope: The topical scope of present study is confined to the “Forest Accounting of Goa”.
- Analytical Scope: The analytical scope of the present study is limited to the analysis of

economic/actual accounting on the basis of selected parameters. The appropriate method for testing of hypothesis will be applied.

- Geographical Scope: The present researcher has selected natural resources of forest area of Goa.
- Periodical Scope: The present study will cover period of last five years from 2014-15 to 2019-20.
- **Research methodology:** The present study is an analytical study and mainly depends on primary and secondary sources of data. The primary sources of data is supplementary.
- Methods of Data Collection: The researcher has used primary and secondary sources for collection of data as given below:
  - Primary Data: The primary data are collected through the formal and informal interactions with forest officers, local experts, traditional bee keepers, farmers, forest dwellers, local people, local business, local processors, exporters, importers, wholesalers, retailers.
  - Random Sampling of Cashew Farmers: There are 900 hectors cashew plantation on forest land. To understand the problems faced by cashew farmers in the region, through random sampling 10 cashew farmers have been interviewed to collect the primary data. Along with the data field observation also have been noted.

**Table 1 Sampling of cashew farmers**

Particulars	Total sample	Sampling technique
Cashew farmers	10	Random sample

- Random Sampling of Honey Farmers: There are 200 registered honey farmers in the state. To understand the problems faced by honey farmers in the region, through random sampling 10 honey farmers have been interviewed to collect the primary data. Along with the data field observation also have been noted.

**Table 2 Sampling of honey farmers**

Particulars	Total sample	Sampling technique
Honey farmers	10	Random sample



- Secondary Data: The secondary data has collected through the following sources:
- Published Sources: The researcher has collected the data from sources such as Directorate of Economics and Statistics (DES), Forest Department of Government of Goa, Administrative Report of Forest Department, Forest Survey of India, National Sample Survey of Organization (NSSO), Central Statistical Organization (CSO) and also Books, research papers published in the Journals, Articles and different Websites etc.
- Unpublished Sources: Ph.D Theses, M.Phil Dissertations and other unpublished sources.
- Methods of Data Analysis: Researcher will use the statistical technique of analysis and interpretation of data. There will be use of specific parameters of forest economic account, administrative performance and ecological classification of forest area. It will also use descriptive statistics to make the analysis of data and software like MS-Excel, SPSS and others.
- Parameters of the study: Following are the parameters researcher will use for the analysing of natural resources accounting of forest area.
- Actual / Economic Accounts:
- Physical Account Monetary Account Flow Account
- Financial Performance (Income and Expenditure)
- Ecological Classification:
- Legal Classification of Forests Forest Types Wise
- Species Wise Animal/Fauna Wise Forest Product Wise
- Universe of the Study: Researcher will select the forest area in Western Ghats of India.
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## Chapter 2

### Review of Literature

- **Introduction:** In this section, an effort has is made to review earlier studies related to natural resource accounting. To state the facts, earlier studies have not given more focus on forest resource accounting. Nonetheless, find very few studies that explore the forest accounting. Therefore, there is need to fillthis gap and extend literature. There are some studies which have covered few issues relating to forest resource accounting and the review of such studies has been given below.
  
- **Haripriya et.al. (2007)** it has emphasis to apply a SEEA based methodology to show the true value of forest resources in India's national as well as state accounts. It has been focused on four components of value creation in forest i.e., timber production, carbon storage, fuel wood usage and the harvesting of non-timber forest products. There is a need to integrate national resources accounting into the national accounting framework that will generate appropriate signals for sustainable forest management. They have concluded that the existing measures of national income in India are underestimated as an unaccounted contribution of forest income. The incomes of NorthEastern states in particular are highly underestimated by these traditional (GDP/GSDP) measures. If the limitation of the current data on p roduction and prices are addressed, the income through forest will be much more than that of today.
  
- **Ykhanbai (2009)**, this study is focused on measuring and assessing forest degradation in Mongolia. The aim of the study is to collect information and review forest degradation accounting of Mongolia. The degradation (depreciation) method and total rent approach and user cost method have been used for conducting this study. It covers physical and monetary accounting of forest resources degradation, but he did not consider accounting for depletion of forest environmental services. The result shows that forest degradation has increased from year to year over in the study period. The expansion of economic activity and increased global climate changes are the

causes of forest degradation. There should be improvement in forest resource management policies for the future sustainable development. For improvement in situation of national resource degradation the institutionalization and adoption of green accounting in the country is necessary.

- **Harris et.al. (2002)**, they have critically examined natural resource accounting in theory and practices. The prime aim of the study is an extensive review of the theoretical and applied literature on natural resource accounting and economic theory that underpins natural resource accounting, counseling welfare and sustainability of the policy goals. They conclude that the insufficient attention paid by economists to the revision to the SNA. Furthermore, they suggest that there should be use of growth theory models to solve particular technical problems.
- **Parikh et.al. (1995)**, they have suggested the natural resource accounting for soil to estimate costs of soil degradation for India. Soil resource as an empirical estimation of the cost of soil degradation by using the soil quality index for the measuring of states in India. Soil productivity is a function of measurable soil properties/assets. Loss in soil productivity consequently affects the soil degradation due to the soil salinization.
- **Blignaut et.al. (2001)** they have studied natural resource accounting of mineral resources i.e. gold and coal in South Africa. Examined the change in value of mineral resources mainly gold, coal and support sustainable development. Used natural resource accounting indicators and measures of sustainable development in the mineral resource sector. There is a very small percentage of total mineral resource rent in South Africa, lower rent of mineral resource helps to capture the market and economic development.
- **Haripriya (2000)** worked on integrating forest resource into the system of national accounts in Maharashtra. Analyzed SEEA framework stumpage value methods for timber, market prices for timber and non-timber forest products, bio-prospecting for

biodiversity in Maharashtra.

- **Mkanta et.al. (2002)** they have made an attempt to study the two views i.e. valuation of non-marketed forest resources and proposing means for generation of modified national accounting. The study area was selected according to enumeration area (EAs) as listed for the 1998 population census. The fuel cured tobacco growing areas were purposely selected for this study and found that 63% of the respondent was regular grower of tobacco. It also found that there is an impact of income, size, and time to reach collection areas and the total areas owned for farming are affected by collection of forest resources. It has been suggested that there is strong need of revising the method used for production of tobacco. The study concludes that there is need of regular delivery of data and regular updates from government department which will help to account the natural resources.
  
- **Ramos et.al. (2002)** they have analyzed physical and monetary accounting of forest areas in Zimbabwe. This paper is mainly focused on theoretical concept of forest resources. They study values of ecological services such as carbon sequestration and water abstraction from forest. They found that the carbon sequestration may not have immediate productive effects in the rural areas but in long run it impacts negatively on productivity. These losses will have general equilibrium effects mainly on agriculture. It emphasizes that using conventional SNA measures of welfare will mislead and sending the wrong signals to policy makers. Lately they conclude that the central government agencies make better planning of natural resource.
  
- **Jordan et.al. (2010)** they have studied the accounting for natural resources and sustainability for linking ecosystem services into human well-being. They used two parameters for the study i.e. individual metric and composites of multiple metrics. They also worked on structured approach to the environmental accountability and for that purpose they studied policy frames of environmental accountability, goals specific environmental outcomes and measured the unit of environmental accounting. They found that for achieving and maintaining the sustainable environment, it requires accounting, legislation, regulation, mitigation, resource management,

education and social responses. Lately they concluded that the human well-being and sustainable eco-system are entirely interdependent.

- The Eliasch, Climate change is serious challenge faced by world which needs to be tackled to reduce down its bad impact. The loss of global forest is also cause of concern for global community therefore, there is need to stop deforestation immediately. Developing countries could play crucial role in maintaining forest for which international community must support to such countries. It will help to stabilize greenhouse gas atmospheric level, forest emissions, biodiversity, ecological cycles etc. It has also been examined that the global carbon trading scheme is best placed to ensure that the emissions from forest are reduced effectively. It stressed on capacity building and filling the funding gap and inclusion of forest sector within comprehensive global cap and trade scheme. It has also focused on identifying practical framework for minimizing forest emissions while maintaining livelihood to forest communities and preserving ecosystem services. There is need to establish strong research and development base for tackling the challenges in forest sector. The trade-off between agriculture and forest raises serious challenges which needs to be tackled through concrete polices at manifold levels. For creating sustainable production, it needs to involve different factors such as private sector, public sector, and civil society.
- **CGMA, (2014)** report on Rethinking the Value Chain explains natural capital includes forest, river, minerals, oceans, air and land which proving significant ecosystem services to society. In fact, entire value chain is depended on natural capital. It is a base of all other capitals including financial on which economy, society and wellbeing is dependent. Natural resources are used at an alarming rate that bring risks of price volatility and shortage of raw material. Natural resources do have an impact onbusiness hence it has to be handled carefully. There is close relationship between business and natural resources. Natural capital consideration is still not included in corporate accounting. Here it is also mentioned that the role of financial professionals in natural resources capital is very important.
- **Shunsuke Managi et.al. (2006)**, due to rapid industrialization, India is facing various environmental problems and as a result, environmental productivity over the period

of time has been decreased. This paper measures productivity changes for environmental outputs in India. They have also taken a glance on environmental policy of India. The existing environmental management system is not sufficient to bring about sustainable development in India. There is a need to take certain concrete steps to tackle environmental threat in long run.

- **Partha Dasgupta (2009)**, The reasons for no rise in ecological capital assets are not just confined to market failure, but they are expressions of institutional failure in its widest sense. There is a need to devise market friendly solutions to environmental problems. Ecological services payment could be given to owners. There is relationship between poverty, natural resources base and population growth. He has made micro level analysis of natural resources in socio-economic perspective.
- **INTOSAI Working Group on Environmental Auditing (1998)**, report entitled Natural Resource Accounting in which it focuses on the meaning and role of natural resources accounting, problems in practices of natural resources accounting, and international organization dealing with natural resource accounting and especially focused on water accounts. There are linkages between the environment and the economy. The major problems of natural resource accounting are the valuation of resources in monetary terms. It has also mentioned here that the external environmental costs, environmental auditing, resources economics, ecological economics, systems of national accounts, gross domestic product and net domestic product.
- **Naresh Sahu et.al**, examine various issues and challenges of the integration of environmental accounting (EA) into the conventional system of national account (SNA). It is very important in order to have sustainable economic development. There are various challenges of integrating environmental accounts in national system accounts. Most of the countries are not doing so. Finding out correct natural resources value is an unsolved problem. There is need to understand interaction between the environment and the economy and progress towards meeting environmental goals.



Policy makers need to focus on resources depletion, ecological balance, and the sustainability of economic development while making economic policies in the long run. There are various indirect advantages of integrating environmental accounting in systems of national accounting. The economic growth, welfare of people and environment protection are directly dependent on integrating environmental accounting in systems of national accounts.

- **Elmqvist T. et.al. (2011)**, focused on ecological perspective on regulating services. It presents the role of economics in developing methodologies to manage trade-offs between provisioning and regulating services. It proposes a general framework of managing trade-offs using a landscape-based approach. They discussed various factors such as climate regulation, water regulation, biological control, pollination, soil control, hazard control and erosion prevention, intensive agricultural landscape, conservation landscape and degraded landscape. Agriculture and environment interface has to be handled with care which has an impact on biodiversity.

Earlier studies on natural resources accounting show that the forest accounting is dynamic and complex in nature. However, it is very important in order to understand contribution of invisible ecosystem services in economy. Several researchers contribute in this direction but still a lot has to be done as far as quality research on forest accounting is concerned.

- **Forest Accounting Concepts:**
  - **Forest Accounting:** It provides framework to capture the value of all economic contributions of forests and how they are linked to economy. (Making Waves, 2016)
  - **Environmental Accounting:** Environmental accounting refers to (1) National Accounting is physical and monetary accounting of environmental assets and the costs of their depletion and degradation and (2) Corporate Accounting is a term usually referred to environmental auditing, but may also include the costing of environmental impacts caused by the corporation. (Sarkar, 2008).
  - **Natural Resource Accounting:** Natural resource accounts are also known as green

accounts, are the accounting frameworks designed to provide information that tracks important changes in economic use of environmental resources, (Statistic New Zealand, 2002). It is frequently used in the sense of physical accounting and monetary accounting.

- **Physical Accounting:** Physical accounting refers to “the natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units.” E.g., weight, area or number. Qualitative measures, expressed in terms of quality classes, types of uses or eco-system characteristics, may supplement quantitative measures (Statistic New Zealand, 2002).
- **Monetary Accounting:** Monetary accounts refer to “the entries corresponding to the physical accounts but contain an additional entry for revaluation, which records the change in asset value due to changes in prices between the beginning and end of the period, (Statistic New Zealand, 2002).
- **Forest Flow Accounts:** Forest flow accounts, include supply and use tables for detailed forest products (wood & non wood, marketed & non-marketed) by sector, which are linked to the input - output (I/O) and also include measures of forest eco-system services, environmental degradation associated with forest use, (Statistic New Zealand, 2002).
- **Biological Assets:** It means all living animals and plants in forest area.
- **Forest Economics:** It is cost benefit analysis of forest resources.
- **Forest Valuations:** Determining the monetary value of biological assets of forest.
- **Biodiversity Loss:** The period since the emergence of humans has displayed an ongoing biodiversity reduction and an accompanying loss of genetic diversity. Named the Holocene extinction, the reduction is caused primarily by human impacts, particularly habitat destruction. It is destroying ecosystems (Encyclopedia).
- **Forest Capital:** Forest capital refers to elements of forest that produce values directly and indirectly useful to people such as stock of trees, animals, goods, and services etc.
- **Natural Capital:** Natural Capital refer to the elements of nature that produce values directly and indirectly to people such as the stock of forests, rivers, land, minerals and oceans. It includes the living aspects of nature such as fish stocks as well as non-living aspects such as minerals and energy resources. Natural capital underpins all other types of capital and is the foundation on which on our economy, society and prosperity is

built (Natural Capital Committee for England).

- **Ecosystem Services:** These services are provided by nature such as fresh air, fresh water, food, timber, medicine, carbon storage, climate regulation, waste treatment, pollination, tourism, soil formation, genetic diversity and habitats, etc.
- **Forest Risk of Disaster:** It means occurring of unwanted events which are harmful for forest such as fire, climate change, man-animals clashes, disturbing ecological balance, loss of biodiversity and food insecurity, etc.
- **Forest Valuation Industry:** It is a universe of all companies that offer valuation services to third parties (Samuel Wagniere, 2011).
- **Forest Soil:** Everything beneath the surface of the earth including the roots of the trees and the material of soil(Samuel Wagniere, 2011).
- **Forest Stand:** It refers to above the ground parts of the trees i.e. the stems, the branches and leaves of the trees on the current rotation (Samuel Wagniere, 2011).
- **Forest Land:** It means bare land on which the forest stands and grows. (Samuel Wagniere, 2011).
- **Forest Assets:** The property belonging to forest such as plants, animals, water, land, etc.
- **Fair Value:** The amount for which an asset could be exchanged or a liability settled between knowledgeable, willing parties in an arm's length transaction (IAS, 2010).
- **Cost Methods:** These are the forest valuation methods with which the values of forests are determined by summing up all the accrued investment, management and operating costs.
- **Current Market Price Method:** It is forest valuation method that derives the value of forest from current observable market price.
- **Discounted Cash Flow Method:** Discounted cash flow (DCF) analysis is a method of valuing a project, company or asset using the concepts of the time value of money. All future cash flows are estimated and discounted by using cost of capital to give their present values (PVs) (Encyclopedia).
- **Capital Assets Pricing Model:** The capital asset pricing model (CAPM) is a model that describes the relationship between risk and expected return and that is used in the pricing of risky securities. The general idea behind CAPM is that investors need to be

compensated in two ways: time value of money and risk (Encyclopedia).

- **Real Option Pricing Method:** Real Options Valuation, also often termed real options analysis, (ROV or ROA) applies option valuation techniques to capital budgeting decisions. A real option itself is the right — but not the obligation — to undertake certain business initiatives, such as deferring, abandoning, expanding, staging, or contracting a capital investment project. For example, the opportunity to invest in the expansion of a firm's factory, or alternatively to sell the factory, is a real call or put option, respectively (Encyclopedia).
- **Sensitivity Analysis:** Sensitivity Analysis is the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs (Encyclopedia).
- **Forest Inventory:** The quantity and Quality of forest resources is called as forest inventory.
- **Forest Management Cost:** Certain expenses have to made for doing forest management such as land and development, road, site preparation, plantings, fertilizing, weeding, harvesting, diseases and fire control, legal fees, taxes, and overhead expenses including insurances, inventories, and selling and distribution, etc.
- **Forest Management:** It includes various activities such as selection of land and development, forest rotations, road, site preparation, plantings (species, geographies, seeding), fertilizing, weeding, harvesting, diseases and fire control, cuttings, legal fees, taxes, insurances, inventories, and selling and distribution, etc.
- **Contingent Risks:** The risks which are not systematic, it occurs with uncertainty which includes expropriation, harvest bans, changes in land taxation, trade barriers, duties, boycotts, forest fires, draughts, storms, snow, floods, insects, mammals, invasive plants (Samuel Wagniere, 2011).
- **Cost of Capital:** The cost of capital is the cost of a company's funds (both debt and equity), or, from an investor's point of view "the required rate of return on a portfolio of company's existing securities." It is used to evaluate new projects of a company (Encyclopedia).
- **Stumpage Value:** Stumpage is the price a private firm pays for the right to harvest timber from a given land base. It is paid to the current owner of the land. Historically, the price was determined on a basis of the number of trees harvested, or “per stump”

(Encyclopedia).

- **Carbon Credit:** It is a financial instrument that allows the holder, usually an energy company, to emit one tons of carbon dioxide. Credits are awarded to countries or groups that have reduced their greenhouse gases below their emission quota. Carbon credit can be legally traded in the international market at their current market price (Investopedia).
- **Carbon Credit Accounting:** It is the process by which organizations account for and report on their greenhouse gas emissions. As an internal metric, carbon allows companies to assess carbon efficiency and exposure to climate change risks (including regulatory risk) (Encyclopedia).
- **Climate Finance:** It refers to financing channeled by national, regional and international entities for climate change mitigation and adaptation projects and programs. They include climate specific support mechanisms and financial aid for mitigation and adaptation activities to spur and enable the transition towards low-carbon, climate-resilient growth and development through capacity building, R&D and economic development. The term has been used in a narrow sense to refer to transfers of public resources from developed to developing countries, in light of their UN Climate Convention obligations to provide "new and additional financial resources," and in a wider sense to refer to all financial flows relating to climate change mitigation and adaptation. (Encyclopedia).
- **Gross National Happiness:** It is a global indicator of progress, which measures both sustainable economy and social development, while protecting the environment and culture (Encyclopedia).
- **Agro-Forestry:** It is combination of forest and agricultural cultivation practices.
- **System of National Account:** It provides an overview of economic processes, recording how the produce is distributed among consumers, businesses, government and foreign nations. It shows how income originating in production, modified by taxes and transfers, flows to these groups and how they allocate these flows to consumption, saving and investment. Consequently, the national accounts are one of the building blocks of macroeconomic statistics forming a basis for economic analysis and policy formulation. (United Nations Statistical Division)
- **Regulating Ecosystem Services:** Regulating services represent the role ecosystems have in: climate regulation, water regulation, biological control, and pollination,

maintenance of soil quality and erosion prevention and hazard control (TEEB 2009).

- **Forest Management:** It is a branch of forestry concerned with overall administrative, economic, legal, and social aspects, as well as scientific and technical aspects, such as silviculture, protection, and forest regulation (Encyclopedia).
- **Sustainable Forest Management (SFM):** It is the management of forests according to the principles of sustainable development. Sustainable forest management has to maintain the balance between three main pillars: ecological, economic and socio-cultural (Encyclopedia),
- **Average Forest:** The forest is overstocked if it has 100 to 200 trees per acre, where a healthy forest has 40 to 60 trees per acre.
- **Forest Biological Diversity:** It means the variability among forest's living organisms and the ecological processes of which they are part of; this includes diversity in forests within species, between species and of ecosystems and landscapes.

As natural resources accounting and particularly the forest sector is posing various challenges before the researchers for developing and defining different forest accounting concepts, the above- mentioned basic concepts would really help for deep understanding of forest accounting.

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## Chapter 3

### Forest Accounting Theory

Forest accounting is a multi-disciplinary area which includes Mathematics, Physics, Life Sciences, Chemistry, Statistics, Accounting, and Finance, economics, etc. Therefore, it is necessary to look at different components of it. There are various parameters on which forest accounting system could be developed. Exploration of all these parameters will give a clear picture of forest accounting in a better way. It is a challenge to develop forest accounting since it involves complex ecosystems and its invisible services to society. Forest accounting is capturing the nature's services especially the forests and its conversion in economic value. It is essential to develop a mechanism that will include the values of all economic contributions of forest linked to economy. There are certain parameters that need to be considered while undertaking forest accounting, such as follows;

- **Actual /Economic Accounts:**
- **Physical Accounting:** Physical accounting refers to “the natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units.” E.g., weight, area or number. Qualitative measures expressed in terms of quality classes, types of uses or eco-system characteristics, may supplement quantitative measures (Statistic New Zealand, 2002). Forest resources stock is changing every year.
- **Monetary Accounting:** Monetary accounts refers to “the entries corresponding to the physical accounts but contain an additional entry for revaluation, which records the change in asset value due to changes in prices between the beginning and end of the period, (Statistic New Zealand, 2002).
- **Forest Flow Accounts:** Forest flow accounts, include supply and use tables for detailed forest products (wood and non-wood, marketed and non-marketed) by sector, which are linked to the input - output (I/O) and also include measures of forest ecosystem services, environmental degradation associated with forest use, (Statistic New Zealand, 2002).
- **Financial Performance:**

- **Income:** Forest department is getting revenue from forest in different ways such as rent of land under temporary cultivation, fees on duplicate permits, sale proceeds of licenses to catch hawks, sale proceeds of condemned tents, furniture and other stores, livestock, tools and plants, etc. While evaluating financial performance of forest department aggregation of all income sources which are coming from the forest needs to be considered.
  
- **Expenditure:** Forest department incurs various expenses in order to maintain forest such as on plantation, protection of forest, salaries and wages of forest staff, harvesting, organization, improvement and extension of forests, livestock, stores, tools and plants etc. Aggregations of these all expenses will be deducted from the revenue of the forest department.
  
- **Ecological Classifications:**
  
- **Legal Classification of Forests:** It is important to understand forests in a legal sense. Interpretation of what constitutes as forest and distinguishing forests from other land uses is essential. (D.Venkateswarlu). In India there are two acts dealing with the issues of forest i.e. Indian Forest Act 1927, and Forest Conservation Act 1980. It is necessary to take into consideration the forest acts as it comes under the preview of forest else it willnot give a correct picture. Identification of forest resources must be under the ambit of law. It is essential for doing forest accounting in a fair manner.
  
- **Forest Type Wise:** Forest type is a group of forest ecosystems of generally similar composition that can be readily differentiated from other such groups by their tree and under canopy species composition, productivity, and/or crown closure. (D. Venkateswarlu). Forest valuation depends on type of forests especially tree species, its utility, availability and its demand, etc. These issues matter for forest accounting because it has impact on economic transactions.
  
- **Species Wise:** Forest is not just about trees, there are various components involved in

it. Hence, in forest accounting has to take care of these all visible and invisible components forming part of forests. Forests are home to 80% of the world's terrestrial biodiversity. These ecosystems are complex webs of organisms that include plants, animals, fungi and bacteria. Forests take many forms, depending on their latitude, local soil, rainfall and prevailing temperatures. Coniferous forests are dominated by cone-bearing trees, like pines and firs that can thrive in northern latitudes where these forests are often found. Many temperate forests house both coniferous and broad-leafed trees, such as oaks and elms, which can turn beautiful shades of orange, yellow and red in the fall (WWL). It's a challenge to undertake forest accounting because of economic invisibility of nature and its impact on society. The valuation of forest would differ from species to species.

- **Fauna and Flora Wise:** India has a rich diversity of flora and fauna. Flora refers to plant species and fauna refers to animal species. The term biota includes both plant as well as the domesticated and wild species of animals. There are over 45,000 plant species and 81,251 animal species. It represents about 7% of world's flora and 6.5% of world's fauna. Plants are the main source of food, fodder and other useful things such as fuel (fire wood), fiber, timber, medicine, gums, tannin, etc. The Indian fauna includes variety of animal life such as mammals, birds, reptiles, fishes, insects, etc. i.e. about 800 species of mammals, 2000 species of birds, 420 species of reptiles, 2000 species of fish, 50,000 species of insects, 4000 species of molluscs (Source K.C. Agarwal, 1998). Forest is the base of biodiversity which include flora and fauna. It exists because of forest. It has its own tremendous socio-economic contribution to society. Therefore, this parameter is very important while making forest accounting which needs to be taken in perspective.
- **Forest Product Wise:** A forest product is any material derived from forestry for direct consumption or commercial use, such as timber, paper, or forage for livestock wood. It is used for many purposes such as wood fuel or the finished structural materials used for the construction of buildings or as a raw material, in the form of wood pulp that is used in the production of paper. All other non-wood products derived from forest

resources, comprising a broad variety of other forest products, are collectively described as non-timber forest products. (Encyclopedia). Thus, forest is home of various products which have great economic value. Therefore, the potential of forests for producing of such products and availability of such products would be one of the essential criteria for determining economic value of forests. This output will be useful to society. Forest accounting is considering of all forest products and giving it an economic value.

▪ **Valuations Methods:**

- **Historical Cost Method:** Cost of a forest is determined by summing up all the accrued investments, management, and operating costs. Basic approach consists in considering the costs that have effectively incurred since the acquisition of the forest e.g. historical cost method. (Samuel Wagniere, 2011). In this forest valuation technique historical cost is taken as base for forest resources valuation.
- **Market Price Method:** Determining the value of a forest by summing up all the accrued investment, management, and operating costs on the basis of the costs that would accrue in case the forest had to be established under current market conditions again e.g. current market price or replacement cost. Value of a forest from current observable market prices (Samuel Wagniere, 2011). In this forest valuation technique, current market price of forest resources is taken into consideration for valuation.
- **Net Present Value Method:** Net present value method is very significant method for forest valuation. It shows the difference between the present value of cash inflows and outflows. It helps investor to make investment decision. Under this method forest valuation is primarily based on future monetary benefits and costs of forest resources which is discounted to the present by using the investors minimum acceptable rate of return (Guillermo Navarro, 2007)
- **Discounted Cash Flow Method:** A discounted cash flow (DCF) is a valuation method used to estimate the attractiveness of an investment opportunity. DCF analysis uses future free cash flow projections and discounts them to arrive at present value estimate, which is used to evaluate the potential for investment. If the value arrived at through

DCF analysis is higher than the current cost of the investment, the opportunity may be a good one (INVESTOPEDIA). In DCF method, calculation of forests starts with an inventory of the current forest stand, followed by the determination of the marketable forest products that will provide future cash flows. After that it follows a projection of the future yields of the forest with regards to the determined products and the forecast of the net cash flows based on cost estimations and revenue estimations. The final step is the discounting of the net cash flows to the present, using an appropriate discount rate (Samuel Wagniere, 2011). DCF is providing more reliable results and at present it is the most accepted method of forest valuation used by experts. Of course there are challenges in this method like finding appropriate discount rate, however it is used widely.

- **Real Option Pricing Methods:** It is also often termed real options analysis; (ROV or ROA) applies option valuation techniques to capital budgeting decisions. Real option itself is the right but not the obligation to undertake certain business initiatives, such as deferring, abandoning, expanding, staging, or contracting a capital investment project (Samuel Wagniere, 2011). It is found that ROP models are applied to the domain of forestry in which the option constellation is provided by a forest property to the forest owner.
- **Sensitivity Analysis:** A sensitivity analysis is a technique used to determine how different values of an independent variable impacts a particular dependent variable under a given set of assumptions. This technique is also useful in forest valuation because parameters of forest valuation is most sensitive such as prices of the forest products and the discount rate, length of the rotation, growth and yield assumptions or the presumed management regime of the forest, (Samuel Wagniere, 2011). In this valuation technique sensitive factors of forest resources are taken into consideration for valuation.
  - **Forest Economics:**
  - **Forest Resources:** It means the various types of vegetation normally growing on forestland, the associated harvested products and the associated residue, including

but not limited to brush, grass, logs, saplings, seedlings, trees and slashing. (Encyclopedia). Forest is rich with various valuable resources. Economics of forest resources is very strong. Forest accounting must include all the forest resources and its cost benefit analysis. It will help in understanding the contribution of forest resources in the mainstream of economy.

- **Goods and Services:** Forest produce significant products such as paper, plywood, sawn wood, timber, poles, pulp and matchwood, fuel wood, Sal seeds, tendu leaves, gums and resins, cane and rattan, bamboo, grass and fodder, drugs, spices and condiments, herbs, cosmetics, and tannins. (Encyclopedia). Along with that forest provide various invisible ecosystem services such as regulating the climate, water regulation, pollution control, biological control, pollination, hazardous control, biodiversity and soil erosion etc. All these goods and services have tremendous economic value and significant contribution in economy. In forest accounting, goods and services are the major components to be considered.
- **Business:** Forest is a significant rural industry. It has tremendous potential of business such as paper mills, fodder industry, food processing, medicine, saw mills, furniture, crafts, etc. Thus, business potential of forest is a significant factor in forest accounting,
- **Employment:** Forest generates huge employment to poor people. Millions and millions of people and animals are directly dependent on forests. They are getting their livelihood from forest. Therefore, employment generation from forest is also one of the important aspects of forest accounting.

The above-mentioned forest accounting parameters will definitely be helpful for developing good forest accounting system. However, only these parameters are not sufficient for further investigation but these parameters will give a good sensible base for conducting forest accounting.

- **Forest Accounting Challenges:** It is very significant to do forest accounting. However, it is a difficult task. Following are the challenges that have emerged while doing forest accounting.

- **Identification of Biological Assets:** Identification of biological assets in forest accounting is a real challenge. Biological assets produce invisible economic ecosystem services. It supports life system. They are hidden and numerouslike microorganisms and hence it very difficult to identify them.
- **Valuation of Biological Assets:** After identification of biological assets, it needs to be valued. However, there is no systematic and perfect method existing for valuation such biological assets.
- **Measurement of bio-diversity Loss:** An important component of forest accounting is identification and measurement of biodiversity loss. Here too, there is no fixed standard available which measures biodiversity loss in monetary terms.
- **Compensatory Value:** Identifying the compensatory value of ecosystem services is difficult. There is no proper methodology available for finding out the compensatory value for nature's services.
- **Availability of Data:** There is a lot of complexity and grayness in data related to forest resources and forest ecosystem. Unavailability of data leads to limitations in doing accurate analysis and interpretations.
- **Internalization of Externalities:** Forest resources and forest ecosystem is a versatile phenomenon on which external and internal aspects have an impact. In forest accounting, internalization of externalities is a problem because there is no standard methodology available for assessing the impact of externalities in monetary terms.

In generally, the above mention challenges are been dealt by researchers in conducting natural resources accounting. It is difficult to resolve them because it involves various invisible services which are difficult to be quantified and assigned value. However, all these services have an economic value.

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## Chapter 4

### Forest Accounting & Biodiversity

Forest biological diversity is a wide term that refers to all life forms found within forested areas and the ecological roles they perform. As such, forest biological diversity encompasses not just trees, but the multitude of plants, animals, and micro-organisms that inhabit forest areas and their associated genetic diversity. Forest biological diversity can be considered at different levels, including the ecosystem, landscapes, species, populations, and genetics. Complex interactions can occur within and amongst these levels. In biologically diverse forests, this complexity allows organisms to adapt to continually changing environmental conditions and to maintain ecosystem functions (CBD). The significant contribution of forest accounting is of helping to maintain biodiversity. There is a strong nexus between forest accounting and biodiversity. Forest accounting explores different services provided by forest to biodiversity and measures its impact on it.

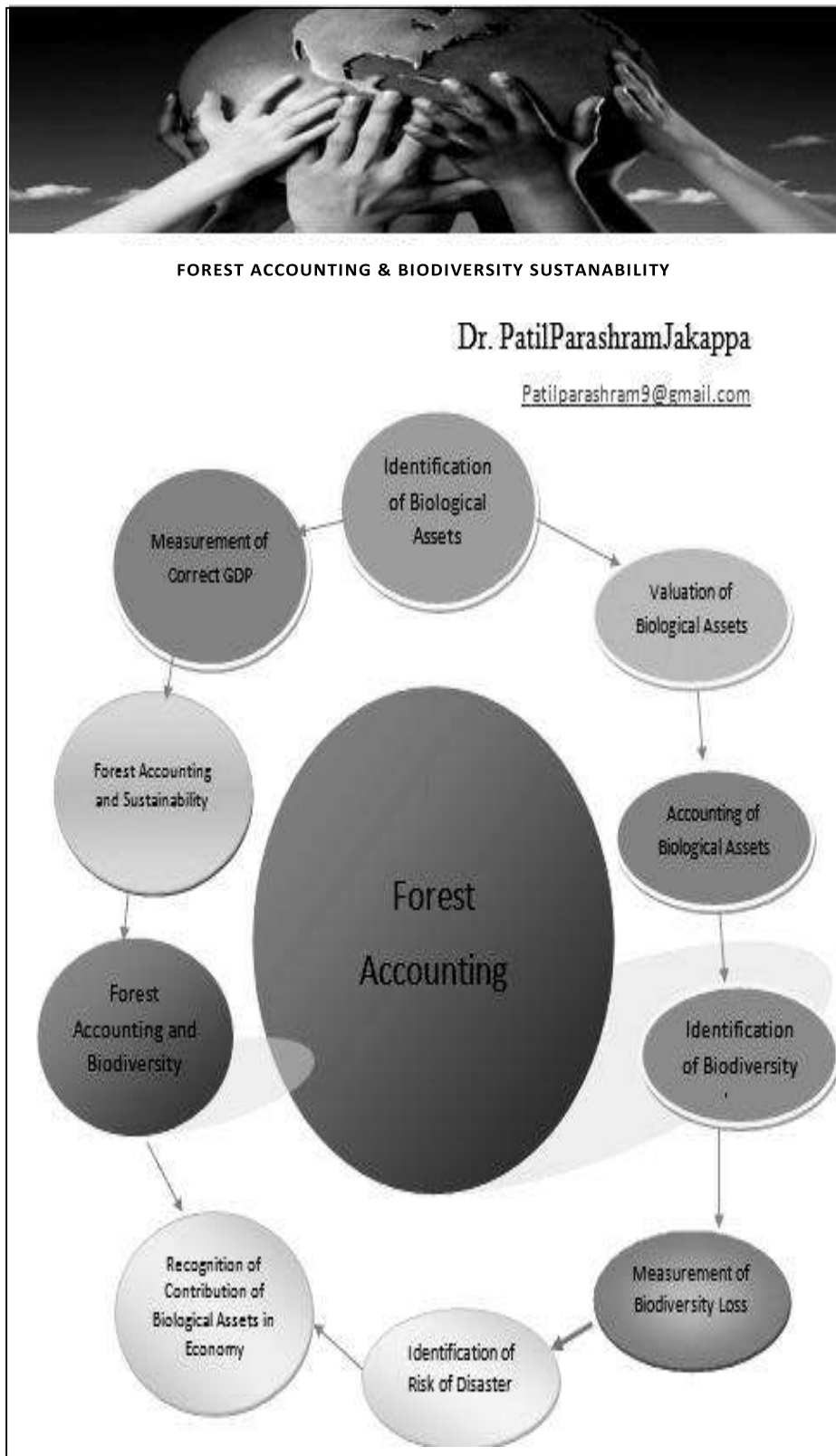
- **Climate:** Forest is providing significant input for climate regulation and it is essential for biodiversity. Forests are the only major ecosystems where the amount of carbon stored in biomass of the plants exceeds that in the soil; deforestation therefore, also affects climate regulation (Elmqvist et.al 2011). These services are provided by forests free of cost. It needs to be taken into consideration in forest accounting. Climate change adversely affects the economy and to reduce down that effect, forest accounting will help to a great extent. Identification of these forest services in climate regulation and quantification of it in monetary value will be a concrete step in understanding and preserving biodiversity in the long run.
- **Water:** Forest services are playing major role in maintaining water cycle. Without forests, water regulation will not be possible. Forest and wetlands with intact groundcovers and root systems are considered very effective at regulating water flow and improving water quality (Elmqvist T et.al 2011). Water is an essential component of biodiversity preservation. Forest services like water regulation are invisible and not considered in monetary value. It can be quantified and given economic value, so that forest services can be recognized. It shows nexus between forest, water regulation, and biodiversity.

- **Biological Control:** The loss of biodiversity can be attributed to deforestation that affects biological process. Forest protects biodiversity in terms of being home of species of flora and fauna. They have their own biological processes that are depending directly and indirectly on forest.
- **Erosion Prevention and Hazard Control:** Vegetation cover is the key factor for preventing soil erosion (Elmqvist T et.al 2011). Forests protect occurring of landslides by modifying the soil moisture regime (Sidle et al. 2006). Thus, forest services are directly contributing in erosion prevention and hazard control which is essential for biodiversity and sustainability. Accounting of forest ecosystem services recognizes the value provided to society by forests.
- **Pollution Control:** Forest plays multiple roles when it comes to local air pollution. Trees in general help to reduce air pollution, including absorbing the greenhouse gases, carbon dioxide, some species contribute to local smog by emitting volatile organic carbons (VOCs). Selecting the planting locations of individual trees and species makes a difference in the overall pollution balance. (Melanie Lenart, 2015). Forest is an essential component for reducing pollution in urban as well as in rural areas. These forest services which absorb carbon dioxide are directly contribution in biodiversity and sustainability.
- **Pollination:** One of significant forest services is Pollination. It is responsible for assisting over 80% of the world's flowering plants. It provides food to humans and animals by pollinating the flowers which later turn into human and animal food. Without the natural pollination process it is not possible to meet the food demands. It is an essential ecological survival function. Without pollinators, the human race and all of earth's terrestrial ecosystems will not survive for long. (USDA). For quantification of pollination services in monetary value is necessary to undertake forest accounting. Pollination is promoting biodiversity.
- **Biodiversity Loss:** Forest accounting using different parameters to measures the loss of biodiversity. Identification and quantification of actual biodiversity loss will help to make concrete policy making decisions to reduce the biodiversity loss. Therefore, for the biodiversity preservation, forest accounting can be used as one of the instruments. Unless the biodiversity loss is identified and measured, one cannot take preventive

action on it. Forest accounting will reveal the loss of biodiversity.

- **Trade off in Agriculture and Environment:** Impact of undesirable trade off could be assessed through forest accounting. 35% of the Earth's land surface is used for agriculture like growing crops or rearing livestock (ML 2005). Due to rapid industrialization and agriculture trade off in agriculture, environment is become a complex issue. It is having a serious adverse impact on biodiversity. Forest accounting will help to assess this trade off situation.
- **Risk of Disaster:** Forest has a significant role in reducing the risk of natural disasters including floods, droughts, landslides, and other extreme calamities. At global level, forests mitigate climate change through carbon sequestration, contribute to the balance of oxygen, carbon dioxide, and humidity in the air, and protect watersheds, which supply 75% of freshwater worldwide (SDNF). Natural disaster causes huge biodiversity loss and damage to ecosystems that have negative impact on economy. Forest accounting will help to identify the risk of disaster.
- **Sustainable Development:** The practices of sustainable development are biodiversity friendly. Forest ecosystem services are supporting sustainable development by regenerating ecosystems. Forest itself shows various ways of practicing sustainable development. Forest accounting will also facilitate in sustainable development.

**Figure 1: Theoretical Model on Forest Accounting and Biodiversi**



Forest biological diversity is a wide term that refers to all life forms found within forested areas and the ecological roles they perform. As such, forest biological diversity encompasses not just trees, but the multitude of plants, animals, and micro-organisms that inhabit forest areas and their associated genetic diversity. Forest biological diversity can be considered at different levels, including the ecosystem, landscapes, species, populations, and genetics. Complex interactions can occur within and amongst these levels. In biologically diverse forests, this complexity allows organisms to adapt to continually changing environmental conditions and to maintain ecosystem functions (CBD). The significant contribution of forest accounting is of helping to maintain biodiversity. There is strong nexus between forest accounting and biodiversity. Forest accounting explores different services provided by forest to biodiversity and measures its impact on it.

In India forest sector is the second largest land used after agricultural sector. The forest helps in maintaining the ecological balance in environment. Forest accounting is helpful and important for maintenance of natural resources in forest in a right way. It is also helpful in formulating monetary accounting of forest resources. It is important to manage the forest areas and understand the availability of natural assets and income earned from these assets. It will show the importance of natural economics and different methods of valuation of natural resources. This study is also helpful to societies and industries dependent on forest products. They can understand and be aware about the forest resources they use for their personal purpose. The forest is beneficial to agricultural system and plays an important role as foster mother in promoting agro industrial economy. Forests contribute significantly to Indian economy and to the state domestic production. Following are the specific advantages of forest accounting (1) to reduce loss of biodiversity. (2) To mitigate inflated economic production figures. (3) To enable value chain and supply chain accounting starting with net forest produce. (4) To enable Gross National Happiness - GNH calculation that is dependent on forest living and environmental standards. (5) To enable balanced economic growth keeping future economic concerns. (6) To enable balance in regional economic diversity. (7) To safeguard biodiversity (both plant and animal). (8) To assess tradeoff between agriculture and environment preservation exercises

to assess nature of food safety networks based on area specific nutrition availability and bring economic measures for balanced nutrition in regions. (10) To cause rational international economic and diplomacy dialogues based on hard data. (11) To measure economic sustainability. Hence, there is a need to conduct in depth theoretical analysis of forest

accounting. It is an instrument to understand deep biodiversity loss of ecosystem services and identify the risk associated with it so that potential disasters can be prevented. Thus, it is essential to look forward at sustainability through this angle by having a proper forest accounting system. This will definitely make difference and show the necessity to value forests services.

Thus, forest accounting is given significant input in various ways such as protecting biodiversity, sustainability, protection of ecosystem, livelihood, economic development, industry and trade, employment generation, reduction of biodiversity loss, risk of disaster, true measurement of economic development, and generating accurate data for policy makers, etc. In the present context bio economics is getting significant importance in national policy making. It implicates that forest accounting practices are inevitable in economy because green economy will be the future. Therefore, it is the greater interest of society that forest accounting should come as one of the major fields of study.

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## Chapter 5

### Forest Accounting of Goa

The main objective of this report is “To develop a framework for economic and environmental resource accounting of Forest in the states of Goa (physical and monetary terms) for which researcher has Study the Forest resource accounting for state of Goa using the Satellite System of Integrated Environmental and Economic Accounting framework (SEEA). For the present research work forest trees in the natural forests are considered and hence, the forest resources are treated as non-produced assets and no distinction is made between economic and environmental assets.

#### Goa fores profile:

**Table 1 Land use pattern in Goa**

Land Use Types	Area (in 000' ha)	Percentage
Geographical Area	370	
Reporting area for land utilization	361	100.00
Forests	125	34.75
Not available for land cultivation	37	10.28
Permanent pastures and other grazing lands	1	0.36
Land under misc. tree crops and groves	1	0.16
Cultivable wasteland	53	14.55
Fallow land other than current fallows	0	0
Current fallows	15	4.11
Net area sown	129	35.79

*Source: Land Use Statistics, Ministry of Agriculture, GOI, (2014-15)*

The table 1 gives the picture of land use pattern in Goa. Net sown area is about 36%, cultivable wasteland is about 15%, land not available for cultivation is about 10% and the contribution of forest is about 35%.

#### Extent of Forests in Goa (Recorded Forest Area):

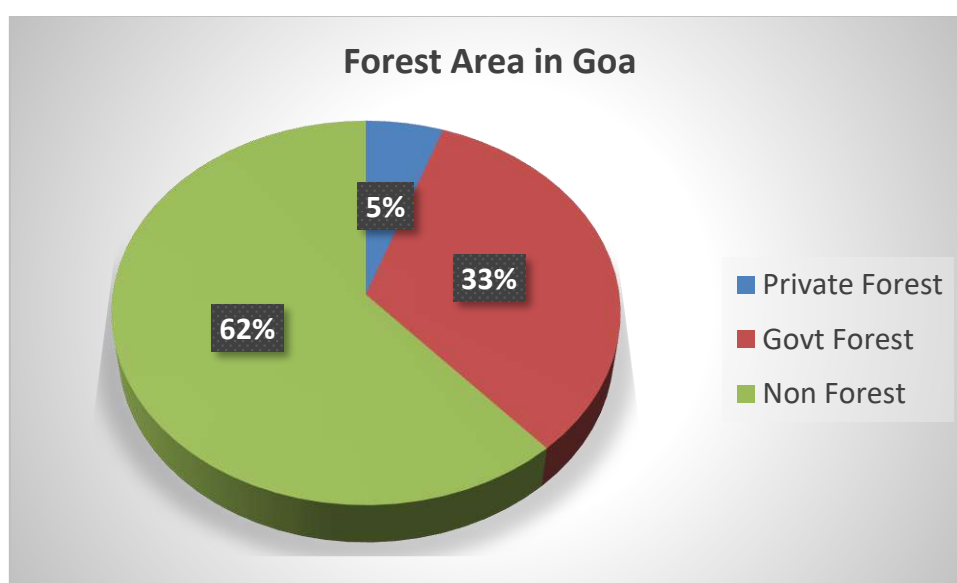


Out of the total geographical area of 3702 sq km of the state about 2219 sq km constitutes forest i.e. 0.17% 0.16% of country's forest area.

**Table 2 Extent of Forest in Goa**

Geographical area (sq.km)	3702
Forest cover (sq.km)	2219
Tree cover (sq.km)	286
Per capita forest and tree cover (sq.km)	0.16 ha

Source: India State of Forest Report 2019.



**District-Wise Forest Cover in Goa (2003):**

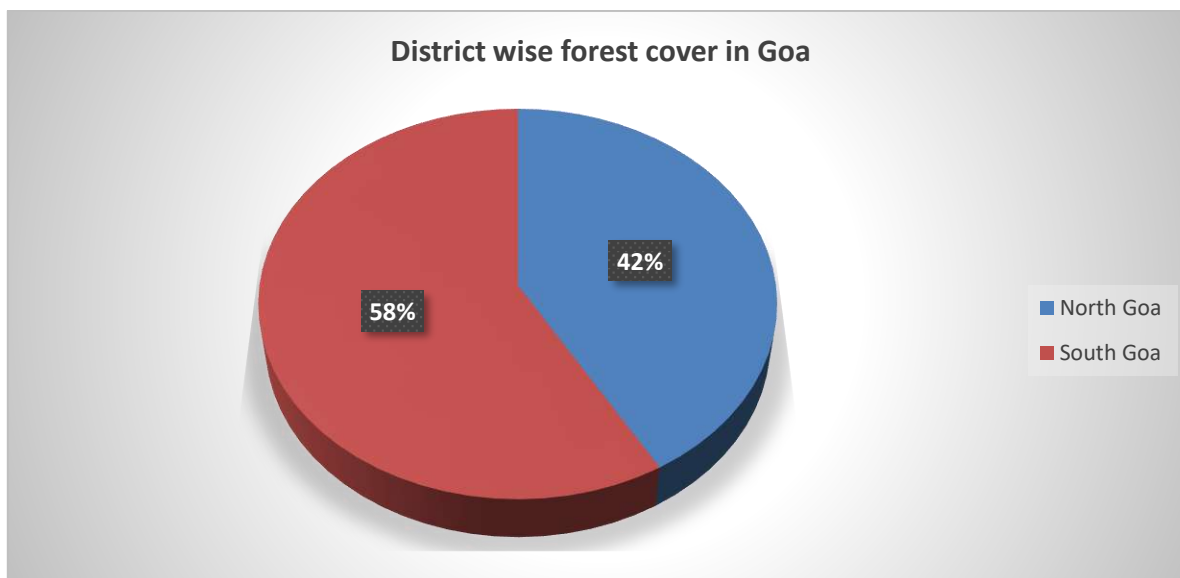
There are two districts in the state. District wise extent of dense, moderate and open forest is furnished in Table 3.

**Table 3 District wise forest cover in goa**

District	Geographical area	Very dense forest	Moderately dense forest	Open forest	Total area	% of Geo Area
North	1736	128	236	559	923	53.17
South	1966	415	349	532	1296	65.92
Total	3702	543	585	1091	2219	59.94

Tree cover	286	7.73
Total forest and tree cover	2505	67.67

Source: India State of Forest Report 2019.



### **Types of forest found in Goa:**

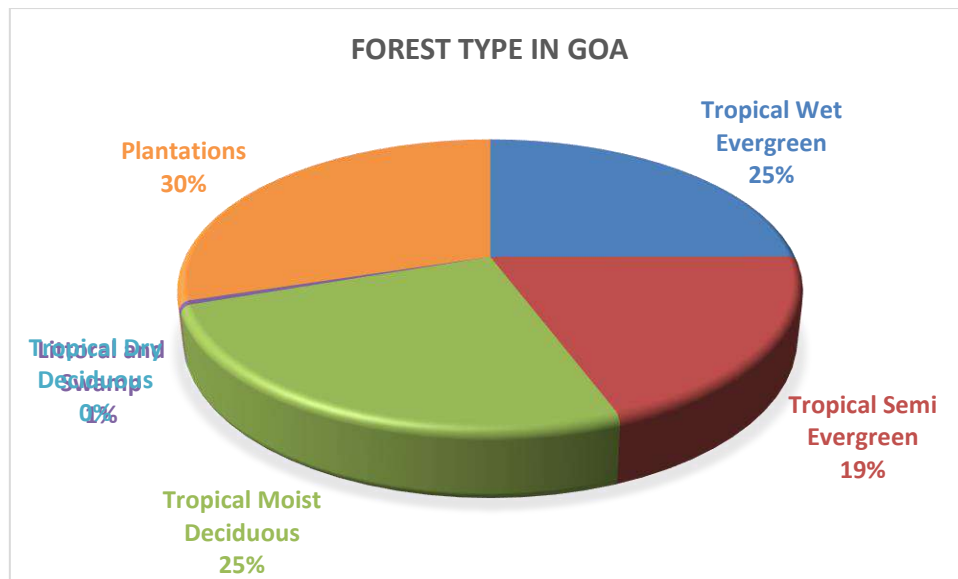
The forests of Goa are typical of the Western Ghats Forest (Southern Maharashtra and Karnataka). The forest survey of India has mapped forest types by using satellite data with reference to Champion and Seth classification. As per this assessment in the state forest report 2011, the state has 5 forest types which is furnished in table 4.

**Table 4 Forest type in Goa**

Forest type	Percentage area
Tropical Wet Evergreen	24.97
Tropical Semi Evergreen	19.33
Tropical Moist Deciduous	25.39
Littoral and Swamp	0.45
Tropical Dry Deciduous	0.01
Plantations	29.85

Source: India State of Forest Report 2019.

Considerable work has been done in recent years to increase the forest cover through plantation activities thereby adding value to the forests of Goa.



### **Biodiversity of Goa:**

Forest cover in Goa is diverse. Goa is India's smallest state in terms of area and the fourth smallest in terms of population. Goa is located on the west coast of India in the region known as the Konkan. Forest cover in Goa stands at 1,424 km<sup>2</sup>, most of which is owned by the government. Government owned forest is estimated at 1224.38 km<sup>2</sup> whilst private is given as 200 km<sup>2</sup>. Most of the forests in the state are located in the interior eastern regions of the state. The Western Ghats, which form most of eastern Goa, have been internationally recognised as one of the biodiversity hotspots of the world. In the February 1999 issue of National Geographic Magazine, Goa was compared with the Amazon and Congo basins for its rich tropical biodiversity. Nanda Lake is the first and the only Ramsar wetland site in Goa. Goa's state animal is the Gaur, the state bird is the Ruby-throated yellow Bulbul, which is a variation of Black-crested Bulbul, and the state tree is the Matti. Coconut palms with their undulating fronds in Goa, India.

The important forest products are bamboo canes, Maratha barks, chillar barks and the bhirand. Coconut trees are ubiquitous and are present in almost all areas of Goa barring the elevated regions. Much deciduous vegetation, including teak, sal, cashew and mango trees, is present. Fruits include jackfruits, mangos, pineapples and blackberries. Foxes, wild boars and migratory birds are found in the jungles of Goa. The avifauna includes kingfishers, mynas and

parrots. Numerous types of fish are also caught off the coast of Goa and in its rivers. Crabs, lobsters, shrimps, jellyfish, oysters and catfish form some of the piscine catch. Goa also has a high snake population, which keeps the rodent population in control. Goa has many famous National Parks, including the renowned Salim Ali bird sanctuary.

**Table 5 Sanctuary in Goa**

Name of the Sanctuary	Area (km <sup>2</sup> )	Location (Taluka)
Mollem National Park	107	Sanguem
Bhagwan Mahavir Wildlife Sanctuary	133	Sanguem
Cotigao Wildlife Sanctuary	86	Canacona
Bondla Wildlife Sanctuary	8	Ponda
Dr. Salim Ali Bird Sanctuary	1.76	Tiswadi
Madei Wildlife Sanctuary	208.48	Sattari
Netravali Wildlife Sanctuary	211.05	Sanguem
Total	755.31	

Source: (Flora and Funna of Goa, Wikipedia, [https://en.wikipedia.org/wiki/Flora\\_and\\_fauna\\_of\\_Goa](https://en.wikipedia.org/wiki/Flora_and_fauna_of_Goa))

The state has more than 33% of its geographic area under government forests (1224.38 km<sup>2</sup>) of which about 62% has been brought under Protected Areas (PA) of Wildlife Sanctuaries and National Park. Since there is a substantial area under private forests and a large tract under cashew, mango, coconut, etc. plantations, the total forest and tree cover constitutes 56.6% of the geographic area.

### **Mangroves in Goa:**

Goa houses 16 mangrove species and it has one of the best mangrove forests in the country (Rhizophora mucronate, Rhizophora apiculate, Bruguiera gymnorrhiza, Bruguiera cylindrica, Ceriops tagal, Kandelia candel (K. rheedi), Avicennia officinalis, Avicennia marina, Sonneratia alba, Acrostichum aureum, Sonneratia caseolaris, Aegiceras corniculatum,

Excoecaria agallocha, Acanthus illici folius, Lumnitzera racemose, Derris heterophylla). Chorao Island in Mandovi river is one of the best mangrove forests and houses most of the species found in Goa.

### **Uses of Mangroves:**

The economic and environmental significance of mangroves are immense and recognized by the whole world. The mangroves are providing various ecosystem services to tighten ecological and livelihood security to coastal regions and people. Especially, People in Goa are making use of mangroves by protecting them as a nursery ground for various fish and crab species, which form a part of their daily food. Mangroves are also used for eco-tourism and firewood purposes. All the river banks are protected by thick mangrove cover. The general services provided by the mangroves are as follows.

- Prevention from soil erosion and stabilization of coasts and beaches
- Protection of land from tidal surges and cyclonic storms.
- Provides fuel wood, green manure, charcoal, timber, etc
- Aqua culture.
- Used for boat / canoe making
- Used for thatching material, cordage and rope material
- Provides tannin.
- Used for art and craft, bow making
- Used as food and beverage
- Widely used for medicinal purposes.
- Useful for bee hives and provides wax and honey.
- Useful for recreational purpose as eco-tourism
- Provides an excellent home to birds and animals.

The value of ecosystem services afforded by mangrove forests is estimated at over US\$100,000 per square kilometer in American Samoa and US\$3.5 million per square kilometer in Thailand. In Matang, Malaysia, a 400 square kilometer managed mangrove forest supports fishery worth

US\$100 million a year. The Matang mangroves also generate further income providing forestry products worth US\$10 million a year. (Dr. Jyoti Parikh et.al, 2008).

### **Growing Stock:**

As per India State of Forest Report 2019, the overall growing stock in the forests is 11.16 m. cum, in the forest area & 4.03 m.cum, given in Table 6.

**Table 6 Growing Stock in Goa**

Growing Stock (GS)	Area in m cum.	Percentage of Country's GS
Growing stock in recorded forest area.	11.16	0.26
Growing stock in tof	4.03	0.25

Source: India State of Forest Report 2019.

### **Villages in Forests:**

There are 360 villages in the state of which 138 have forest as a land use. The forest area in these villages is 88,358 ha. The villages having less than 100 ha, between 100-500 ha and more than 500 ha forest area in each village constitutes 28%, 41% and 31% of the total villages respectively. Table 7 provides details of villages by forest area and population.

**Table 7 Forests as land use in villages**

<b>Forest Area</b>	<b>No. of villages</b>	<b>Total Forest Area (ha)</b>
Less than 100 ha	39	1,777
100 - 500 ha	58	16,233
More than 500 ha	41	70,348
Total	138	

Source: India State of Forest Report 2019.

**Quantified estimation of Dependence of People living in forest fringe villages on forests in Goa:**

Through a nation-wide study, FSI has done estimation of dependence of people living in the villages close to forest for fuel wood, fodder, small timber and bamboo in quantified terms for each State & UT of the country. The estimated quantities of the four produces for Goa is given in the table 8.

**Table 8 Dependence of People living in forest fringe villages**

<b>Fuelwood (tonnes)</b>	<b>Fodder (tonnes)</b>	<b>Bamboo (tonnes)</b>	<b>Small Timber (cum)</b>
30,285	34,852	312	2,699

Source: Source: India State of Forest Report 2019.

**Table 9 Forest Cover Change Matrix for Goa (in sq km)**

Class	Assessment 2019					Total ISFR 2017
	VDF	MDF	OF	Scrub	NF	
Very dense forest	538	0	0	0	0	538
Manderley dense forest	0	576	0	0	0	576
Open forest	0	0	1115	0	0	1115
Scrub	0	0	0	0	0	0
Non forest	0	0	8	0	1465	1473
Total ISFR 2019	538	576	1123	0	1465	3702

Source: India State of Forest Report 2019.

Main reasons for the increase in forest cover in the State are plantation and conservation activities. Goa Forest Department implements various schemes like Rehabilitation of Degraded Forests, Western Ghats Development Programme, Development of Gardens, Parks and Fountains, Social and Urban Forestry etc. Based on the interpretation of IRS Resourcesat-2 LISS III satellite data period of Dec 2017, the Forest Cover in the State is 2,237.49 sq km which

is 60.44% of the State's geographical area. In terms of forest canopy density classes, the State has 538.00 sq km under Very Dense Forest (VDF), 576.09 sq km under Moderately Dense Forest (MDF) and 1,123.40 sq km under Open Forest (OF). Forest Cover in the State has increased by 8.49 sq km as compared to the previous assessment reported in ISFR 2017. The State has reported extent of recorded forest area (RFA) 1,225 sq km which is 33.09% of its geographical area. The reserved and unclassed forests are 20.65% and 79.35% of the recorded forest area in the State respectively. As per the new methodology of assessment, Cashew, Mango and other horticultural trees have been included in the forest cover and hence the reported increase.

**Forest Values:**

The table below gives the details about different values accounted in Goa Forest and framework adopted for the same.

**Table 10 Forest Values and Framework**

<b>Sr no</b>	<b>Values accounted for</b>	<b>Framework adopted</b>
2	1.Timber products	Physical Accounts and Monetary Accounts
2	Non-timber products Fodder, Fuelwood. Canes, Bamboo, other NTFPs	
3	Watershed services specially Mangroves	
4	Biodiversity	
5	Eco-tourism	
6	Carbon storage	



### Valuation Techniques:

#### Classification of Techniques Used:

The table below gives the details about different valuation technique that will be adopted for valuation of forest resource in the state of Goa.

**Table 12 Forest Uses and their Valuation Techniques**

Variables accounted for	Component	Valuation Technique
DIRECT USE VALUES		
Timber products	Marketable produce Non- Marketable produce	Market price analysis Forest Asset account and Market price analysis
Non-timber products	Marketable produce Non- Marketable produce	Market price analysis Direct Substitute Approach
INDIRECT USE VALUES		
Environmental services Biodiversity Eco-tourism Carbon storage	Non-Marketable	Forest Asset and Expenditure accounted using production function & damage cost

### Physical Accounts:

Physical accounting refers to the natural resource and environmental accounting of stocks and changes in stocks in physical (non-monetary) units e.g. weight, area or number. Qualitative measures, expressed in terms of quality classes, types of uses or eco-system characteristics, may supplement quantitative measures (Statistic New Zealand, 2002). Forest resources-based accounts include different forest resources individually. Forest has a number of resources and it is significant to account for it. In physical resources-based forest accounting record all forest assets even if they are not currently expected to deliver benefits. In monetary resources-based asset accounting record economic value of such forest assets.

**Table 13 Forest Stock Accounts of Goa**

Stock	Forest cover (sq. km)
-------	-----------------------

Opening Stocks 2017	2229
Change in Dense Forest	VDF – 538 MDF - 576
Change in open forest	1115
Closing stock	2237
Changes in Stock 2019	+8

Source: SFR

Table 13 reveals that the stock of forest was in 2017 was 2229 sq. km & in 2019 forest stock was 2237 sq. km, it means forest stock has been increased by 8 sq. km.

### **Timber Production:**

The timber resources accounts present the volume of timber resources at both the beginning and end of an accounting period. It also records change in stock over the accounting period. The details of physical assets account of timber resources has been given in Table 14. Timber resources include volume of trees, living or dead, and include all trees regardless of diameter, tops of stems, large branches, and dead trees lying on the ground that can be used for timber or fuel. (SEEA Central Framework). The main additions to the stock of timber resources are annual growth and reclassifications. Reductions in the stock are due to removals, losses and reclassifications.

**Table 14 Timber Production from Government and Private Areas in Goa (M3)**

Year	Timber (M3) from Govt. Forest	Timber (M3) from Private Forest
2017	419.863	2769.41
2018	149.641	2380.7794
2019	940.07	6370.802
2020	480.894	6863.856

Source: Department of Forest, Govt of Goa.

Table 14 reveals that the timber production is more in private forest as compare to govt forest. It also shows that the over the years timber production from govt forest is reduced and timber production from private forest has been increased.

### **Firewood Production:**

Firewood is a major energy source, especially in developing countries. Because firewood is often collected from forest, forest quality may affect firewood consumption patterns.

**Table 15 Firewood production**

Year	Firewood (M3) from Govt. Forest	Firewood (M3) from Private forest
2017	1038.71	349.936
2018	518.992	12019.992
2019	1404.723	938.728
2020	3271.096	14524.151

Source: Department of Forest, Govt of Goa.

Table 15 reveals that the firewood production is more in private forest as compare to govt forest. It also shows that the over the years firewood production from govt forest as well as is private forest has been increased.

### **Bamboo Production:**

The reclassification of bamboo as a grass from a tree by the central government has opened up vistas for its commercial use. Bamboo has always been an integral part of the life of the local communities in Goa. The growth of the bamboo sector depends on people's initiative, market responses and the performance of the various agencies involved.

**Table 16 Bamboo Production**

Year	Bamboo (M3) from Govt. Forest	Bamboo (M3) from Private Forest
2017	33	27900
2018	0	0
2019	0	0

2020	1500	0
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Source: Department of Forest, Govt of Goa.

Goa has suitable conditions for bamboo production. The data reveals that there is no significant bamboo production both in private as well as in govt forest in the last couple of years.

**Table 17 Quantity & value of forest produce during 2020-21**

Sl. No	Item	Quantity (in Number)			Value realized (in Rs Lakhs.)
		North Goa	South Goa	Total	
(0)	(2)	(3)	(4)	(5)	(6)
<b>Canes (Nos.)</b>	NA	NA	NA		
<b>Bamboos (Nos.)</b>					
Govt.			1500	1500	1.13
Pvt.					
<b>Timber (Cu. Mt)</b>					
Govt.		324.318	156.576	480.894	54.22
Pvt.		5963.64	900.216	6863.856	361.16
<b>Firewood (Cu. Mt)</b>					
Govt.		2976.526	294.57	3271.096	13.29
Pvt.		13528.625	995.526	14524.151	55.99

Note: The Timber and the firewood extracted, put for auction, are combined together at the request of the bidder for their convenience and hence the amount quoted is combined for Timber and Firewood

Source: Office of the Conservator of Forests, Panaji – Goa

Table 17 reveals that the combine value of firewood, timber and bamboo both in private as well as in govt forest is 484 lakhs. The cane production value is not available hence it is not included in total value.

**Table 18 Change in Production and Revenue from Goa Forest in Last Two Decades**

Sl. No	Item	Unit	2010	2020
1	Timber production	Cu. Mt.	11284.48	804.154
2	Fuelwood production	Cu. Mt.	22287.53	6192.71
3	Pole production	No.	153	376
4	Cane Production	No.		
5	Bamboo's production	No.	86250	1500
6	Area brought under plantation			
	a) New plantations	Ha		
	i) Casuarina	Ha		
	ii) Mangrove	Ha	20	-
	iii) Mixed	Ha	237.5	173
	iv) Canes	Ha	42	47
	v) Medicinal plants	Ha	85	-
	vi) Bamboo		12	-
	vii) Jatropha		-	-
	b) Enrichment			
	i) Mixed Species		105	12.5 Ha 17 R/ km
	Revenue realized	Rs. In lakhs	293.39	370.46

*Source: Office of the Conservator of Forests, Panaji – Goa*

Table 18 reveals that the revenue of the forest department has been increased substantially from 293.39 to 370.46 lakhs. It indicates effective forest management as well as increase in the value of forest products.

#### **Volume Accounts of Carbon in Goa:**

As per the ISFR report, Goa has 25.3 million tons of carbon stock in its forests. The estimated value of carbon credit of Goa Forest is approximately 200 cores dollar. Forests play an

important role in mitigation and adaptation to climate change. Forests are considered as a reservoir, sink and sources of carbon.

**Table 19 Volume Accounts of Carbon in Goa**

<b>AGB</b>	9,010
<b>BGB</b>	2,617
<b>Dead wood</b>	172
<b>Litter</b>	665
<b>SOC</b>	12,874
<b>Total</b>	25,338

Source: India State of Forest Report 2019.

The total Carbon stock of forests in the State including the TOF patches which are more than 1 ha in size 25.34 million tonnes (92.91 million tonnes of CO equivalent) which is 0.36% of total forest carbon of the country. Pool wise forest carbon in Goa is given in the table 19. The value of carbon credit would be USD 17 cores. The valuation may increase in future. Therefore, forest department may think to develop carbon credit projects to unleash the benefits of carbon credit market.

#### **Overview of revenue & expenditure:**

The forest revenue system is, therefore, an instrument used by government to achieve various goals and objectives in forest management. It is also a tool for obtaining maximum benefits from the management of forest resources.

**Table 20 Revenue raised & Expenditure incurred by Forest Department**

<b>Sr. No</b>	<b>Year</b>	<b>Revenue (Rs in lakhs)</b>	<b>Expenditure (Rs in lakhs)</b>		<b>Total Expenditure (Rs in lakhs)</b>
			<b>Non Plan</b>	<b>Plan</b>	
1	2010-11	310.01	1468.49	2006.13	3474.62
2	2011-12	245.89	1689.22	3687.80	5377.02
3	2012-13	473.72	1776.39	1983	3759.39
4	2013-14	378.25	2016.80	2454.21	4471.01
5	2014-15	431.75	2055.45	2814.60	4870.05

6	2015-16	426.27	2464.61	3122.26	5586.87
7	2016-17	382.83	2296.62	2229.54	5126.16
8	2017-18	49179	3101.93	3262.21	6364.14
9	2018-19	588.17	3239.65	4704.97	7944.62
10	2019-20	462.36	3502.46	3927.26	7429.72

Source: Goa forest department.

## 14. MONETARY VALUE OF TREE

Forest is a collection of trees and each tree gives invisible ecosystems services which have economic value. Since trees are providing various services, a tree has certain economic value. The market value of tree is decided by tree species, stem quality, height, and diameter (Michael Jacobson). It is highly difficult to calculate accurate value of trees but efforts must be taken in this regard so that at least we arrive at some value which will form as a sensible base. Developing monetary valuation system for trees is a complex task. Tree valuation system differs in methodology and data input and output (Vadims Sarajevs, 2011). It is a methodology of converting basic inputs of trees to economic benefits. A Tree provides **\$73** worth of air conditioning, **\$75** worth of erosion control, **\$75** worth of wildlife shelter, and **\$50** worth of air pollution reduction (American Forestry Association). It requires taking into consideration various aspects for monetary valuation of a tree.

**Formula for Value of a Tree** = (timber + carbon sink + provisioning services + regulating services + cultural services + replacement cost + reproductive cost + cost of biodiversity loss - opportunity cost X discount factor).

**Value of a tree = T**

A = timber (Tones x market price).

B = carbon sink (Tons x market price).

C = provisioning services (food, water, shelter, fuel, fiber and medicines) (No. of services x market price).

D = regulating services (control floods, diseases, pests, and the climate, and provide for waterpurification and pollination) (No. of services x cost of externality).

E = cultural services (No. of visitors x cost).

F = Replacement cost (Input cost of tree plantation).  
 G = Cost of biodiversity loss.  
 H = opportunity cost (Revenue generations from other foregoing alternatives).  
 I = Reproductive cost  
 J = Discount Factor.

$$T = (A+B+C+D+E+F+G+H-I \times j)$$

**Assumptions = the value of tree changes as per tree's length, weight, width, age, species and locations.**

Forest accounting is mainly dependent on four components i.e. forest timber, carbon sequestration, non-wood forest products and livestock. These components determine the commercial value of a forests. However, forest ecological characteristics and forest services do play role in it. Forest accounting helps to identify economic, social, and ecological potential of forests.

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## **Chapter 6**

### **Forest Assets Accounting**

#### **(Case Study)**

Forest accounting involves macro and micro level analysis. Since there are complex issues involves it is better to make a micro level analysis of individual significant forest assets that will bring more clarity to the analysis. Micro level analysis supports to develop forest accounting system in great detail. In the present study two important forest products have been selected for the detail value chain analysis i.e., Cashew & Honey from Goa Forest. Cashew cultivation in Goa helps to increase non forest area in the state.

**1. Cashew (Wild Crop):** Portuguese seafarers were introduced into the west coast of India in the sixteenth century (Patil P.J, 2012). Commercial cultivation began in the early 1960s and, over the years, cashew became a crop with high economic value, employing more than 10 lakh people on farms and factories in rural areas and attained the status of an export-oriented commodity, earning considerable foreign exchange for the country. In the past the Indian cashew industry has performed well in the domestic market as well as in the export market. Over the period of time competition has manifold in the cashew market, in this competitive environment this sector is facing several challenges that can be addressed by adopting appropriate strategies. Hilly and forest region of Goa and its environment is suitable for cashew production. The cashew has significant importance in the Goan economy. Thus, cashew- nut industry can play very decisive role in overall development of the Goa. As cashew has tremendous business potential that may create different business opportunities to poor people. This crop has capacity to influence the life of the poor people to large extent. Therefore, there is a need to utilize this potential to uplift the life of poor people. In this direction present study will explore the seasonal issues that can be helpful to policy makers to formulate the desired policies in this direction. Edaphic and agro-climatic conditions of Goa offer good scope for cultivation of cashew. In the state of Goa, it occupies the largest area among horticultural crops. This crop covers about 55 302 ha area with an annual production estimated at 27 070 tones.

**Review of literature:** The past studies with regard to agriculture policies have the primary goal of ensuring food security, and agro-trade policies support to this goal.

K G Chay et al., 2019, India is a significant player in world Mango economy in a standing of production, processing, export and its very crucial as well for Indian rural economy being one of the significant springs of income for millions of mango farmers. And in larger perspective fruits like mango plays very vital role in national food security.

Ajay Kumar Sharma et al., 2012, India is facing tough competition in export market from countries like Chile, South Africa and Israel which produced quality grapes.

Rede Ganesh Kumar, 2016, at present, India is exporting less than 5.00% of its total production, being the largest pomegranate producer, India has huge export opportunities.

Paramsivan C et al., 2017, Indian agriculture has a lot of potential for agriculture exports, especially in Rice and Spices as rural sector of India can provide quality raw material to the agro-based industry which can be exported worldwide.

**Anwarul Hoda and Ashok Gulati, 2013**, Utilization of irrigation, regenerating groundwater, water harvesting, and drip irrigations, nutrient-based fertilizer subsidy, agro credit through institutional sources, only keeping strategic reserves of food grain stock, and levying an export duty rather than imposing quantitative restriction etc are advisable for sustained agriculture development in India.

**B.H. Nagoor, 2009**, India's export of teas has been gone down due to good domestic demand, low productivity, and reduction in cultivation area, strong competition, market demand, and loss of the traditional tea market.

**Sandhu, 1982**, Due to competition in production technology and processing coupled with low units of value offered by the competing economies, India's cashew export has been reduced.

**A.K. Salgotra, A. J. Singh Manhas, P.D. Singh, 2018**, suggests credit creations, supply of quality seeds, better irrigation facilities, decrease the pressure of populations, cooperative farming, agriculture marketing, agriculture education, storage centers, forecasting early warning systems etc for improvement in agriculture growth and productivity.

**Paramsivan C, Pasupathi R, 2017**, India has tremendous potential for agriculture exports, especially in Rice and Spices. A rural sector can provide quality raw material to the agro-based industry.

Nonetheless researcher find no studies that empirically examine the Indian cashew sector. Therefore, researcher will fill this gap and extend literature.

**Data, Variables and Methodology:** The empirically examine the Indian cashew sector in general and Goa in particular from 2011 to 2021 on focusing of cashew production; cashew export; cashew raw material import; area of cultivation, domestic consumptions, government initiatives. These data are collected from the website of the Directorate of Cashew and Cocoa Development, Director, Directorate General of Commercial Intelligence and Statistics, Ministry of Commerce and Industry. To the best of our knowledge, this data is used for the first time for research purposes.

**Random Sampling of Cashew Farmers:** There are 900 hectares cashew plantation on forest land. To understand the problems faced by cashew farmers in the region, through random sampling 10 cashew farmers have been interviewed to collect the primary data. Along with the data field observation also have been noted.

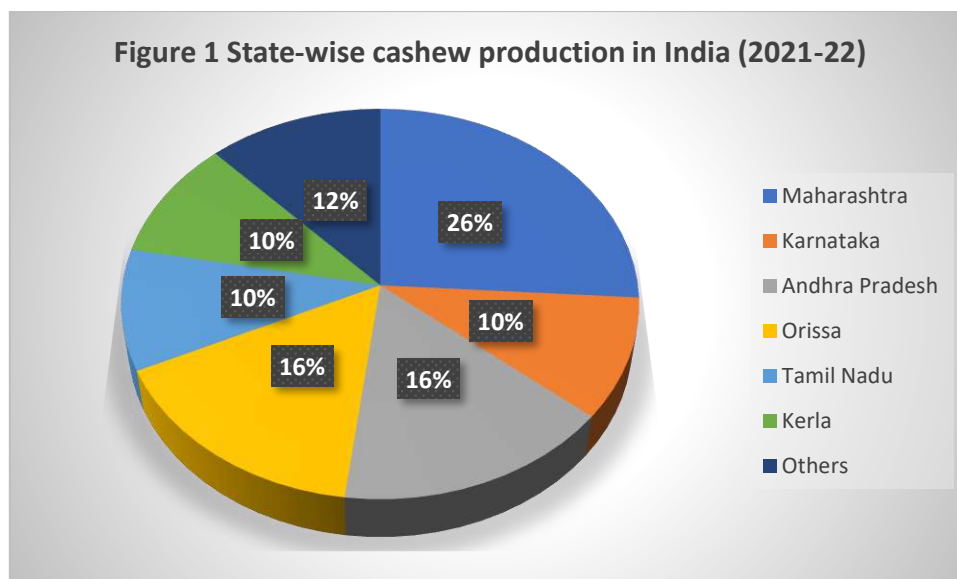
**Table 1 Sampling of cashew farmers**

Particulars	Total sample	Sampling technique
Cashew farmers	10	Random sample

### **Results and discussion:**

**National Scenario:** The cultivation of cashew in India covers a total of 0.7 million hectares of land, and the country produces over 7.73 lakhs tonnes. In India, cashew cultivation spread along the coastal regions of the peninsula. Cashew is mainly grown in states like Maharashtra, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Goa, Odessa, West Bengal, and some parts of the North-Eastern region. Maharashtra stands first in annual cashew nut production in India (Figure 1).

**Figure 1 State-wise cashew production in India (2021-22)**

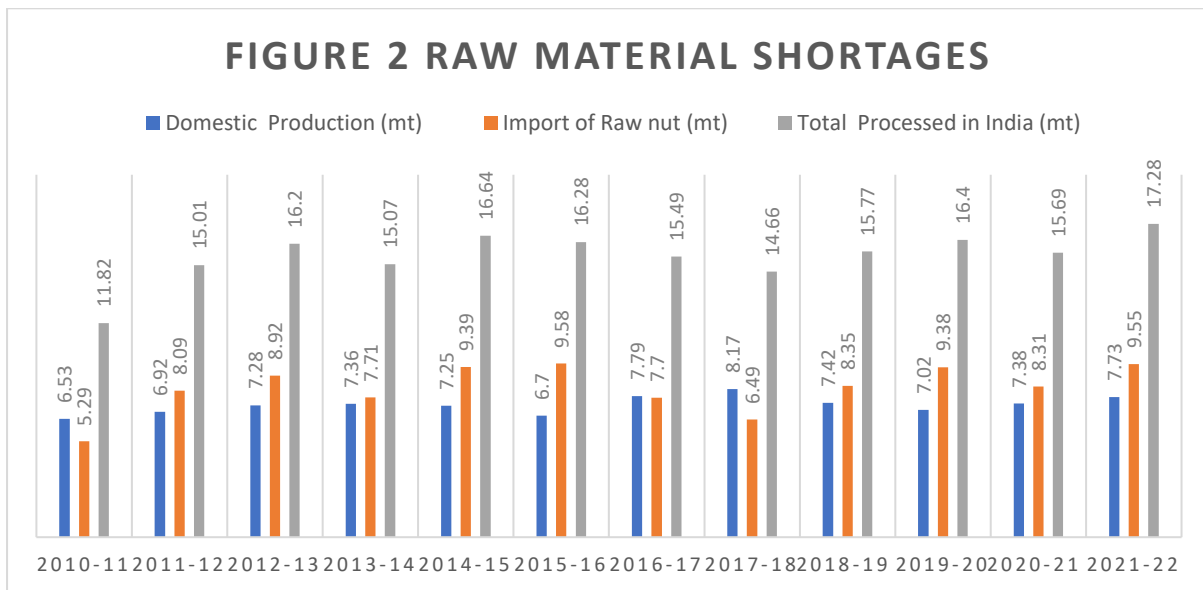


**Source: DGCI&S**

**Table 2 Domestic cashew production, processing and raw material import**

Year	Domestic Production (mt)	Import of Raw nut (mt)	Total Processed in India (mt)
2010-11	6.53	5.29	11.82
2011-12	6.92	8.09	15.01
2012-13	7.28	8.92	16.2
2013-14	7.36	7.71	15.07
2014-15	7.25	9.39	16.64
2015-16	6.7	9.58	16.28
2016-17	7.79	7.7	15.49
2017-18	8.17	6.49	14.66
2018-19	7.42	8.35	15.77
2019-20	7.02	9.38	16.4
2020-21	7.38	8.31	15.69
2021-22	7.73	9.55	17.28

Source: Directorate of Cashew and Cocoa Development, Cochin.

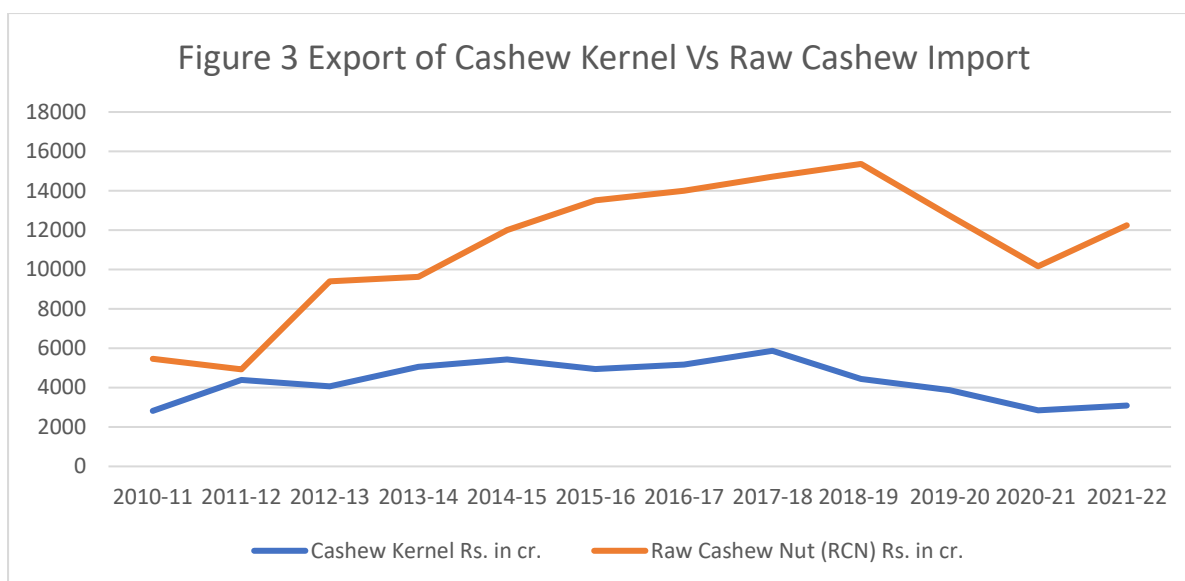


India is the second largest one of the major producers (7, 73 mt) of cashew nut after Côte D'Ivoire, at the same time India is the largest importer of raw cashew nut in the world as India's cashew processing requirement is large and competitive. Import of rawnut is in increasing rate due to low domestic production (Table 1 & Figure 2). Also, growth rate of Consumption in domestic market is increasing trend (15%). Imported raw nut rate are quite low as compare to the Indian produce, so processors are preferring imported rawnut as it is economically feasible. India needs to adopt high density planting with high yielding varieties to enhance domestic production and reduce import. Massive area expansion and replanting and farmers to be encourage at national level to take up cashew farming as primary crop. Indian cashew sector is highly dependent on African countries for raw cashewnut, which accounts for almost half of the domestic and export demand for cashew kernels in the country. Department of Agriculture, Cooperation and Farmers Welfare (DAC&FW), under the Mission for Integrated Development of Horticulture (MIDH) and Rashtriya Krishi Vikas Yojana (RKVY), had implemented various initiatives that led to increased domestic production of cashew. It includes massive area expansion under cashew cultivation and replacing senile cashew plantations with high-yielding varieties in traditional and non-traditional states. DAC&FW has also approved the roadmap program to extend the cashew cultivation area by 1.20 lakh hectare presented by the Directorate of Cashew nut & Cocoa Development (DCCD).

**Table 3 Export of cashew kernel and import of raw cashew nut**

Year	Cashew Kernel	Raw Cashew Nut (RCN)	Trade Balance
	Rs. in cr.	Rs. in cr.	Rs. In cr.
2010-11	2819.39	2649.56	169.83
2011-12	4390.68	538.64	3852.04
2012-13	4067.21	5331.74	-1264.53
2013-14	5058.73	4563.99	494.74
2014-15	5432.85	6570.93	-1138.08
2015-16	4952.12	8561.01	-3608.89
2016-17	5168.78	8839.42	-3670.64
2017-18	5870.97	8850.03	-2979.06
2018-19	4433.99	10929	-6495.01
2019-20	3867.17	8861.58	-4994.42
2020-21	2840.39	7331.28	-4490.89
2021-22	3096.81	9145.17	-6048.36

**Source: DGCIS**



Over the period of time import of raw cashew nut as compared to export of cashew kernel has increased significantly (Table 2 & Figure 3). From 2014-15 to 2021-22 cashew trade balance is negative. It shows the Indian cashew industry is heavily dependent on imported raw cashew-nut for processing. It's high time to implement aggressive strategies to increase domestic cashew production.

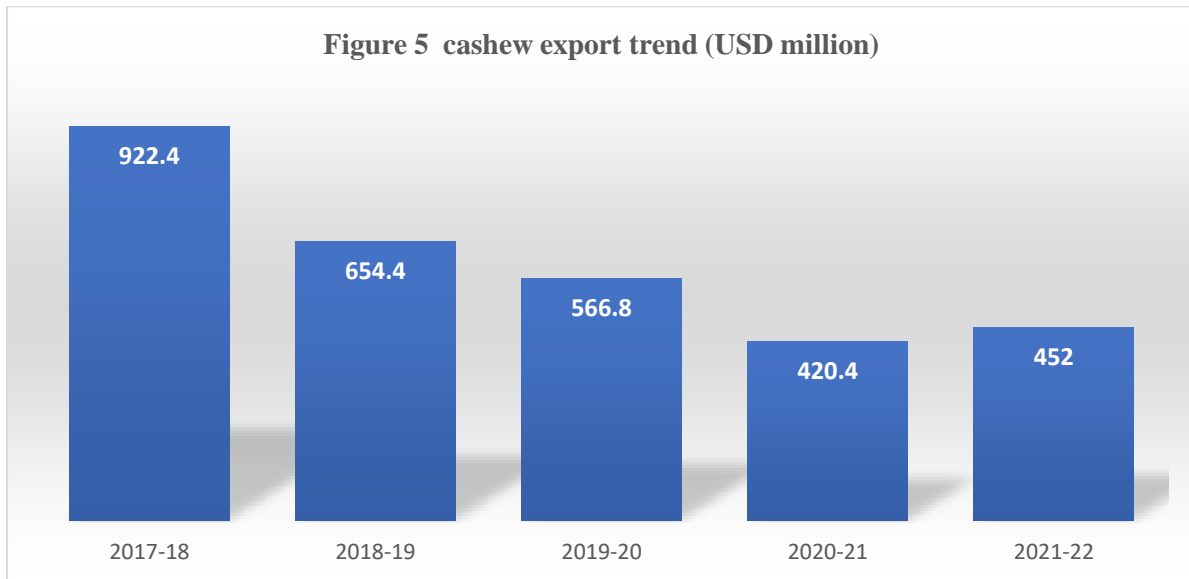
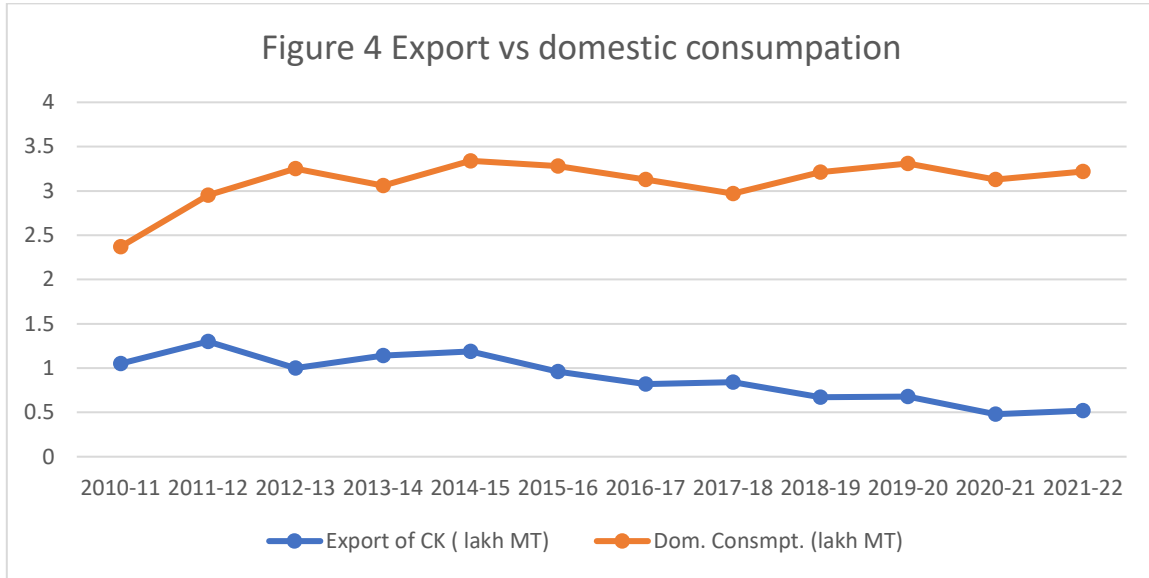
**Table 4 Cashew Kernel exports vs domestic consumption**

Year	Export of CK ( lakh MT)	Dom. Consmt. (lakh MT)	Total Kernel output (lakh MT)
2010-11	1.05	1.32	2.38
2011-12	1.3	1.65	2.96
2012-13	1	2.25	3.25
2013-14	1.14	1.92	3.06
2014-15	1.19	2.15	3.34
2015-16	0.96	2.32	3.28
2016-17	0.82	2.31	3.13
2017-18	0.84	2.13	2.97
2018-19	0.67	2.54	3.2
2019-20	0.68	2.63	3.3



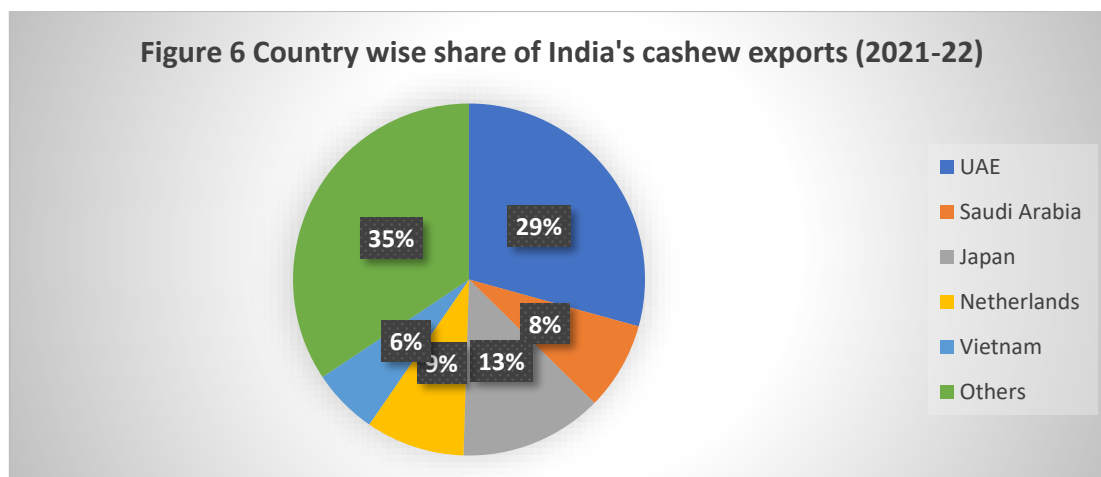
2020-21	0.48	2.65	3.13
2021-22	0.52	2.7	3.22

Source: Directorate of Cashew and Coca Development. Cochin.



Source: Ministry of Commerce and Industry RBI handbook of statistics

Figure 6 Country wise share of India's cashew exports (2021-22)



Source: DGCIS

India cashew exports markets are diversified in over 60 countries spread across different parts of the world such as UAE, Japan, Netherland, Saudi Arabia, the USA, the UK, Canada, France, Israel, and Italy (figure 6). UAE is the largest importer of Indian cashews, valued at US\$ 131.5 million, accounting for 29% of overall exports during 2021-22 as compared to US\$ 98.5 million in the previous year. In volume terms, India's cashew exports to UAE stood at 16.6 million kg, growing by 29% from 12.8 million kg of exports recorded in the previous year. Japan and Netherland are among the top 3 importers of Indian cashews, with a share of exports at 13% and 9%, respectively. The top 10 importing countries of Indian cashew have a share of 84% of the total exports, which implies the huge significance of traditional markets (APEDA, 2022).

Saudi Arabia & UAE are the major export destinations for Indian cashew export. India does not have tariff disadvantages in Saudi Arabia & U.A.E. As applied tariff rate for all competing countries is 5%. However, the government of India may try to reduce down duty further by having trade negotiations with both the countries (WTO Tariff Database). India is the largest cashew exporter with more than 15% of the world's export share. However, exports are in a declining trend whereas domestic consumption is in increasing trend (Table 3, & figure 4& 5). There are specific reasons of decline of cashew export are as follows

- High cost of domestic processing and price competition from Vietnam in cashew kernel trade in the international market.
- The shifting trend in trade, cashew industries are concentrated in the domestic market due to higher price realization (15-20%) than export price.

- Growth rate of Consumption in the domestic market is increasing trend (15% CAGR ).
- Lack of aggressive export promotion measures.
- RCN exporting countries have started mechanised processing and export of Kernels (Ivory Coast,Nigeria,Ghana,Tanzania,Benin).
- Difficulty of doing business overall nationally compared to Vietnam.

**Impact of Covid on Indian Cashew Export:** India is facing tough competition from Vietnam as it expanding its cashew exports to more countries during the lockdown and second our domestic market is standstill, it's not good sign for cashew export sector as they will face huge setback (Navamy Sudhish, 2020). India could not fulfil the overseas orders, and the industry was hardly able to ship major consignment during lockdown. Whereas Vietnam was operating fully they were able to fulfil the overseas cashew export orders. On the other side India's contracts got cancelled. Vietnam stepped into that vacuum, banking on demand. R.K. Bhoolesh, former chairman of Cashew Export Promotion Council of India (CEPCI) mentioned the biggest blow was losing the Middle East market which was loyal to Indian cashew and they have almost captured the U.S., another major market. And India may lose further these markets after even coming back in the market as they may continue with Vietnam. On the one hand Indian cashew industry is facing problems in the international market and on the other hand the domestic market is also not doing well due to the pandemic. India is the biggest consumer of cashew and that is the real strength of the Indian cashew economy, appropriate marketing strategies may plan to tap into the domestic market even pandemic time and after post covid. Vietnam has mechanised processing, they can sell the product at a much lower price. At the same time Indian cashew has more quality and longer shelf life, which is India's Unique Selling Proposition (USP). Quality cashew kernels (Wholes, W-180) are always exported. Splits and broken kernels go to the domestic market. Hence performance export-oriented units are crucial for recapturing the lost markets for the sector's survival.

**Government Initiatives:** The promotion of cashew export is the prime concern of the government of India, therefore with Cashew Export Promotion Council, have taken various initiatives such as non-financial assistance to exporters, many trade delegations, buyer-seller meets, fairs, development workshops, and research and development.

**Table 5 Steps taken by Govt. of India**

<b>Organisations</b>	<b>Steps</b>	<b>Explanations</b>
Director General of Foreign Trade	Change in import policy	Changes in import policy for cashew kernel (both broken and whole)
Cashew Export Promotional Council of India	Revision in Standard inputs outputs	Revision of the standard inputs output norms (SION) for cashew exports
Ministry of Finance	Medium term framework scheme	Approval of Medium-Term Framework scheme for process mechanization and automation of cashew processing units with a financial outlay of Rs. 60 crore (US\$ 8 million)
Ministry of Finance	GST	Goods and Services Tax (GST) on the same was reduced to 5% from 12%.
Ministry of Commerce and Industry	Duty free import	Allowing duty-free import of raw cashew nuts under Duty-Free Tariff Preference (DFTP) Scheme from least developed countries (LDCs)
Ministry of Commerce and Industry	Basic Customs Duty	Basic Customs Duty on raw cashew nut was reduced to 2.5% from the previous 5%,

**Source:** India Brand Equity Foundations2022.

The major issue faced by cashew exporters is the tough sanitary phytosanitary conditions imposed by US FDA, UK , EU, Japan, South Korea, Australia in the G20 Nations. Cashew is considered "expensive" and "luxury" by consumers as the retail selling price is almost double the core price of FOB Indian price. The major global crisis in the world following the Russia - Ukraine war was port congestion in China, which increased the Freight Rates globally by an unprecedented 700 percent, which were borne by exporters or importers hurting price structure. The Russia - Ukraine war has hit consumption of cashew in both nations pushing that surplus into other.

**Goa State Scenario:** In the state of Goa, it occupies the largest area among horticultural crops. This crop covers about 55 302 ha area with an annual production estimated at 27 070 tones. The productivity of cashew trees in the state is 430 kg / ha which is less than the national average of 748 kg/ ha. The productivity is much lower than the all other cashew producing states in India. Cashew cultivation plays a significant role in the economy of Goa. Growth rates in area, production and productivity of Cashewnut in Goa state and for all India. Goa state recorded Compound Annual Growth Rate (CAGR) of 0.25 per cent and at all India level CAGR was 2.29 per cent which was significant at 1 per cent probability level. In Goa, a decreasing growth rate was observed for the area under cashew nut (-0.43 per cent). The productivity of cashew in India as a whole was growing at the rate of 0.71 per cent per annum with 10 per cent significance, while in Goa productivity was growing at the rate of -0.69 per cent per annum, which were Non significant. The major cashew producing area in the state are Ponda, Sanquelim, Mapusa, Curchorem, Canacona, Valpoi, Pernem.

**Table 6 State wise Growth of Area, Production, Productivity under cashew in India**

State	Area (000 ha)		Increase/Decrease Between 2008-2017	Production (000MT)		Increase/Decrease Between 2008-2017	Productivity (Kg/ha)		Increase/Decrease Between 2008-2017
	2008	2017		2008	2017		2008	2017	
Kerala	70	91	21	75	84	9	1071	962	-113
Karnataka	107	128	21	60	85	25	561	672	91
Goa	55	58	3	30	33	3	545	561	16
Maharashtra	170	186	16	125	257	132	1323	1378	155
Tamil Nadu	131	142	11	68	68	00	519	478	-41
Andhra Pradesh	182	186	4	112	111	-1	615	600	-15
Orissa	137	183	46	95	94	-1	693	513	-80
West Bengal	11	11	00	11	13	2	1000	1140	1140
Others	30	57	27	19	35	16	633	708	74

Source: Directorate of Cashew and Coca Development.

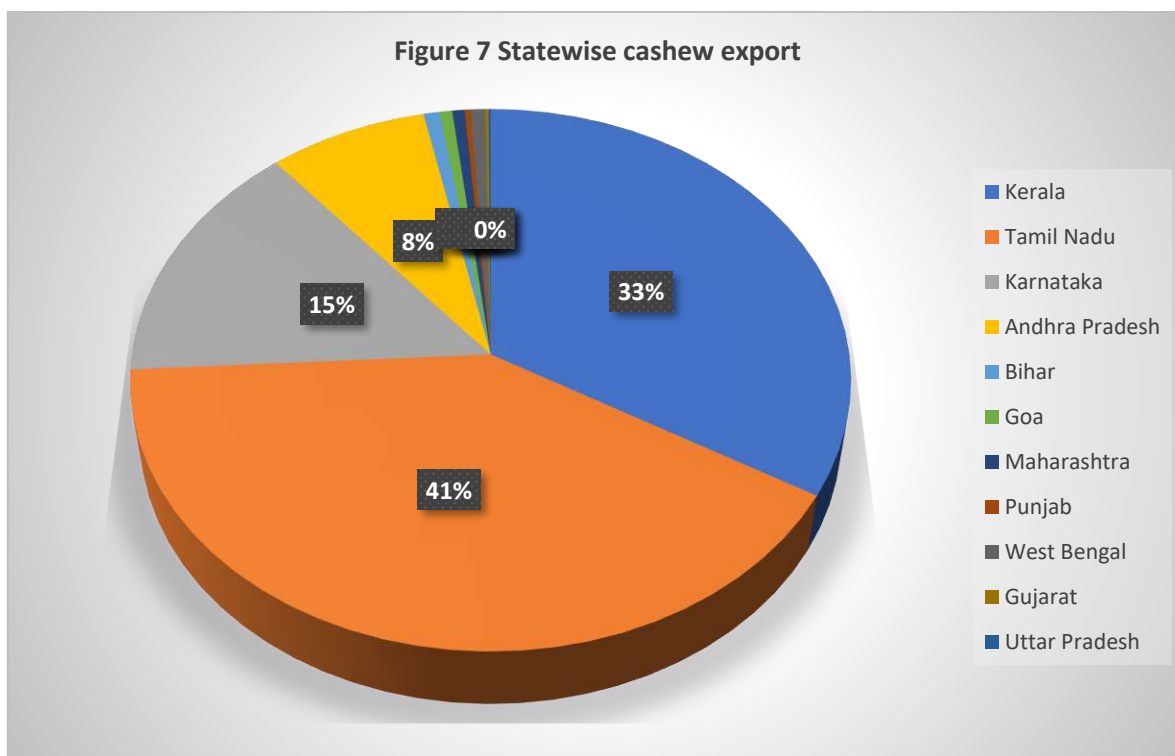
The production and productivity of cashew is highest in the state of Maharashtra. The highest average productivity of Maharashtra is 1378 Kg/ha. West Bengal and Kerala are the other two States in the 2nd and 3rd position followed by Maharashtra in the production of cashew in India. Among the major states in the country, Maharashtra tops with respect to area, production and productivity of cashew nut. During 2016-17, area under Cashewnut in Maharashtra was

186.20 thousand hectares producing 256.61 thousand tonnes with yield of 1378 kg per hectares (Table 5). However, in terms of cashew production Goa among the top ten largest producer state in India.

**Table 7 state wise cashew exports**

State	Qty
Kerala	25144.6
Tamil Nadu	30741.3
Karnataka	11124.63
Andhra Pradesh	5900.57
Bihar	596.14
Goa	467.27
Maharashtra	461.44
Punjab	214.35
West Bengal	541.03
Gujarat	122.2
Uttar Pradesh	83.93

Source: APEDA



Maharashtra is the leading producer of cashew nut in the country (Table 6, figure 7). The state has more than 2200 cashew factory in the state (Directorate of Cashew and Caoco Development), therefore it is reasonable to assume that state has largest cashew processing in the country. However, Goa is the among top ten cashew exporter state in the country. The Government of Goa need to take several steps to to promote the cashew kernel exports produced in the state. Ponda, Sanquelim, Mapusa, Curchorem, Canacona, Valpoi, Pernem can be develop as Agri Export Zone for Cashew kernel. Central Government's scheme of One District One Product (ODOP) also considers Cashew for North and South Goa. Ratnagiri, Also, there are infrastructural facilities required for promotion of cashew kernel like ports in state shall have authority to issue of Phy- sanitary certificate required for export. The development of cashew sector in the state will be helpful to growers of cashew to get remunerative price to the produce earning more profitability to the cashew processors due higher prices in the export market and huge employment generation to the illiterate rural women folk.

**Natural and Organic Cashew Farming in Goa:** The Government of Goa state can provide a special program to cashew farmers who are engaged in serious horticulture activity of producing raw cashews. First and foremost, it is required to have a registration campaign for all raw cashew farmers under an appropriate government of Goa agency, headquartered at Sindhudurg – Oros. A sub component needs to be provided for certified organic farmers in consultation with APEDA. The Government of Goa needs to make a special CIPIS-EXP program, wherein the Government of Goa decides to accord special status to cashew kernels manufactured in Goa that is processed for the purpose of exports, and involve raw cashew producers, cashew kernel manufacturers, re-processors and value adders in Ponda, Sanquelim, Mapusa, Curchorem, Canacona, Valpoi, Pernem. The Government of Goa needs to dovetail the APEDA Scheme which is now an exclusive agency meant for promotion of cashew kernels export and a joint Committee can be set up by APEDA, Mumbai and Government of Goa and nominated agencies and experts to have oversight on cashew exports from Goa with an ambitious target.

A special scheme can be devised for organic exports from Goa manufactured and sold for export. The industrial policy specifies the required impetus for backward regions in the case of new units or substantial expansion. It can be focuses on following issues:

- Encouraging farmer activity and the least intermediation from producer to the manufacturer.
- Goa provides that element and it has evidence of all the forms of purchase.
- Manufacturers direct purchase from producers.
- Manufacturers purchase from producers with only one step - a trader.
- A cluster of at least 100 producers can get generated in about 10 centers, and 3 FPOs can get generated

### Climate Change:

**Table 8 Climate Change**

Do you face the problems of climate change on cashew production?	Yes (%)	No (%)
	80	20
Total	100	100

Source: Field work

Cashew production is sensitive to climate change, The majority of cashew farmers (80%) are saying there is an impact of climate change on cashew production. Impacts such as defect in cashew kernel, small size of cashew, early harvesting, low production. This impacts on the farmers income substantially.

### Minimum Support Price to Cashew:

**Table 9 Minimum Support Price for Cashew**

Do you get MSP for Cashew?	Yes (%)	No (%)
	50	50
Total	100	100

Source: Field work

The state of Goa support cashew farmers with minimum support price. However, the majority of cashew famers (50%) are not getting the benefits of minimum support price due to land is not on their name.

### PM Kissan:

**Table 10 PM Kissan**

Do you get benefits of PM Kissan?	Yes (%)	No (%)
	30	70
Total	100	100

Source: Field work



PM-Kisan provides income support to all landholding farmers' families who have cultivable lands. However, in Goa 30 % cashew farmers are not getting the benefits of PM kissan as they are land tenant and not the actual land owner.

**Role of traders:**

**Table 11 Role of Traders**

Do you get cheated by traders in terms of price and weight?	Yes (%)	No (%)
	30	70
Total	100	100

Source: Field work

The raw cashew market is unorganized; cashew farmers are facing problems in the market. 30 % cashew farmers are saying they are getting cheat by traders in terms of price and weight.

**Role of Cooperatives Societies in Cashew Marketing:**

**Table 12 Role of Cooperative Societies**

Are you associated with any cooperative societies for cashew marketing ?	Yes (%)	No (%)
	100	00
Total	100	100

Source: Field work

The cooperative societies like Aadharsh Krushi Sahakari khardei vikri Processign Sanstha, Barli, Goa, Kaju Bagayetdar Sangh are plyaing important role in raw cashew market of Goa. They buy the cashew form farmers are at good price and they give to the factories. The member farmers are need not to go any other place to find the buyer for their cashew. It good model in Goa thousands of farmers are getting benefit of it.

**Organic Cashew:**

**Table 13 Organic Cashew**

Are you associated with any cooperative societies for cashew marketing ?	Yes (%)	No (%)
	80	20
Total	100	100

Source: Field work

The market for organic cashew is developing. In Goa, cashew farmers are involved in organic cashew production. In our survey 20 % farmers are getting and organic cashew production and they also get 5 to 6 rupees premium price.

**Conclusion:** Considering India's socio-economic structure and deep-rooted presence in rural areas, the smooth growth of cashew sector in the state of Goa is very critical for the inclusive development of rural area. There are specific and aggressive strategies that are needed to implement to overcome the challenges of the cashew industry. The strong growth in cashew exports across export destinations will continue to drive economic growth and employment generation in the state. Following are the policy recommendations to improve performance of the Goa cashew sector.

- Massive area expansion and replanting in cashew with High density concept and High yielding varieties (50,000 ha new planting and 20,000 ha replanting per annum need to be achieved).
- The highly promising states like Goa which has more scope for cashew cultivation needs to be promoted.
- Strong intervention from the Central government to boost domestic production.
- Concentrated approach in socially backward areas to safeguard the livelihood of small and marginal farmers with the involvement of FPO's and other stakeholders.
- Upgradation and mechanization of cashew processing industries.
- Promotion of *Indian Cashew* as a brand.
- *Produce of India to be distinguished from made in India*
- Expansion in new markets and enhancement of value added products range.
- Broad institutional mechanism with the involvement of all the stakeholders like opening of regional cashew directorate at the concentrated cashew production regions.
- More emphasis on Research & Development on good agricultural practices on cashew farming *and in cashew industry*.
- Regional cashew boards may be set up in the states like Maharashtra to increase reach of the cashew farmers with central authority.

- A special scheme can be devised for organic exports from India manufactured and sold for export.
- For Cashew apple to make cashew apple liquor very useful which is wasted now.
- Goa needs to incubate a special focus institutional support. Initially this can be under GOFCO to incubate when justified a Goa Dried Fruit and Nuts authority that can cover all dried Fruits and Nuts grown and sold in Goa.

## 2. Honey:

- **Introduction:** Goa is reached by flora fauna; therefore, honey production is one of the important forest products in state which can be commercially viable. Goa is situated in midst of the rich bio-diversity. There are several fruit crops like jackfruit, pomegranate, cashew nuts, coconut, grapes, guava, chikoo, pineapple, papaya, drumstick, Jamun, etc. Apart from fruits, several types of vegetables are also produced in Goa. These fruit and vegetable crops and the wild flora fauna in the Western Ghats can provide ample quantity of pollen and nectar to the bees throughout the year. Hence, Goa is quite suitable for beekeeping activities. Therefore, honey value chain development in state can bring employment opportunities to the local people.
- **Review of Literature: Tessema Aynalem Abejew et.al. (2017)** they study existing local honeybees and their productive characteristics and behavior in Ethiopia. In order to identify local honeybees, production potential and biological behaviors in local area of Ethiopia beekeeping experience and indigenous knowledge of bee keepers are essential.

**S Shrestha et. al. (2017)** they study honey value chain in Nepal, there is short supply chain exists in study region starting from producers, wholesalers, retailers and consumers. It is one of the important commodity in Nepal providing livelihood, food security and poverty elevations.

**Manisha Deb Mandal et.al. (2011)** they study medicinal properties of honey in great detail. Honey is possessing antimicrobial property. They discussed medicinal property of honeys in context of their antibacterial activities.

- **Random Sampling of Honey Farmers:** There are 200 registered honey farmers in the state. To understand the problems faced by honey farmers in the region, through random sampling 10 honey farmers have been interviewed to collect the primary data. Along with the data field observation also have been noted.

**Table 1 Sampling of honey farmers**

Particulars	Total sample	Sampling technique
Honey farmers	10	Random sample

- **Forest Accounting of Forest Asset (Forest Honey):** Western Ghats region of Goa has been mapped for forest beekeeping through the local beekeepers. There is large potential for establishment and management of Honey cluster through organization and by providing proper training to traditional beekeepers. There was a need to divert from the traditional honey hunting and adapt the state of art modern honey extraction and collection methods. It helps to increase the social status of these beekeepers, as well as in protection and conservation of billions of bees, ecology, and their diversities from becoming eminently endangered and extinct. Through local community's participation and efforts for such conservation and sustainability, forest department can develop honey value chain in the state.
- **Scenario of Western Ghats:** The range starts near the borders of Gujarat and Maharashtra, south of the Tapti river, and runs approximately 1,600 km (990 mi) through the state of Maharashtra, Goa, Karnataka, Tamilnadu and Kerala ending at Kanyakumari, at the southern tip of India. It is a 'UNESCO World Heritage Site' and is one of the eight "hottest hotspots" of biological diversity in the world. The area is one of the world's ten "Hottest biodiversity hotspots" and has over 7,400 species of flowering plants, 139 mammal species, 508 bird species, 179 amphibian species and 288 freshwater fish species; it is likely that many undiscovered species live in the Western Ghats. The range is known as *Sahyadri* in Maharashtra and Karnataka and as *Sahya Parvatam* in Kerala. Historically the Western Ghats were well-covered in dense forests that provided wild foods and natural habitats for native people. These Western Ghats hills cover

160,000 km<sup>2</sup> (62,000 sq mi) and form the catchment area for complex riverine drainage systems that drain almost 40% of India. Though this area covers barely five percent of India's land, 27% of all species of higher plants in India (4,000 of 15,000 species) are found here. Due to high variation of latitude, longitude, and climate, Western Ghats supports wide variety of habitats and rich biodiversity. Due to isolation from habitats in Indian subcontinent it had developed the endemism in dri-deciduous and evergreen forests. Out of thousands of species found 62% are reptiles, 78% amphibians, 53% fishes, 12% mammals and 12% birds are endemic to this region i.e. not found anywhere else in this region. Out of 4000 species of floral plants 1500 (38%) are endemic to this region. In addition to this Western Ghats is full of numerous medicinal plants and other genetic resources as local variety of rice etc. It has Monsoonal climate with 2000 to 4000 mm rainfall concentrated in 3 to 4 months.

- **Goa Forest:** Forest cover in Goa is diverse. Goa is India's smallest state in terms of area and the fourth smallest in terms of population. Goa is located on the west coast of India in the region known as the Konkan. Forest cover in Goa stands at 1,424 km<sup>2</sup>, most of which is owned by the government. Government owned forest is estimated at 1224.38 km<sup>2</sup> whilst private is given as 200 km<sup>2</sup>. Most of the forests in the state are located in the interior eastern regions of the state. The Western Ghats, which form most of eastern Goa, have been internationally recognised as one of the biodiversity hotspots of the world. In the February 1999 issue of National Geographic Magazine, Goa was compared with the Amazon and Congo basins for its rich tropical biodiversity. Nanda Lake is the first and the only Ramsar wetland site in Goa.<sup>[1]</sup> Goa's state animal is the Gaur, the state bird is the Ruby-throated yellow Bulbul,<sup>[2]</sup> which is a variation of Black-crested Bulbul, and the state tree is the Matti. The important forest products are bamboo canes, Maratha barks, chillar barks and the bhirand. Coconut trees are ubiquitous and are present in almost all areas of Goa barring the elevated regions. Much deciduous vegetation, including teak, sal, cashew and mango trees, is present. Fruits include jackfruits, mangos, pineapples and blackberries.

Foxes, wild boars and migratory birds are found in the jungles of Goa. The avifauna includes kingfishers, mynas and parrots. Numerous types of fish are also caught off the coast of Goa and in its rivers. Crabs, lobsters, shrimps, jellyfish, oysters and catfish form some of the piscine catch. Goa also has a high snake population, which keeps the

rodent population in control. Goa has many famous National Parks, including the renowned Salim Ali bird sanctuary. Goa has more than 33% of its geographic area under government forests (1224.38 km<sup>2</sup>) of which about 62% has been brought under Protected Areas (PA) of Wildlife Sanctuaries and National Park. Since there is a substantial area under private forests and a large tract under cashew, mango, coconut, etc. plantations, the total forest and tree cover constitutes 56.6% of the geographic area.

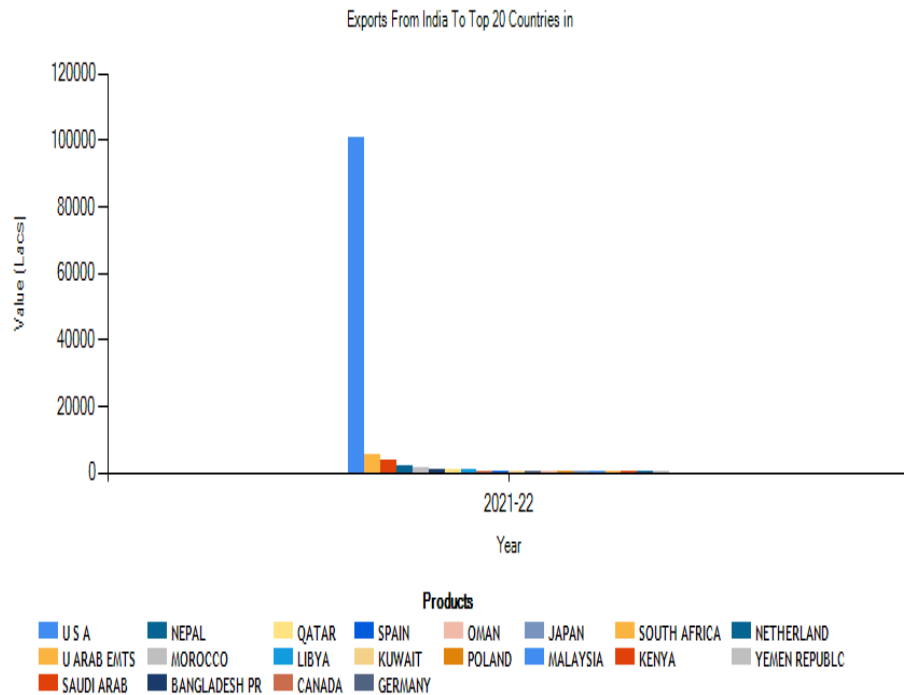
- **Potential Beekeeping Locations in Goa:** There are several potential beekeeping locations in the talukas of Canacona, Quepem, Sanguem, Darbandora, Salcete, Sattari, Bardez and Ponda, where apiculture have to be actively encouraged to increase production of Goan honey. Goa has got ghats falling talukas. The foot hills of the state are abundant in honey bee population. Tribals are traditionally honey hunters. Poinguinim , Fonsorem, Agonda , Cavelossim, Dramapur, Carmona, Netorlim, Vichundrem, Sulcorná , Colomba, Rivona , Don Bosco Quepem, Dharbandora , Mollem farms, Khotordem, Mangushi , Parra , Assagao valley , Acoi – Khamerkajan, Tivim , Colvale Cabo Raj Niwas porvorim are locations where beekeeping is being pursued for honey production and breeding. (Field work).
- **National Scenario of Honey Export:** Honey and beekeeping have a long history in India. Honey was the first sweet food tasted by the ancient Indian inhabiting rock shelters and forests. The raw materials for the beekeeping industry are mainly pollen and nectar that come from flowering plants. Both the natural and cultivated vegetation in India constitute immense potential for the development of beekeeping. About 500 flowering plant species, both wild and cultivated, are useful as major or minor sources of nectar and pollen. There are at least four species of true honey bees and three species of stingless bees. Several subspecies and races of these are known to exist. In recent years the exotic honey bee has been introduced. Together these represent a wide variety of bee fauna that can be utilized for the development of the honey industry in the country. There are several types of indigenous and traditional hives including logs, clay pots, wall niches, baskets and boxes of different sizes and shapes. *Rapeseed / Mustard Honey, Eucalyptus Honey, Lychee Honey, Sunflower Honey, Karanj / Pongamea Honey, Multi-flora Himalayan Honey, Acacia Honey, Wild Flora Honey, Multi and Mono floral Honey* are some of the major varieties of Natural Honey. North East Region of India and Maharashtra are the key areas for natural honey production. The

country has exported 74,413.05 MT of Natural Honey to the world for the worth of Rs. 1,221.17 Crore/ 163.73 USD Millions during the year 2021-22. Major Export Destinations (2021-22) are U.S.A, United Arab EMTs, Saudi Arab, Nepal and Morocco.

**Table 2 Honey Export from India**

<b>Sr No.</b>	<b>Country</b>	<b>Qty</b>	<b>Value</b>
<b>1</b>	U S A	59,262.50	100,889.95
<b>2</b>	U Arab Emts	4,362.01	5,359.37
<b>3</b>	Saudi Arab	2,475.43	3,707.36
<b>4</b>	Nepal	1,504.15	1,810.29
<b>5</b>	Morocco	1,227.52	1,301.85
<b>6</b>	Bangladesh Pr	719.30	1,168.95
<b>7</b>	Qatar	725.08	1,160.69
<b>8</b>	Libya	650.50	923.09
<b>9</b>	Canada	327.94	630.15
<b>10</b>	Spain	511.75	585.68

Source: APEDA



- Beekeeping and insects for Human Welfare:** Insects as group, comprises about 7,50,000 species, found to be heavily dependent on the diverse plant species for food and shelter. In turn many plant species co-evolve to suit for the benefits of insects. Out of them Honey bees are found to be strong pollinating agents. The bees collect pollens and honey from different floral plants. They fly from one flower to another of same or different species and therefore develop complex routes of cross pollination. The floral plants are conserved and evolved through reproduction. Pollination by bee's play an important role in this reproduction cycle. In addition to pollination, it is responsible for increased crop yield which can be estimated in terms of flourished flora and fruits. The Convention on Biological Diversity has recognized pollination as a key driver in the maintenance of biodiversity and ecosystem function. Bees are the most effective pollinators of crops and natural flora and are reported to pollinate over 70 percent of the world's cultivated crops. About 15 percent of the hundred principal crops are reportedly pollinated by domestic bees, including honey bees, and at least 80% are pollinated wild bees. Unfortunately, traditional beekeepers at Kolhapur are giving less attention to this silent service of honey bees. They are destroying colonies of billions of bees by employing some destructive methods of honey collection. The honey bees in Goa Forest are of different species like *Apis Dorsata* (Agya), *Apis Cerena Indica* (Sateri), *Apis Floria* (Katyal) and *Trigona* (Poya) (field work).



- **Apis Dorsata (Konaga):** These are the largest types of bees. These wild bees sustain even in adverse environment. Single colony of these bees gives 20 to 25 kg of honey. They cannot be domesticated and are the wildest variety found in nature. Their honey combs are as large as 1 x 1 meter. The local people in Goa call them as ‘Konaga’.
- **Apis Cerana Indica (Sateri):** These are medium sized bees. These are not wild but can sustain in adverse environment. Their single colony gives 5 to 10 kg of honey. These bees can be domesticated at any place in any season. Their combs map 20 cm. X 15 cm, they build 1 to 8 parallel hexagonal compartments out of which 7 are prominent and so called as ‘Sateri’ or ‘Sativ’.
- **Apis Floria (Katyal):** These are small bees. They are not wild but can sustain in adverse environment. Their single colony gives 1 to 3 kg honey. These cannot be domesticated. Their Honey combs measure 6-inch x 4 inch. They migrate if sufficient feed is not available.
- **Trigona (Poya):** These are smallest bees. They are not wild. Their single colony gives 100 gm to 250 gm honey. They live in the same habitat over years and build the egg shaped combs. They are also wild bees and cannot be domesticated. They do not have stings to bite but for protection they attack on the enemies by entering into their ear, nose, hairs etc. All these honey bee species collect multifloral honey from different local plant species. To explore the honey bee and floral plant relation it is necessary to map the floral plants and habitat specific use of them by honey bees (field work).
- **Biodiversity of Floral and Nesting Plants:** Honey bees collect honey from almost all floral plants in the forests and act as cross pollinating agents for conservation of forests. The list of floral plants include Karvi, Ain, Behada, Hirda, Kate Sawar, Jamun, Karvand, Mango, Gela, Gulmohar, Palas, Shikekai, Kinjal, Anjan, Pisa, Chimat, Chinch, Kaju, Surangi, Ambulaki, Akesia, Fanas, Wild lemon, Apata, nana, Kanchan, Sagargota, Wild fanas, Kataki, Kunbha, Sisam, Karambal, Nerli, Awala, Wildpangara, Garanbi, wildmodi, Wad, Umber, Kalaumber, Pimple, Kharvat, Kokam, Giripushap, Shivan, Muradsheng, Dinda, Chandada, Wild tambhakhu, Yellow chapha, Bakeri,

Narakya, Karanj, Chimat, Biba, Sagwan, Wildbhendi, Nirgudi, Dhayati, Kuda, Alu, Dhavada, Saptarni, Tambat, Wild badam, Bel, Bhokar, Rui, Torani etc (field work).

- **Deforestation:** Beekeeping is itself is a conservation strategy and tool to combat the people from deforestation. Almost 1500 species of floral plants are endemic to Western Ghats of Kolhapur region. These plants possess medicinal values and deforestation is increasing for timber, firewood, medicines and mining industry. So, the endemic species of floral plants may become eminently endangered. In addition to this the Nesting Plants are also hunted for firewood and other activities. Thus, deforestation may demolish the habitats of honey bees. Therefore, for the conservation of honey bees the floral and nesting plants must be conserved and vice versa. Afforestation of Nesting Plants must be carried out for retaining sustainability of honey collection.
- **Social Status of Traditional Beekeepers:** The local beekeepers community includes poor low land or no land farmers and tribals. The lack of education and other skills is posing difficulties in getting employment. These people are migrating to cities for labor work. They are facing different problems of infrastructure and medical care. No irrigation facilities are available and therefore there is no development of agriculture. The youth from this community are observed to be migrating to cities like Mumbai, Pune etc. for labor work. To improve the overall social status of these communities, beekeeping can be a way out as a sustainable occupation (field work). Forest department can take the initiative to develop the honey business in the state. Beekeeping as a livelihood option will offer them to increased their social integration, responsibility, and awareness about conservation of biodiversity.
- **Honey Collection Methods:**
- **Traditional Methods of Honey Collection:** In the traditional methods, groups of beekeepers hold the fire flames under the trees on which the honey combs are present for the bees to fly away. In this process, the Queen and a lot of worker bees die out which causes great harm to honey bee colonies and their exotic species. They destroy complete honey comb during extraction of honey and irresponsibly destroy the branches of trees and harm the bee population. They are ignorant to the fact that the colonies are getting destroyed on large scales and biodiversity is in danger due to

demolition of pollinating agents, the bees. Millions of bees and the eggs as well as the offspring's are destroyed. It also affects the reproduction of honey bees to reproduce the next generation. It demolishes the bee colonies as well as reduces the honey production. The extracted honey may be impure and the methods employed also require hard work. These people are not aware about the modern technology and also lack the basic tools and techniques. No one had tried to disseminate the corresponding knowledge to them prior to this. Therefore, honey is needed to be extracted with extreme care without destroying the colonies. These proper methods offer the increased production of honey as well as the conservation of biodiversity. Western Ghats region is full of natural resources. The local people here are migrating due to lack of education, unemployment, and unavailability of sustainable occupation. To stop the local people from migrating and creating an population imbalance, honey production can be set as an organized business and become a part of their income. It is most important is to adopt the modern technology of honey extraction. In scientific methods of honey extraction, it is not necessary to cut the complete honey comb. The colonies of giant forest bees are generally found on stones in the hills and some host plants as Jamun, Mango, Palas, Behada, Katesawar, Awala, Karanj etc. The 'Apis Cerena Indica' colonies are found on plants and stones but in just dark region.

- **Scientific Methods of Honey Collection:**

- By using the smoking machine, the bees in the combs are flown away.
- Beekeepers by wearing the sting protection dress, reach up to the combs of bees with the help of ropes.
- The bees in the giant bee combs are removed by hands carefully. The upper central portion containing 80 to 90 % honey of the comb is cut through by the cutter and placed in collecting bucket.
- The base of the comb is generally stuck to the branch of a plant or the stones. The Upper central Honey portion is just below it. Therefore, the honey portion is cut through without touching the base of the comb so that they can grow it back.
- The total honey should not be extracted from the comb. About 20 % of honey is retained in the comb for the growth of offspring's of bees and thereby sustaining of bee colony.

- The 'Apis Cerena Indica' honey combs contain almost 6 to 7 hexagons and the honey is found to be filled in only one hexagon. Only that honey filled hexagon is slit through by cutter and others are retained.
- The collection bucket is slowly pushed to the ground by the help of rope.
- The honey in the bucket is stored in the GI Can.
- Honey is extracted at early mornings and late evenings when it is dark.
- To overcome the darkness two rechargeable batteries are used.
- If honey is extracted without harming the bees, they fill and rebuild the cut part of the comb in just next month.
- Using this scientific method, honey can be extracted thrice a year.
- About 4 to 5 kg of honey can be extracted from a single honey comb.
- This method does not harm the bees. Therefore, it helps to increase the population of bees as well as the honey production. This method is therefore useful to both beekeepers and eco-conservation.
- Beekeepers get the employment of about 50 to 60 days per year.
- To summarize, the beekeepers are required be to provide with the equipment's as follow-

**Stink Protection Dress:** This dress kit includes Helmet, Wire Gauge, Double Jeans shirt, Double Jeans pant, Jeans socks, rubber hand gloves, etc.

**Smoking Machine:** Honey bees are generally found to fear the fumes and fire flames. So, the traditional beekeepers employ the fire flames and fumes to fly away the bees. But it destroys the bee colonies. The modern fuming machine does not harm the bee colonies.

**Tape Rope Ladder:** To reach the Honey bee combs the tape Rope Ladder is used. It also supports while removing the bees from the hexagons of wax and cutting through the honey portion of the bee comb.

**Tape Rope:** The Honey collection Bucket will be pushed slowly to the ground by the Tape ropes. It also gives support to the beekeeper at the heights.

**G. I. Bucket:** It is preferred because of its light weight and strength. It collects the honey extracted and is used to carry it to the ground with the help of rope.

**G. I. Cutter:** It is used to cut through the honey portion of the comb with care without touching the base of the comb. It cuts only middle lower portion of the comb.

**Rechargeable Battery:** Generally, Honey is extracted in the evening with some darkness. Therefore, it is dangerous to extract honey in dark without battery. Batteries help to reach the combs, to cut the honey portions of the comb and collect & carry the honey to the ground.

**Honey Extractor:** It separates the Honey and wax. This machine includes the metal net joined to handle through bivoual gear. When the handle is rotated, the metal net also rotates. Due to centrifugal force the honey is thrown outside and collected in a pot covering. The wax pieces remain stuck in the net itself. Thus pure honey is extracted in the pot.

- **Significance of forest accounting of forest assets:** A single beekeeper destroys an average of 100 honeycombs per season. The colonies of *Apis Dorsata* comprise an average of 15000 (Fifteen Thousand) bees. During the traditional extraction of honey this huge population of bees including Queen, Worker Bees, Eggs and Offsprings are destroyed.  $15000 \times 100 = 15,00,000$  (15 Lacs) number of bees are destroyed by a single beekeeper in a season. If we assume the average working age of a beekeeper to be of 40 years, it is clear that a single beekeeper alone destroys billions of honey bees. If we worked with 100 beekeepers using scientific method at first stage, it will protect and conserve  $100 \times 15,00,000 = 15,00,00,000$  (15 Crores) number of bees and make available the same number of pollinating agents for biodiversity conservation. No one has mapped the flora and their association with pollination in Goa, Therefore it is necessary to map the floral biodiversity of Goa in association with pollination by honey bees and the nesting plants of honey bees. It will help to develop conservation strategies for biodiversity conservation through community participation in Goa. At least 250 traditional beekeepers are available in the state and they are destroying the honey colonies continuously over the years. It is necessary to include them in modern beekeeping to save huge number of bees according to above calculation. The honey cluster of these beekeepers should be established to promote the developing of honey industry. The economically backward beekeepers can be organized in the honey clusters and be provided with sustainable occupation through Extension Communication services. The youth from this region will be stopped from migration to urban cities with the adoption of this income generating beekeeping. It will also offer the opportunities of increasing social status and integration.

- **Sustainable Model: Scientific Method of Honey Collection:**

**Smoking machines:** Bees in the combs just fly away in the meanwhile and do not die, thus not harming them. In the existing traditional method, fire is used wherein most of the bees die.

**Sting protection suit:** Beekeepers reach up to the comb wearing the suit with the help of ropes. In the traditional method there is a danger of bee stings and thus the beekeeper cannot reach up to the comb.

**Tape Rope Ladder:** The ladder is used to reach the branch of the tree or the stone where the honeycomb is situated, in order to systematically slice the comb. In tradition methods the honeycomb is hit with sticks and it is broken haphazardly which destroys the base of the comb.

**G.I.Cutter:** The base of the comb is kept intact and the comb is cut above the base with the cutter and collected in a G.I.Bucket. About 20 % of honey is retained in the comb at the base for the growth of offspring's of bees and thereby sustaining of bee colony.

**Rechargeable batteries:** Honey is extracted in the evenings and early mornings in the dark which requires artificial lighting using batteries.

**Honey Extractor:** The extractor uses centrifugal force to pour out honey in a pot and keeps the wax in the extractor itself and thus pure honey is extracted.

- **Honey Production;**

**Table 3 Honey Production**

Particulars	Yes (%)	No (%)
10 kg	10	00
20 kg	10	00
30 kg	60	00
40 kg	10	00
More than 50 kg	10	00
Total	100	00

Source: Field work

The state of Goa has diverse flora and fauna that increase prospects of honey production. As per the industry input at present total honey production in the state is 1 tone. With systematic efforts up to 4 tone honey production can be taken up in the state. The majority honey farmers

in the state are small (60 %) quantity having less than 30 kg. Apis cerana indica honey bee production generally found in Goa.

- **Honey Price:**

**Table 4 Honey Price**

Particulars	Yes (%)	No (%)
Rs 500 per kg	20	00
Rs 1000 per kg	40	00
Rs 1500 per kg	10	00
Rs 2000 per kg	10	00
Rs 3000 per kg	10	00
Rs 4000 per kg	10	00
Total	100	00

Source: Field work

The price of honey is depending on the kind of honey. In the state as per trader input honey price spread is between Rs 500 per kg to 4000 per kg. In survey, 40 % honey farmers are getting price more than Rs 1000 per kg.

- **Climate Change:**

**Table 5 Climate Change**

Do you face the problems of climate change on honey production?	Yes (%)	No (%)
	100	00
Total	100	100

Source: Field work

The impact of climate change is visible in honey production such as heavy rain destroyed the honey bomb, destroyed the flora and fauna that leads to migration of honey bees to other area.

- **Problems in Honey production:**

**Table 6 Problems in honey production:**

Do you face problem while honey production?	Yes (%)	No (%)
	100	00
Total	100	100

Source: Field work

While interaction with honey farmers in the state, they have been told they are facing various problems such as heavy rain, management of bee colony, climate change, fear of honey bees, flowers defective etc.

- **Honey Business:**

**Table 7 Honey business**

Do you want to continue in honey production business?	Yes (%)	No (%)
	100	00
Total	100	100

Source: Field work

The honey farmers in the state would like to continue into honey production business. It show that they are getting return and they feel they gave good prospects.

- **Training:**

**Table 8 Training**

Do you get training form government for honey production?	Yes (%)	No (%)
	100	00
Total	100	100

Source: Field work

The bee keeping farming is required sufficient training. All the registered farmers are getting good training form various organisations.

- **Market:**

**Table 9 market for honey**

Do you get buyer easily for your honey production?	Yes (%)	No (%)
	100	00
Total	100	100

Source: Field work

As per traders' input, there is good demand for honey in the market but there is low supply. Production is limited in the state. All the bee keeping farmers are getting easy buyer for their production.

**Conclusion and Recommendations:** Honey collection in the forest and non-forest area in the state. Large potential for establishment and management of Honey clusters through state of art modern honey extraction and collection methods by training the traditional beekeepers. If honey is extracted without harming the bees, they revive the comb from the base of the comb in just one month. In this scientific method, honey can be extracted thrice a year. About 4 to 5



kg of honey can be extracted from a single honey comb through this method. It helps to increase the population of bees as well as the honey production and collection. This method is therefore useful to both beekeepers and eco-conservation. It curbs down deforestation as it is a source of income to the beekeepers. Beekeepers get the employment of about 50 to 60 days per year and it improves their living standards. Forest honey collection promotes biodiversity conservation. It brings a lot of socio-economic benefits. It can make a difference in the life of beekeepers at the same time it will help biodiversity conservation. Forest honey has rich medical properties and is organic in nature free from all artificial chemicals and pesticides. Therefore, forest honey is one of the forest assets which influence forest value. Scientific Beekeeping is a conservation strategy to reduce deforestation. Goa needs a comprehensive beekeeping policy to boost honey production in the state and generate livelihood for local youth. Beekeeping can be encouraged in the state as an economic activity for unemployed Goans. In the state there are several potential beekeeping locations such as Canacona, Quepem, Sanguem, Darbandora, Salcete, Sattari, Bardez and Ponda, where the forest department can take lead and develop honey business. Since Goa is a tourist state, the Forest department can also open forest products Shoppes at different places in Goa and exhibit the forest products such as honey. Considering the suitable environment for honey production in Goa, the forest department can take lead to develop honey value chain in the state at the production level, processing level and marketing level.

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## Chapter 7

### Conclusion & Policy Recommendations

Forest accounting helps in identifying economic contribution of various forest ecosystem services. After carrying out detailed analysis of Goa Forest, the present research concludes as follows.

1. The total India's forest cover is 708,273 square km, which is 21.54 percent of the total area of the country. Considering external pressure on forest trees, there is a need to have proper strategies to keep forests intact by creating awareness for agro forestry, ecotourism, etc.
2. Between 2015 and 2017, India has added 6,778 square km of forest cover and extended 1,243 square km of tree cover. It's showing good prospects and it is helping to make strong forest ecosystem.
3. Madhya Pradesh has the largest forest cover in India.
4. Forestry Contributes 2 % of India's GDP.
5. Punjab, Haryana, Rajasthan, Uttar Pradesh, Gujarat and Bihar have the lowest percentage of Forests in India. There are various reasons such as rapid industrialization, agriculture expansion, and climatology of respective zones. This state needs to increase forest cover by adopting various practices such as community forest and agro forestry.
6. In state of Goa net sown area is about 36%, cultivable wasteland is about 15%, land not available for cultivation is about 10% and the contribution of forest is about 35%.
7. Out of the total geographical area of 3702 sq km of the state about 2219 sq km constitutes forest i.e.0.16% of country's forest area.
8. The forests of Goa are typical of the Western Ghats Forest (Southern Maharashtra and Karnataka). The forest survey of India has mapped forest types by using satellite data with reference to Champion and Seth classification. As per this assessment in the state forest report 2011, the state has 5 forest types. Considerable work has been done in recent years to increase the forest cover through plantation activities thereby adding value to the forests of Goa.

9. There are various parameters of forest accounting such as follows.
- Actual / Economic Accounts:
  - Physical Account
  - Monetary Account
  - Flow Account
  - Financial Performance
  - Ecological Classifications of forest
  - Valuation Method
  - Forest Economics
10. Forest accounting is providing significant input in various ways such as protecting biodiversity, sustainability, protection of ecosystem, livelihood, economic development, industry and trade, employment generation, reduction of biodiversity loss, risk of disaster, true measurement of economic development, and generating accurate data for policy makers, regulating climate change, etc. In the present context of bio economics, forest accounting is getting significant importance in national policy making. It suggests that adoption of green accounting and its institutionalization is essential in order to improve upon the degradation level of forest resources.
11. Forest cover in Goa is diverse. Goa is India's smallest state terms of area and the fourth smallest in terms of population. Goa is located on the west coast of India in the region known as the Konkan Forest cover in Goa stands at 1,424 km<sup>2</sup>, most of which is owned by the government. Government owned forest is estimated at 1224.38 km<sup>2</sup> whilst private is given as 200 km<sup>2</sup>. Most of the forests in the state are located in the interior eastern regions of the state. The Western Ghats, which form most of eastern Goa, have been internationally recognised as one of the biodiversity hotspots of the world. In the February 1999 issue of National Geographic Magazine, Goa was compared with the Amazon and Congo basins for its rich tropical biodiversity. Nanda Lake is the first and the only Ramsar wetland site in Goa. Goa's state animal is the Gaur, the state bird is the Ruby-throated yellow Bulbul, which is a variation of Black-crested Bulbul, and the state tree is the Matti. Coconut palms with their undulating fronds in Goa, India.



12. The important forests products are bamboo, canes, Maratha barks, chillar barks and the bhirand. Coconut trees are ubiquitous and are present in almost all areas of Goa barring the elevated regions. Much deciduous vegetation, including teak, sal, cashew and mango trees, is present. Fruits include jackfruits, mangos, pineapples and blackberries. Foxes, wild boars and migratory birds are found in the jungles of Goa. The avifauna includes kingfishers, mynas and parrots. Numerous types of fish are also caught off the coast of Goa and in its rivers. Crabs, lobsters, shrimps, jellyfish, oysters and catfish form some of the piscine catch. Goa also has a high snake population, which keeps the rodent population in control. Goa has many famous National Parks, including the renowned Salim Ali bird sanctuary.
13. The state has more than 33% of its geographic area under government forests (1224.38 km<sup>2</sup>) of which about 62% has been brought under Protected Areas (PA) of Wildlife Sanctuaries and National Park. Since there is a substantial area under private forests and a large tract under cashew, mango, coconut, etc. plantations, the total forest and tree cover constitutes 56.6% of the geographic area.
14. Goa houses 16 mangrove species and it has one of the best mangrove forests in the country (*Rhizophora mucronate*, *Rhizophora apiculate*, *Bruguiera gymnorhiza*, *Bruguiera cylindrica*, *Ceriops tagal*, *Kandelia candel* (*K. rheedi*), *Avicennia officinalis*, *Avicennia marina*, *Sonneratia alba*, *Acrostichum aureum*, *Sonneratia caseolaris*, *Aegiceras corniculatum*, *Excoecaria agallocha*, *Acanthus illici folius*, *Lumnitzera racemose*, *Derris heterophylla*). Chora Island in Mandovi river is one of the best mangrove forests and houses most of the species found in Goa.
15. As per India State of Forest Report 2019, the overall growing stock in the forests is 11.16 m. cum, in the forest area & 4.03 m.cum.,
16. There are 360 villages in the state of which 138 have forest as a land use. The forest area in these villages is 88,358 ha. The villages having less than 100 ha, between 100-500 ha and more than 500 ha forest area in each village constitutes 28%, 41% and 31% of the total villages respectively.
17. Through a nation-wide study, FSI has done estimation of dependence of people living in the villages close to forest for fuel wood, fodder, small timber and bamboo in quantified terms for each State & UT of the country.

18. Main reasons for the increase in forest cover in the State are plantation and conservation activities. Goa Forest Department implements various schemes like Rehabilitation of Degraded Forests, Western Ghats Development Programme, Development of Gardens, Parks and Fountains, Social and Urban Forestry etc. Based on the interpretation of IRS Resourcesat-2 LISS III satellite data period of Dec 2017, the Forest Cover in the State is 2,237.49 sq km which is 60.44% of the State's geographical area. In terms of forest canopy density classes, the State has 538.00 sq km under Very Dense Forest (VDF), 576.09 sq km under Moderately Dense Forest (MDF) and 1,123.40 sq km under Open Forest (OF). Forest Cover in the State has increased by 8.49 sq km as compared to the previous assessment reported in ISFR 2017. The State has reported extent of recorded forest area (RFA) 1,225 sq km which is 33.09% of its geographical area. The reserved and unclassed forests are 20.65% and 79.35% of the recorded forest area in the State respectively. As per the new methodology of assessment, Cashew, Mango and other horticultural trees have been included in the forest cover and hence the reported increase.
19. The stock of forest was in 2017 was 2229 sq. km & in 2019 forest stock was 2237 sq. km, it means forest stock has been increased by 8 sq. km. It shows department of forest has taken various steps to increase the forest by which biodiversity may increase in the forest area.
20. The timber production is more in private forest as compare to govt forest. Over the years timber production from govt forest is reduced and timber production from private forest has been increased.
21. The firewood production is more in private forest as compare to govt forest. It also shows that the over the years firewood production from govt forest as well as in private forest has been increased.
22. Goa has suitable conditions for bamboo production. The data reveals that there is no significant bamboo production both in private as well as in govt forest in the last couple of years.
23. The combine value of firewood, timber and bamboo both in private as well as in govt forest is 484 lakhs. The cane production value is not available hence it is not included in total value.
24. The revenue of the forest department has increased substantially from 293.39 to 370.46 lakhs. It indicates effective forest management as well as increase in the value of forest products.

25. As per the ISFR report, Goa has 25.3 million tons of carbon stock in its forests. The estimated value of carbon credit of Goa Forest is approximately USD 17 cores. Forests play an important role in mitigation and adaptation to climate change. Forests are considered as a reservoir, sink and sources of carbon. The Department of Forest can take initiative or build a project carbon credit project.
26. Considering India's socio-economic structure and deep-rooted presence in rural areas, the smooth growth of cashew sector in the state of Goa is very critical for the inclusive development of rural area. There are specific and aggressive strategies that are needed to implement to overcome the challenges of the cashew industry. The strong growth in cashew exports across export destinations will continue to drive economic growth and employment generation in the state.
27. Honey collection in the forest and non-forest area in the state. Large potential for establishment and management of Honey clusters through state of art modern honey extraction and collection methods by training the traditional beekeepers. If honey is extracted without harming the bees, they revive the comb from the base of the comb in just one month. In this scientific method, honey can be extracted thrice a year. About 4 to 5 kg of honey can be extracted from a single honey comb through this method. It helps to increase the population of bees as well as the honey production and collection. This method is therefore useful to both beekeepers and eco-conservation. It curbs down deforestation as it is a source of income to the beekeepers. Beekeepers get the employment of about 50 to 60 days per year and it improves their living standards. Forest honey collection promotes biodiversity conservation. It brings a lot of socio-economic benefits. It can make a difference in the life of beekeepers at the same time it will help biodiversity conservation. Forest honey has rich medical properties and is organic in nature free from all artificial chemicals and pesticides. Therefore, forest honey is one of the forest assets which influence forest value. Scientific Beekeeping is a conservation strategy to reduce deforestation. Goa needs a comprehensive beekeeping policy to boost honey production in the state and generate livelihood for local youth. Beekeeping can be encouraged in the state as an economic activity for unemployed Goans. In the state there are several potential beekeeping locations such as Canacona, Quepem, Sanguem, Darbandora, Salcete, Sattari, Bardez and Ponda, where the forest department can take lead and develop honey business. Since Goa is a tourist state , the Forest department can also open forest products Shoppes at different places in

Goa and exhibit the forest products such as honey. Considering the suitable environment for honey production in Goa, the forest department can take lead to develop honey value chain in the state at the production level, processing level and marketing level.

28. Non-wood products such as Cashew, bay leaf, Hirda, Honey, Shikakai, Bamboo and Amsole, Jackfruit etc are available in Goa Forest in large quantities. These products are sources of food, fodder, medicines, gums, resins, and construction materials. It is raw material to various forest based industries such as forest honey industry, cashew industry, fodder industry, furniture industry, pharmaceuticals, and food processing industry, etc. It plays significant role in life of rural people.
29. It suggests that there is a need of regular updates and delivery of data from forest department which will help to undertake proper forest accounting and to include it in Government's policies.
30. There are four major sources of forest revenue i.e. Timber, Firewood, other minor forest products and some other receipts. Firewood and timber is significantly contributing to revenue as compared to other sources.
31. Goa forest has scope for various agro forestry-based businesses such as honey, bay leaf, cashew, bamboo, furniture, fodder, wild spices, Jackfruit etc. Goa Forest Department may promote forest products based startups to unleash the potential of forest products and generate employment at local area.
32. Goa's diversified climate promotes production of jackfruit at scale in forest and non-forest area. The jackfruit is becoming more and more well-known throughout the world as a "superfood" meat substitute, creating a huge opportunity for Goan farmers and exporters. The largest fruit produced by a tree is rich in nutrients. Every component of this fruit or tree has nutritional and economic value. To further tap the export potential of fruit and to strengthen the supply chain between producers and exporters to foray and expand the opportunities, Goa Forest Department may take initiatives for Export promotion on Jack fruit & its value-added products. Jackfruit is an important raw material for vegan products. We do have raw materials available but we have to work on making jackfruit a vegan product. Jackfruit has a meat-like texture and with the right process and flavor add-ons, it can be jackfruit a substitute for meat. In both mainstream and ethnic markets around the world, jackfruit is rising in popularity. Regarding the export situation, India shipped

different fresh fruits, including Jackfruit, valued at 388.41 million US dollars in 2021–2022. Around 7.1 percent of total, or 27.67 million US dollars. The main markets for fresh fruits coming from India are Bangladesh, the UAE, Iran, and Nepal, Maldives, the UAE, Qatar, Germany, and the USA, among other places. The jackfruit is predicted to become the most sought-after fruit in the next years due to the increased awareness of the fruit's nutritional and health benefits. Goa has the potential to become into one of India's top producing and exporting states for jackfruit.

33. India allows the export of only processed wood, not timber. In fact, the timber harvested from Indian forests is not enough to meet the domestic demand for housing, furniture, and other products. India's forests contribute just about five million cubic metres of wood every year. Almost 85% of the demand for wood and wood products is met by trees outside forests (ToF). About 10 % is imported. India's wood import bill is Rs 50,000-60,000 crore per year. Since ToF are so important, new certification standards are being developed for their sustainable management. PEFC already has certification for TOF and in 2022, FSC came up with India-specific standards that included certification for ToF.
34. Forest certification in India is still at an early stage and therefore the nation has not been able to make use of the benefits of forest certification. Therefore, Goa Department of Forest may take the initiatives in terms of forest certifications.
35. Formula for Value of Tree = (timber + carbon sink + provisioning services + regulating services + cultural services + replacement cost + cost of biodiversity loss + reproductive cost - opportunity cost X discount factor).
36. As agriculture and natural resources is the base of industrial development, forests provide basic input as raw material and some of the products as final product. Among all natural resources forest are the most valuable natural resources. Numerous inputs are given by forest for socio-economic development. Therefore, considering economic benefits of forests to society, it is important to account the forest resources. Forest accounting helps to identify risk of disaster by taking preventive and corrective actions. Forest accounting of Goa can attract investment in forest sector. In order to keep forest intact, detailed analysis of forest

sector is needed. Forest accounting helps in recognizing invisible forest ecosystem services and its contribution to economy. Forests are just not stock of trees instead it is a base for land, water, animals, oxygen, food chain, etc. It is life support system. These all services are invisible in terms of economic value. However, ecosystem services have strong monetary value. It is playing very significant role in economic development. But it has not been recognized and not assigned the economic value to it. Therefore, it is imperative to identify and recognize such services and find out its economic value looking at the innumerable services and products forests provide.

37. At present all-natural resources including forest are in danger. Due to this the world is facing various problems such as climate change, food insecurity, disturbed ecological balance, disturbed food chain, health issues, etc. Therefore, there is a need to change our approach towards natural resources and especially towards forests. In this context recognizing and assigning value of forest services to society could be a significant initiative. Once we know the value of forest services and keep an account of it, it will help to control forest destruction. Therefore, the formula is developed to provide a base for assigning monetary value to a tree which needs further development.
38. Present research explores forest accounting of Goa. It has tried to reorient invisible ecosystem services accounting and its contribution in economic development. It discusses basic forest accounting theory and its concepts, forest accounting parameters, forest accounting and biodiversity, forest accounting challenges and sustainability, etc. Forest and agriculture go hand in hand. There is always a need to maintain fine balance between them. Forest accounting can be helpful to maintain trade-off between forest and agriculture. It is a theoretical and practical analysis of entire forest accounting of Goa with serious detailed research investigation. It consists of various components of forest accounting. Goa forest has very strong potential of carbon sequestration that can provide economic benefits. It has also tremendous carbon sequestration potential & agro forestry which needs to be utilized.
39. The forest resources degradation can be curtailed by adopting green accounting and its institutionalization. Reduction in forest degradation will promote sustainable development. However, regular data and updates are required from

the forest department to undertake proper forest accounting. Without sufficient data from official sources, it is difficult to identify the nexus between forest accounting and sustainable development.

40. Accounting of forest sector of Goa increases the prospects in terms of more investment in forest sector, reducing the risk of disaster, more business opportunities, curbing biodiversity loss, biodiversity conservation, ensuring food and ecological balance, etc. The forest rich countries and low forest countries have differences in their economic levels, one of the reasons being the area of forest cover in the country which facilitate most of the economic activities. As India is a forest rich country forest accounting is essential as it has a great facilitating role to play in influencing all other economic activities and needs to have a place in the calculations of Gross Domestic Product.

41. **GOA FOREST EXPORT INCUBATION CENTER (FEIC):** Export Oriented Forest business incubator aims to set a benchmark in the field of forest overcoming the risk of monsoon and market to check post-harvest losses in perishable forest products in the state. The incubation centre inculcates significant issues of post-harvest technology research with effective and cost-attractive processing systems and encourages export hubs particularly for various forest products like honey, jackfruit, bay leaf, spices, coconut, cashew, etc. The potential of forest rural food export industry is tremendous. Employment opportunities will open up and flourish with export oriented forest business. Therefore, there is a role for Export oriented FEIC for a rapid and steady transformation of the rural economy in a state like Goa.

The data base shows that largely the Agristartups are doing well in input ecosystem. To explore and succeed in the output ecosystem, the agri export sector parameters must be channelised through Farmers to Farmer Producer Organisations (FPOs). Supply chain to value chain needs a unified platform of organised exports with customized support system for the stakeholders in agriculture ecosystem. A full-fledged Forest Export based Incubation centre may be developed in Goa. India's agriculture is the second largest in the world with an estimated value of 405 billion USD. It stands second in global agricultural production. It is also amongst the top ten exporters of agricultural products in the world. However, India's agri export is estimated at 36 billion USD which

accounts for only 2% of the global trade. Moreover, in spite of being one of the leading exporters of various agricultural and processed food commodities, the export potential of India remains unexploited. After the call given by the Honourable Prime Minister to double agri exports by 2022, many government authorities like APEDA, MPEDA, SPICE BOARD, CASHEW BOARD, State Governments, exporters, farmers and other trade bodies are now gearing up to achieve this target. Furthermore, the rise in world population has increased the demand for better quality and higher quantity of food which gives India's rich forest agrarian culture an opportunity to proliferate through the export market. Forest export startups provide one such solution across the agricultural supply chain which bridges the gap between grower and consumer. The world has witnessed a decent growth of Indian Agricultural startups that have helped in providing remunerative markets for agriculture products and supply them to end-consumers at reasonable prices. In order to provide boost to private investment in the farm sector, enhance market access for farmers and to encourage exports, the need of the hour is to stimulate and minister agri exporters and export startups through extending support and guidance. There is a need to address a whole range of issues which could potentially propel India into the top bracket of agricultural export in order to promote forest startups with a view to attracting budding entrepreneurs to the farm sector and boost exports, supporting the PM's vision of Doubling Agri Exports,

Forest Exports Incubation Centre (FEIC) will incubate budding agri export startups. Agri export entrepreneurs need to be supported to start a new venture in agriculture products exports during their initial period of establishment. FEIC will offer unique technical and business mentorship focused on the individuality of product, business model through network of industry experts as well as access to funding platforms for the Startups. FEIC will be supporting agri-startups in scaling up their businesses and commercializing their product and will be working extensively to help build teams, find a product-market fit and chalk out market-specific growth strategies while facilitating selected Startups to receive an angel investment with the potential to score follow-on funding apart. This will be the significant step will promote innovation and entrepreneurship and will build a strong ecosystem that is conducive for the growth of agri export startup



businesses, to drive sustainable economic growth and generate large scale employment opportunities. FEIC will only focus on forest products export start-ups. It is kind of first incubation centre in India which only be dedicated for forest products exports.

Forest export incubation centre will promote the state of art of export outlook research and product development for the benefit of the public in the state. Incubation centre will facilitate creation of forest export enterprises through technology development and commercialization. It will develop, produce and promote the value-added products from crops of the state to ensure food security and high income to the farmers through export enrichment. It will analyse the quality and safety of various food commodities and to standardize its protocol through organised exports. It will build forest products export hubs in state.

42. To promote forest products department of forest may take initiative to established Goa forest product cooperative society in the state.

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## Annexture

### Interview Scheduled for Cashew Farmers

1. Do you face the problems of climate change on cashew production?

Yes

No

2. If yes, what are those impacts?

3. Do you get MSP for Cashew?

Yes

No

4. If no, what are those reasons?

5. Do you get benefits of PM Kissan?

Yes

No

6. If no, what are those reasons?

7. Do you get cheated by traders in terms of price and weight?

Yes

No

8. Do you get cheated by traders?

9. Are you associated with any cooperative societies for cashew marketing ?

Yes

No

10. Name of the cooperative societies?

Aadharsh Krushi Sahakari khardei vikri Processign Sanstha, Barli, Goa.

11. How cooperative societies help in cashew marketing?

12. Do you get organic cashew production?

Yes

No

13. Do you get premium price for organic cashew

Yes

No

## Interview Scheduled for Honey Farmers

1. How much honey production do you take?  
10 kg   
20 kg   
30 kg   
40 kg   
More than 50 kg.
2. How much price you get for honey  
Rs500 kg   
Rs 1000 kg   
Rs 2000 kg   
Rs 3000 kg   
More than Rs5000 kg.
3. Do you face the problems of climate change on honey production?  
Yes   
No
5. If yes, what are those impacts?
  
6. Do you face problem while honey production?  
Yes   
No
7. If yes, what are those problems?
  
8. Do you want to continue in honey production business?  
Yes   
No
9. If no, what are those reasons?
  
10. Do you get training form government for honey production?  
Yes   
No
11. Do you get buyer easily for your honey production?  
Yes   
No